Comment Letter B1

THE LAW OFFICE OF
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January 4, 2011

Iain Fisher, CPUC
Greg Thomsen, BLM
c/o Dudek
605 Third Street
Encinitas, CA 92024

Re: DOI-BLM-CA-D070-2010-0027-EIS (ECO Sub)
DOI-BLM-CA-D070-2008-0040-EIS (Tule Wind)
Comments on Joint DEIR/DEIS dated December 24, 2010

Dear Mssrs. Fisher and Thomsen:

We represent the San Diego Rural Fire Protection District ("District") in its review of the Joint DEIR/DEIS listed above (the "DEIR/DEIS"). The District appreciates the opportunity to comment upon the DEIR/DEIS. All of the comments below refer to Section D.15 Fire and Fuels Management of the DEIR/DEIS. B1-1

I. DEIR/DEIS Fails to Comply with CEQA

The DEIR/DEIS fails to comply with the California Environmental Quality Act ("CEQA"). The four proposed mitigation measures with respect to Fire and Fuels Management constitute improper deferral of mitigation. There are no legal grounds to defer the measures. B1-2 The mitigation measures fail to adequately address impacts as required by law. The DEIR/DEIS fails to inform the public about impacts of the proposed project on public health and safety services and deprives the public of its right to know and comment on mitigation measures. B1-3

A. Mitigation Measures MMFF-1 and MMFF-2

MMFF-1 and MMFF-2 require the submission of draft Construction Fire Prevention/Protection Plans ("Protection Plans") to the fire agencies, including the District, for comment a minimum of 90 days prior to the start of construction. There is no reason to defer these mitigation measures. The likelihood of a failure to comply with the measures increases as the planned date for construction approaches. In addition, there is no enforcement mechanism in either MMFF-1 or MMFF-2. Nowhere does it state that the project proponent shall not commence construction until all responsible fire agencies, including the District, are satisfied with and have approved the Protection Plans. This is a clear violation of CEQA and presents a fire protection safety hazard to the local community as well as to all of the responsible fire agencies. Without the Protection Plans, the B1-4

District cannot determine what resources will be necessary to appropriately respond to a project fire or other emergency. Ninety days to review the Protection Plans provides an inadequate amount of time for the fire agencies to prepare for or gather necessary resources to provide an appropriate and timely response to a fire or other emergency. The District's duties include protecting the public as well as the proposed project and these mitigation measures fail to meet even minimal fire protection standards. B1-4 Cont.

B. Mitigation Measure MMFF-3

MMFF-3 completely fails to comply with CEQA. There is no time frame for compliance. There are no grounds to legally defer compliance with the measure. To date, the applicant has not submitted to the District a draft copy of a Protection Plan for review nor has there been any coordination effort on the part of the applicant. The District agrees that such a plan is essential for the project. There is no enforcement mechanism for the project's failure to comply with the mitigation measure. The measure is also faulty in that it provides for the inclusion of certain items in the proposed agreement only as agreed upon by the District, the San Diego County Fire Authority, and the applicant. Therefore, if the applicant does not agree to include an item required by either the District or the Fire Authority, the item will not be included in the agreement. That renders the proposed agreement and the mitigation measure meaningless. At a minimum, the mitigation measure should include a statement that the agreement will include those items deemed appropriate and necessary by the District or Fire Authority. B1-5

C. Mitigation Measures MMFF-4

MMFF-4 is misleading. A Protection Plan incorporating the listed features has not been submitted to the District. There is no enforcement mechanism for failure to comply. It is an unenforceable mitigation measure. The District has attempted to work with the project proponents for many months to complete a Protection Plan for the project. The project proponents have failed to cooperate or respond to the District. This mitigation measure does not provide any incentive for the applicant to comply at any time and there is no method for enforcing the measure. In addition, it should be made clear that the Protection Plan shall include those items that the District deems appropriate and necessary. B1-6

II. DEIR/DEIS Fails to Comply with NEPA

The District objects to the DEIR/DEIS on the grounds that it is inadequate and fails to meet the goals of the National Environmental Policy Act ("NEPA"), as follows:

A. The DEIR/DEIS fails to make clear that there is incomplete information available with respect to the proposed mitigation for the significant adverse impact of the major potential for wildfire ignition. Without such information, a reader cannot make an intelligent decision on the risk of project implementation nor assess the environmental impact of proposed agency decisions on the project. B1-7

B. The BLM must supplement the DEIR/DEIS with critical information regarding the contents of: a) a revised Fire Protection Plan; b) a final, binding agreement for the provision of fire protection services for the project; and c) a Prevention Plan. These items are time-sensitive and must B1-8 be published prior to certification of the DEIR/DEIS in order to provide readers with adequate information to evaluate the proposed methods to address the most fundamental firefighting needs of the project. Despite the fact that a Prevention Plan will be necessary prior to the commencement of any project construction, a reader must have adequate information available to assess the proposed process to mitigate for the risks inherent in the construction phase of the project. The applicant's failure to respond to the District in a timely manner suggests that it will also fail to provide adequate time to allow for the consideration and involvement of all appropriate agencies in adequately addressing construction fire risks and hazards. B1-8 Cont.

III. Additional Comment

DEIR Page D-15-19: Please clarify the paragraph that refers to fire station locations and staffing as follows: B1-9

The Jacumba area is serviced by Station 43 of the San Diego Rural Fire Protection District (staff consists of volunteer firefighters). The Boulevard area is also serviced by Boulevard Fire and Rescue Department, a volunteer fire station, which is located at 39223 Highway 94 in Boulevard.

IV. Conclusion

The sections of the DEIR/DEIS that address fire protection services must be supplemented and recirculated to correct the inadequacies of the current document and allow for readers' meaningful analysis. The current draft precludes meaningful analysis in violation of CEQA and NEPA. B1-10

Very truly yours,

CEldred

Cynthia L. Eldred, Esq.
THE LAW OFFICE OF CYNTHIA L. ELDRED

cc: (via electronic mail only)
San Diego Rural Fire Protection District
Patrick P. Brown, Project Planner, County of San Diego

Comment Letter B2

California State Senate

STATE CAPITOL
SACRAMENTO, CA 95814
(916) 651-4036

SENATOR
JOEL ANDERSON
THIRTY-SIXTH SENATE DISTRICT

February 7, 2011

Iain Fisher, California Public Utilities Commission
Greg Thomsen, Bureau of Land Management
c/o Dudek
605 Third Street
Encinitas, CA 92024

To Whom It May Concern:

I write in support of the Tule Wind Power Project as proposed by Iberdrola Renewables.

McCain Valley is one of the few suitable quality wind resource areas in the United States and is the ideal place for San Diego to generate power to meet mandated renewable energy goals.

If we are going to commit to renewable energy, the time to do so is now. This project will create approximately 325 jobs at the peak of construction and 12 permanent jobs for local residents. It will also bring $5 million per year to the County of San Diego in tax revenue. Furthermore, the proposed wind turbines will provide renewable energy to power more than 60,000 San Diego area homes and go a long way toward helping the region meet California's renewable energy goals. B2-1

Through their work on many other projects across the country, Iberdrola Renewables has shown a strong track record of developing wind energy projects that minimize impacts to the surrounding community. By supporting the Tule Wind Power Project, San Diego has the opportunity to become a leader in clean technology while stimulating a struggling economy.

Thank you, Mr Fisher for your consideration in this manner.

Sincerely,

Joel Anderson
Senator

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND GAME
South Coast Region
4949 Viewridge Avenue
San Diego, CA 92123
(858) 467-4201
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Edmund G. Brown, Jr., Governor
John McCamman, Director

February 28, 2011

Iain Fisher, California Public Utilities Commission
Greg Thomsen, Bureau of Land Management
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605 Third Street
Encinitas, California 92024
Email: ecosub@dudek.com and catulewind@blm.gov
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Subject: Draft Environmental Impact Report for East County Substation/Tule Wind/Energia Juarez Gen-tie Projects, (SCH# 2009121079), County of San Diego

Dear Mr. Fisher:

The Department of Fish and Game (Department) has reviewed the Draft Environmental Impact Report/Environmental Impact Statement (EIR/EIS) received December 27, 2010, for the proposed construction of three projects: San Diego Gas & Electric's (SDG&E) East County (ECO) Substation; Iberdrola Renewables, Inc./Pacific Wind Development's Tule Wind Project (Tule); and Energia Sierra Juarez U.S. Transmission, LLC's Energia Sierra Juarez Generator Tie-Line (ESJ Gen-Tie). All three projects (collectively referred to as the Project) are located within unincorporated southeastern San Diego County (County) near the communities of Boulevard and Jacumba. B3-1 The Department requested an extension to the comment period on the EIR/EIS, which the California Public Utilities Commission (CPUC) and Bureau of Land (BLM) granted until March 4, 2011. We appreciate the extension. B3-2

When SDG&E filed the application with the CPUC for the Permit to Construct the ECO Substation, the CPUC determined pursuant to the California Environmental Quality Act (CEQA) that the ECO Substation, Tule Wind, and ESJ Gen-Tie projects were "connected actions" and, therefore, all three projects would be evaluated under a single document. In addition, the CPUC and BLM included the Campo Wind Project, Manzanita Wind Project, and Jordan Wind Project in their review because all three projects are proposed to connect to the transmission line associated with the Boulevard Substation proposed to be rebuilt as part of the ECO Substation project. Therefore, the EIR/EIS generally addresses the potential direct and indirect environmental impacts from the construction and operation of the Campo, Manzanita, and Jordan Wind projects. B3-3

PROJECT SUMMARY

ECO Substation: SDG&E's proposed ECO Substation includes the construction of a 500/230/138 kV substation, construction of the Southwestern Powerlink (SWPL) Loop-in (tie-in of the substation to the SWPL 500 kV line), a rebuild of the existing Boulevard Substation, and construction of a 13.3-mile 138 kV transmission line between the rebuilt Boulevard Substation and the proposed ECO Substation. The proposed ECO Substation would result in 48.69 acres of temporary impacts and 110.35 acres of permanent impacts. B3-4

Tule Wind: The footprint of Pacific Wind Development's proposed 200 MW Tule Wind Project, located north of McCain Valley Road, encompasses lands variously owned or managed by BLM, California State Lands, Ewiiaapaayp Indian Reservation, and private parties. The project would consist of up to 134 wind turbines (1.5 MW to 3.0 MW towers ranging from 328 feet to 492 feet in height, with a rotor diameter of approximately 201 to 238 feet), a 34.5 kV overhead and underground collector cable system linking the wind turbines to the collector substation, a 5-acre collector substation, a 5-acre operations and maintenance building site, two permanent meteorological towers, one sonic detecting and ranging (SODAR) unit, and a 138 kV overhead transmission line running south from the collector substation to interconnect with the Boulevard Substation proposed to be rebuilt as part of the ECO Substation project. The Tule Wind project would result in 290.4 acres of temporary impacts and 562.8 acres of permanent impacts.

ESJ Gen-Tie: The ESJ Gen-Tie project includes a 0.5-mile segment of transmission line required to connect a 1,250 MW wind project proposed in Baja California, Mexico, to the SWPL transmission line at the proposed ECO Substation. The transmission line would include 500kV or 230kV transmission capacity. The proposed project would result in no more than 10.65 acres of permanent impacts.

Campo Wind: Invenergy and SDG&E propose to construct and operate the Campo Wind Project, including approximately 106 wind turbines capable of generating 160 MW of electricity on the Campo Indian Reservation land located north and south of the Crestwood/Old Highway 80 exit off Interstate 8, west of Boulevard and south of the Tule Wind project. The approximately 450-foot-tall turbines would be located on available ridgelines on the reservation. The project would also include a switchyard and new 138 kV transmission line on non-tribal land along the existing 69kV transmission route. The Campo tribe has requested an additional 140 MW of capacity be analyzed under the Bureau of Indian Affairs' (BIA) National Environmental Policy Act (NEPA) review for further development purposes. The proposed Campo Wind Project would connect with the rebuilt Boulevard Substation.

B3-4 Cont.

Manzanita Wind: The Manzanita tribe proposes to construct an approximately 57.5 MW wind farm which would include up to 25 wind turbines. The approximately 414-foot-tall wind turbines would be located on the same ridgeline as the existing Kumeyaay Wind facility north of the proposed location for the Campo Wind project and south of the proposed location of the Tule Wind project. The Manzanita Wind project would connect with the rebuilt Boulevard Substation, and would also include a switchyard and new 138 kV transmission line on non-tribal land along the existing 69kV transmission route.

Jordan Wind: Enel Green Power (now known as Jewel Valley Wind) has completed a preliminary wind energy assessment to construct and operate a 92 MW facility of approximately forty 2.3 MW turbines west of Boulevard and east of the proposed Manzanita and Campo projects. The turbines would be approximately 430 feet tall. The preferred point of interconnection for the Jordan Wind project is the rebuilt Boulevard Substation.

DEPARTMENT'S COMMENTS AND RECOMMENDATIONS

Department Jurisdiction: The following statements and comments have been prepared pursuant to the Department's authority as Trustee Agency with jurisdiction over natural resources affected by the Project (CEQA Guidelines § 15386) and pursuant to our authority as a Responsible Agency under CEQA Guidelines section 15381 over those aspects of the proposed Project that come under the purview of the CESA, (Fish and Game Code § 2050 *et seq.*) and/or

B3-5

Fish and Game Code section 1600 *et seq*. The Department also administers the Natural Community Conservation Planning (NCCP) Act. B3-5 Cont.

Coordination: The EIR/EIS does not address previous Department comments. The analysis of impacts to sensitive species and natural resources within the Department's public trust mandate could be more complete if they were to reflect comments and outcomes from the following discussions: B3-6

- The Department recommends Iberdrola meet with the Department to discuss the need for a California Endangered Species Act (CESA) Incidental Take Permit (ITP) for impacts to State-listed species. B3-7
- The Department recommends additional coordination between the CPUC, BLM and the applicants, informed by input from the Department, to develop measures to help minimize impacts and avoid potential "take" of golden eagles, a species designated as fully-protected pursuant to Section 3511 of the Fish and Game Code. B3-8
- The Department recommends the proponents meet with stakeholders of the East County Multiple Species Conservation Program (MSCP) Plan (County, Department, and U.S. Fish and Wildlife Service (Service)) to discuss the proposed Projects implications for the planning process for the MSCP Plan. B3-9
- The Department recommends BLM meet with stakeholders of the East County MSCP Plan (County, Department, and Service) to discuss the implications of these large-scale wind projects for regional planning efforts, and approaches BLM and the stakeholders could employ cooperatively to avoid or minimize the projects' negative biological impacts. B3-10

Campo, Manzanita, and Jordan Wind projects: Because the EIR/EIS provides no specific information about these projects, the Department cannot provide specific comments herein on their design, though we do comment on their proposed construction relative to regional planning efforts, wildlife movement, and habitat connectivity. We intend to provide specific comments on the Campo, Manzanita, and Jordan Wind projects during the comment period for each project's respective subsequent environmental document. B3-11

Section D.2.2.2 State Laws and Regulations: All statutes in the Fish and Game Code relevant to this project (CESA, NCCP Act, Native Plant Protection Act, section 1600 *et seq*., *etc*.) should be included in this section. The Department provides the following additional comments on this section: B3-12

1) CESA – This section references Fish and Game Code section 2091 for State Agency Consultation. Please delete this section as it was repealed in 1999. B3-13
2) California Fish and Game Code: The title of this section is too general because the Fish and Game Code contains many statutes unrelated to birds and mammals. Please title the first paragraph in this section more accurately as *Birds and Mammals* to capture the discussion of Fish and Game Code sections 3511 and 4700 *et seq*., and title the second paragraph as *Resident and Migratory Birds*. The Department recommends this paragraph cite compliance with Fish and Game Code sections 3503, 3503.5, and 3511. B3-14
3) California Natural Community Conservation Planning Act – Please cite this section as Fish and Game Code section 2800 *et seq*., and reference the East County NCCP Planning Agreement in this section (see comments below regarding the East County NCCP). B3-15

Fully Protected Species: The Department has jurisdiction over fully protected species of birds, mammals, amphibians, reptiles, and fish, pursuant to Fish and Game Code sections 3511, 4700, 5050, and 5515. "Take" of fully protected species is prohibited, and the Department cannot authorize "take" of these taxa. The bighorn sheep (*Ovis canadensis*), golden eagle (*Aquila chrysaetos*), and California condor (*Gymnogyps californianus*) are fully protected species that could occur within the Project footprint. Although the Project includes several measures to minimize the potential for "take" of fully protected species, based on the information in the EIR/EIS, the Department cannot conclude that these measures will prevent "take" during construction and particularly operation of the wind projects. B3-16

Peninsular Bighorn Sheep: Although the Project is located just to the west of federally designated Critical Habitat for bighorn sheep, the Department is concerned that the Project may negatively affect bighorn sheep. The Department recommends removal of three turbines (R8, R9, and R10) to reduce the likelihood that bighorn sheep would be impacted by the Project. The Department welcomes coordination with our bighorn sheep experts to determine adequate minimization measure for the species. B3-17

Golden Eagle: Section 15126.6(a) of the CEQA Guidelines states that an EIR should describe "alternatives to the Project, or to the location of the Project, which would feasibly attain most of the basic objectives of the Project but would avoid or substantially lessen any of the significant effects of the Project, and evaluate the comparative merits of the alternatives." Section 15126.6(f) of the CEQA Guidelines, the "Rule of reason", requires, "The alternatives shall be limited to ones that would avoid or substantially lessen any of the significant effects of the Project. Of those alternatives, the EIR need examine in detail only the ones that the lead agency determines could feasibly attain most of the basic objectives of the Project." B3-18

The proposed Project includes the build-out of all 134 turbines in two phases to accommodate a ten year (minimum) study on golden eagles in the Project vicinity (BIO-10). The Department disagrees with this strategy because we maintain that the identification of project-related mitigation after and outside of the CEQA process is inconsistent with CEQA Guidelines §15002(a)[1] because it deprives the public of knowledge about how impacts will be mitigated and undermines a fundamental purpose of CEQA, which is to determine whether project impacts will be adequately mitigated. The draft EIR/EIS should include clearly articulated feasible mitigation measures, rather than deferring the identification of the mitigation to a later time (CEQA Guidelines, § 15126.4 (a)(1)(B)). Without the study results recommended in the EIR/EIS, the document does not provide the analysis necessary to determine the full effects the Project has on golden eagles. Absent an analysis of the results of the golden eagle survey completed by Wildlife Research Institute (WRI) in 2010, and the results of the eagle study (BIO-10) to be B3-19

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[1] Section 15002(a) of the CEQA Guidelines defines the purpose of CEQA to:

(1) Inform governmental decision makers and the public about the potential, significant environmental effects of proposed activities.
(2) Identify ways that environmental damage can be avoided or significantly reduced.
(3) Prevent significant, avoidable damage to the environment by requiring changes in projects through the use of alternatives or mitigation measures when the governmental agency finds the changes to be feasible.
(4) Disclose to the public the reasons why a governmental agency approved the project in the manner the agency chose if significant environmental effects are involved.

B3-19a

conducted prior to Project approval, the Department cannot provide meaningful comments on project impacts to golden eagles B3-19 Cont.

In addition, the Department is not able to conclude that "take" of eagle will be avoided by the reduction of turbines (Alternative 5 - Reduction in Turbines). Based on the analysis in the draft EIR/EIS, the Department can only conclude that, because the Reduced Turbine Alternative minimizes impacts to golden eagles, it is an environmentally superior alternative. However, this Alternative does not assure "take" of golden eagles will be avoided. B3-20

Finally, mitigation for loss of golden eagle habitat is not included in the draft EIR/EIS. The final EIR/EIS should include a measure providing for compensation of lost nesting and foraging habitat resulting from project actions. The analysis and mitigation determination should consider the need for land-based compensatory mitigation in the form of land acquisition and perpetual conservation. B3-21

Species listed under CESA

Willow Flycatcher: The Department has reviewed the applicant's *2005-2006 Avian Survey Report* and *2007-2008 Avian Survey Report* (Tetra Tech 2008 and 2009). According to the 2007-2008 survey report (page 13), the state-listed willow flycatcher was observed on the Project site. The EIR/EIS (page D.2-159) states that the subspecies southwestern willow flycatcher (*Empidonax traillii extimus*) does not have the potential to occur on site, but "the full species of willow flycatcher *(Empidonax traillii)* could occur during migration in the variety of shrub/tree habitats." The EIR/EIS concludes "...the loss of willow flycatcher is significant but can be mitigated to less then significant (Class II) with the implementation of mitigation measures." We recommend the proponent consult with the Department regarding anticipated Project-related "take" of willow flycatcher to determine the need for an Incidental ITP under CESA. B3-22 In our February 10, 2010, comment letter on the Notice to Preparation of the EIR/EIS, and our comments on June 6, 2010 and July 14, 2010 on EIR/EIS Administrative drafts, we recommended early consultation on the Project with the Department to determine if "take" authorization is required. If "take" of this species cannot be avoided during construction and operation of the Project, as the direct EIR/EIS indicates, "take" authorization would be required to comply with CESA. B3-23

Swainson's Hawk: Although Swainson's hawk (*Buteo swainsoni*) were not observed during the Tetra Tech 2007-2008 avian surveys, this species is known to generally migrate through the Project area. The final EIR/EIS should analyze the potential for "take" of this species during operation of the Project. If Project-related mortality of Swainson's hawk is anticipated, we recommend the proponent consult with the Department to determine the need for an ITP. B3-24

NCCP Program: The County participates in the NCCP program by implementing its approved East County Multiple Species Conservation Plan. The County is also actively working towards approval of the North County MSCP and Implementing Agreement under the NCCP program and has conducted a preliminary habitat evaluation for the draft East County MSCP Plan. The Project location is within the geographical area covered by the East County MSCP Plan. B3-25

East County Multiple Species Conservation Plan/Class III Impact for Wildlife Movement: Page D.2-121 "County of San Diego Multiple Species Conservation Program - East County Plan" – Please amend this section to include the preparation of a joint NCCP/Federal Habitat Conservation Plan (HCP). The County, Department, and Service are signatory to an approved B3-26

Planning Agreement (preliminary planning document for the NCCP), which sets the framework for the East County MSCP Plan and defines broad conservation goals and objectives for the County to conserve multiple species, their habitats, and connectivity to habitats to ensure long-term retention of functions and values of the biological resources of East County. The Planning Agreement also provides an interim process which the County uses for projects seeking approval prior to the completion of the East County MSCP Plan. This interim process is included as Attachment B of the Planning Agreement. Upon completion of the East County Plan, the Department will issue a permit for the "take" of both listed and not listed species "covered" by the NCCP/HCP. The last line of this paragraph in the EIR/EIS should be amended to reflect that the "take" authorization applies to "Covered Species" under the NCCP Act (Fish and Game Code § 2835). B3-26 Cont.

The Department's June 6, 2010 and July 14, 2010 comments on the Administrative drafts of the EIR/EIS discussed the need for the EIR/EIS to adequately address Project impacts on the East County MSCP Plan. However, the EIR/EIS does not adequately address this concern. Although the Plan is draft, the County has drafted the East County MSCP Working Draft Focused Conservation Area Map (County 2008), a large scale map of the Planning Area that designates a conceptual reserve design within "Future Conservation Areas." The EIR/EIS does not evaluate the proposed Project's implication to the "Future Conservation Areas," and the species covered under the NCCP planning process, nor does it adequately analyze whether the Project, once built, would preclude the County from meeting the goals and objectives of the NCCP Planning Agreement. The Department is concerned that the proposed Project alone and the cumulative effects of it in conjunction with the additional Campo, Manzanita, and Jordan Wind projects, could have the potential to severely compromise the completion of the East County MSCP Plan. B3-27

Wildlife Movement and Connectivity: The EIR/EIS does not provide data to substantiate its conclusions that the proposed Project would have no impacts to wildlife movement and that wildlife will acclimate to the Project. The Department is not aware of any wildlife movement study that analyzes the Project-related effects of habitat loss or movement restrictions within the Project area. Based on the projected number of wind turbines proposed in the study area and the lack of data to support the EIR/EIS' above conclusions, the Department cannot concur with the conclusion in the document. The footprints of the proposed Tule Wind Project and the Campo, Manzanita, and Jordan Wind projects incorporate a substantial portion of the remaining private land within the conceptual Focused Conservation Area of the East County MSCP Plan. The installation of these projects on these lands may significantly negatively affect wildlife movement within the Focused Conservation Area and between Cleveland National Forest and BLM land. As the Department recommended previously, the EIR/EIS should thoroughly analyze these impacts and require actions (*e.g.*, redesign, relocate, mitigate) to avoid or minimize them. B3-28

BLM Eastern San Diego County Resource Management Plan
The Land Use Section D.4-61 of the EIR/EIS discusses the BLM's Eastern San Diego County Resource Management Plan (RMP) (BLM 2008). BLM prepared the RMP to guide the development and management of the Eastern San Diego County Planning Area. The RMP addresses conflicts among various recreational uses, provides direction for future site-specific development, and provides for planning monitoring to determine the effectiveness of BLM's land management strategies. The RMP contains goals, policies, and management actions directed towards Lands and Realty Management. While the proposed Project is located outside of BLM dedicated Wilderness Study Areas and Areas of Critical Environmental Concern, portions of the Project footprint on BLM land nevertheless support important habitat linkages and connectivity B3-29

between existing open spaces significant to the regional conservation planning efforts, as addressed above in the context of the East County MSCP Plan. Again, the Department is concerned about the lack of analysis in the EIR/EIS of the Project-related effects on the East County MSCP Plan, relative to both the implications for its planning process and the impacts on its Focused Conservation Area. B3-29 Cont.

The BLM is signatory to a Memorandum of Understanding (MOU) (see Attachment) with the Department, Service, County, City of San Diego, and San Diego Association of Governments (signed on July 21, 1994). The purpose of the MOU was to provide a framework within the NCCP process for a collaborative conservation planning and management approach among all the land use agencies within the County. It is not evident to the Department that the letter or intent of this MOU have been integrated into the proposed Project, particularly (as addressed above) in the context of the potential Project-related significant impacts on the long-term conservation planning process (MOU page 3, paragraph D and E). The EIR/EIS should explicitly address the MOU and discuss how the Project would be modified to avoid or minimize these impacts. B3-30

Mitigation, Monitoring, Compliance and Reporting Program
The Department has the following comments on the measures identified on the Mitigation, Monitoring, Compliance, and Reporting (MMCRP) table in the draft EIR/EIS Biological section. B3-31

- The MMCRP includes measures for mitigation of permanent impacts (BIO-1e). The Department recommends compensatory mitigation is provided for temporary impacts as well as permanent impacts. The Department also recommends mitigation for impacts to native vegetation communities consistent with the County's *Guidelines for Determining Significance and Report Format and Content Requirements, Biological Resources,* Table 5 page 56 (September 15, 2010).
- The MMCRP should include a measure requiring that all vegetation clearing be conducted outside of the avian breeding season (generally from February 15 to September 15). B3-32
- Measure BIO-7j – *Conduct preconstruction nesting bird surveys and implement appropriate avoidance measures for identified nesting birds.* It appears this condition allows construction during the breeding season (see above) only in already cleared areas, provided preconstruction surveys are conducted. Please add to this measure to prohibit construction which will result in nest abandonment or failure within the work area or buffer zones. B3-33
- The MMCRP should include a measure prohibiting the removal of active raptor nests during the breeding season (generally January to June) pursuant to Fish and Game Code section 3503.5. B3-34

Cumulative Impacts: CEQA requires considering cumulative impacts (CEQA Guidelines §§15065(a)(3), 15130). Cumulative impact analysis requires considering the "incremental impacts of closely related past, present, and reasonable foreseeable probable future projects" (CEQA Guidelines §15355). When a project's impact is cumulatively considerable, an EIR is required unless the impact is mitigated to less than significant levels. Section F.3.1 of the draft EIR/EIS evaluates the Project's cumulative impacts to Biological Resources. B3-35

The final EIR/EIS should include mitigation to offset cumulative avian and bat fatalities, avian displacement, or avian habitat degradation resulting from fatality risk. The project has the potential to contribute to significant cumulative impacts on birds and bats, and should provide commensurate mitigation for these impacts. B3-36

Thank you for this opportunity to provide comment. Please contact Mrs. Erinn Wilson, Staff Environmental Scientist, at (714) 968-0953 if you should have any questions and for further coordination on the proposed Project.

Sincerely,

Edmund Pert
Regional Manager
South Coast Region

B3-37

Attachment
Memorandum of Understanding –BLM, County, City of San Diego, U.S. Fish and Wildlife Service, Department, in Cooperation with the San Diego Association of Governments for Cooperation in Habitat Conservation Planning and Management.

References:

County of San Diego Department of Planning and Land Use. 2008.
http://www.sdcounty.ca.gov/dplu/mscp/docs/east_mscp_csa2_2_8x11.pdf
http://www.sdcounty.ca.gov/dplu/mscp/ec.html

County of San Diego, Department of Planning and Land Use and Department of Public Works, *Guidelines for Determining Significance and Report Format and Content Requirements, Biological Resources* (September 15, 2010).

ec: Mr. Stephen M. Juarez, Department of Fish and Game, San Diego
Mr. Steve Cannata, Department of Fish and Game, San Diego
Ms. Erinn Wilson, Department of Fish and Game, Huntington Beach
Mr. William Condon, Department of Fish and Game, Sacramento
HabCon-Chron, Department of Fish and Game, San Diego
Mr. Eric Porter, U.S. Fish and Wildlife Service, San Diego
Ms. Bobbie Stephenson, County of San Diego
State Clearinghouse, Sacramento

MEMORANDUM OF UNDERSTANDING
AMONG THE
U.S. DEPARTMENT OF THE INTERIOR - BUREAU OF LAND MANAGEMENT,
THE COUNTY OF SAN DIEGO, THE CITY OF SAN DIEGO,
THE U.S. DEPARTMENT OF THE INTERIOR - FISH AND WILDLIFE SERVICE,
THE CALIFORNIA DEPARTMENT OF FISH AND GAME, AND
IN COOPERATION WITH
THE SAN DIEGO ASSOCIATION OF GOVERNMENTS
FOR
COOPERATION IN HABITAT CONSERVATION PLANNING AND MANAGEMENT

I. PREAMBLE

The U.S. Department of Interior - Bureau of Land Management (BLM), the County of San Diego (County), the City of San Diego (City), and in cooperation with the San Diego Association of Governments (SANDAG), share a common interest with the California Department of Fish & Game (CDFG) and the U.S. Department of the Interior - Fish & Wildlife Service (FWS) in sustaining the integrity of biological and natural resource systems and the human and economic values they support. Efforts to coordinate conservation programs among local, State, and Federal agencies in California are well established. B3-38 In 1991, *The Agreement on Biological Diversity* created an Executive Council on Biological Diversity. The signing of this agreement by twenty-seven Federal, State, and local representatives (including BLM, CDFG, and FWS) exemplifies California's commitment to cooperative ecosystem management. The agreement establishes a framework by which State and Federal resource managers, local governments, and the public can discuss and establish collaborative conservation planning and management programs on a bioregional or local scale. The State of California's Natural Community Conservation Planning (NCCP) Program is a mechanism for implementing this framework as well.

BLM manages over 1[illegible] million acres in California and is actively involved in managing its lands to accomplish these shared goals. The majority of these lands are located in Southern California. Currently BLM has recently concluded its land use planning efforts in the South Coast Planning Area located in San Diego, Riverside, San Bernardino, Los Angeles, and Orange Counties. Roughly, 8[illegible],000 acres of BLM lands are located in western San Diego County and are included in the South Coast Resource Management Plan (RMP). Another 100,000 acres of BLM lands are located in the eastern portion of the County and are covered under BLM's Eastern San Diego County Management Framework Plan (MFP), completed in 1981.

The County, the City, and SANDAG are also actively involved in several multi-habitat conservation programs to accomplish these shared goals. The three programs are designed to protect key habitat areas and wildlife corridors and to meet the requirements of the Federal and State Endangered Species Acts in a manner that addresses land use and economic objectives of the San Diego region. Lands which contain the remaining critical biological resources are being identified and plans are being developed to design conservation areas and wildlife corridors. Each program is individually tailored to a specific geographic area, yet is being coordinated to

DOCUMENT NO RR-2840

avoid duplication and will be linked together to create a regional habitat conservation system.

The three programs referenced above are the County's Multiple Habitat Conservation/Open Space Program (MHCP/OSP), the City's Multiple Species Conservation Program (MSCP), and SANDAG's North County Multiple Habitat Conservation Program (MHCP), all of which are consistent with the NCCP Program.

II. PURPOSE OF THE AGREEMENT

This Memorandum of Understanding (MOU) establishes a partnership between BLM, the County, the City, CDFG, and FWS in cooperation with SANDAG, to cooperate in planning and managing publicly-owned lands within the San Diego region for the purpose of conserving the area's rich and unique biological diversity and maintaining its economic viability. It seeks to develop a proactive, coordinated approach for assessing wildlife value of publicly-owned lands and the relation of these lands to the long-term needs of the areas's native plants and animals. The MOU also seeks to design and implement a strategy for incorporating publicly-owned lands with high wildlife value within the planned regional habitat conservation system. The strategy will be developed within the framework of the existing legal authorities of the parties to this MOU.

III. POLICIES

A. The signatory parties agree to make maintenance and management of the area's unique biological diversity a principal goal in the design and implementation of their respective habitat conservation programs. Furthermore, BLM agrees to work with local government representatives to assure the development of a coordinated approach for incorporating those lands managed by BLM within the regional habitat conservation programs.

B. BLM agrees to coordinate with the other signatory parties regarding assessment of the wildlife values of those lands managed by BLM within San Diego County. These lands amount to approximately 180,000 acres. The County, the City, and SANDAG agree to provide BLM with information regarding types of vegetation and quality of vegetation on lands managed by BLM in their respective habitat conservation program areas. BLM agrees to apply this information as appropriate to provide an assessment of wildlife habitat values on the lands it manages within San Diego County. In addition, BLM agrees to use this information to aid in its determination of the relation of BLM lands to the long-term protection of the San Diego region's native plant and animal species and the adequacy of BLM's management prescriptions for meeting these objectives.

C. Using its Geographic Information System (GIS) data base, SANDAG agrees to map biological, land use, and ownership information on all lands in the San Diego region, including those managed by BLM within that region. SANDAG agrees to provide digital files and hard copy maps to BLM upon request. BLM agrees to provide SANDAG digital files on the lands BLM manages in the South

B3-38 Cont.

Coast planning area. Separate protocols for updating and revising the data base are being prepared by the County and the City for the lands within their respective planning areas.

D. Where BLM, State, regional and/or local land management prescriptions are found to be inconsistent with existing or proposed conservation objectives, the parties will work collaboratively to resolve these inconsistencies. If significant changes are found to be necessary, BLM will consider modifying its plans in compliance with the Bureau's planning regulations (43 CFR 1600). Modifications to State, regional, and/or local plans shall also be considered where significant changes are found to be warranted. Whether or not change is needed to a particular State, regional, and/or local plan shall be decided by the agency that has administrative authority over that plan.

E. An integral part of habitat conservation planning strategies revolves around the creation of a regional interconnected habitat conservation system. The system is intended to protect key habitat areas and corridors within the San Diego region. BLM agrees to work with the County, the City, SANDAG, CDFG, and FWS in identifying the lands it manages for inclusion within the region's habitat conservation system. While these and other publicly owned lands will provide the initial system framework, it is understood that contributions to the system will be derived from privately owned lands as well. The County, the City, and SANDAG are committed to pursuing multiple funding sources to provide a balance between public and private contributions. BLM, CDFG, and FWS agree to work with the other signatory agencies in identifying and pursuing Federal funding sources, including funding from the Federal Land and Water Conservation Trust Fund (LWCTF). B3-38 Cont.

F. A variety of other techniques are available for acquiring key habitat areas and corridors. BLM, CDFG, and FWS agree to work with the other signatory parties to incorporate those techniques available to them in the acquisition strategies being designed by the County, the City, and MSCP Policy Committee. Aside from the LWCTF, other techniques potentially available to BLM, CDFG, and FWS include land acquisitions through exchanges, the Federal Recreation & Public Purposes Act (R&PP), and donations. While lands acquired by BLM must be retained by BLM, they will be managed by BLM to conform with the habitat conservation plans of the other signatory parties. In addition to acquisition strategies, the signatory parties also agree to design strategies for effectively and efficiently managing the lands acquired through their respective acquisition efforts. This may entail the development and use of cooperative management agreements between the signatory parties and/or other agencies.

IV. MODIFICATIONS

This MOU is to remain in effect until modification by the parties in writing; it is negotiable at the option of any of the parties.

IN WITNESS HERE OF, this MOU is executed by action of the following signatories:

USDI - BUREAU OF LAND MANAGEMENT

By: Ed Hastey Date: 7/11/94
EDWARD L. HASTEY, California State Director

CALIFORNIA EXECUTIVE COUNCIL ON BIOLOGICAL DIVERSITY

By: Douglas Wheeler Date: 7-21-94
DOUGLAS WHEELER, Chairman

UDSI - FISH AND WILDLIFE SERVICE

By: Wayne White Date: 7/12/94
WAYNE S. WHITE, California State Supervisor

CALIFORNIA DEPARTMENT OF FISH AND GAME

By: Boyd Gibbons Date: 7/19/94
BOYD GIBBONS, Director

Approved as to form and legality
this 21st day of June 1994
JOHN W. WITT, City Attorney

CITY OF SAN DIEGO

By Kelly J. Salt
Deputy City Attorney

By: Jack McGrory Date: 6-20-94
JACK McGRORY City Manager

R-284032

B3-38 Cont.

COUNTY OF SAN DIEGO

By: _______________________ Date: 7-1-94
DAVID JANSSEN, Chief Administrative Officer

COOPERATING AGENCY:
SAN DIEGO ASSOCIATION OF GOVERNMENTS

By: _______________________ Date: 6-28-94
KENNETH E. SULZER, Executive Director

B3-38
Cont.

(R-94-1870)

RESOLUTION NUMBER R-284032

ADOPTED ON JUN 06 1994

BE IT RESOLVED, by the Council of The City of San Diego, that the City Manager be and is hereby authorized and empowered to execute, for and on behalf of said City, a memorandum of understanding among the U.S. Department of the Interior - Bureau of Land Management, the County of San Diego, the U.S. Department of the Interior - Fish and Wildlife Service, the California Department of Fish and Game, and the San Diego Association of Governments (in a coordinating role), to cooperate in planning and managing publicly-owned lands within the San Diego region for conservation of the region's rich and unique biological diversity and maintenance of its economic viability, under the terms and conditions set forth in the Memorandum of Understanding, on file in the office of the City Clerk as Document No. RR-284032, as well as any reasonably necessary amendments or modifications thereto which do not increase this project's scope or cost and which the City Manager shall deem necessary from time to time in order to carry out the purposes and intent of this project and Memorandum of Understanding.

APPROVED: JOHN W. WITT, City Attorney

By Kelly J. Salt for
Frederick M. Ortlieb
Deputy City Attorney

FMO:mb
05/24/94
Or.Dept:Metro.
R-94-1870

B3-38
Cont.

Passed and adopted by the Council of San Diego on June 6, 1994, by the following vote:

YEAS: Roberts, Kehoe, Stevens, Warden, Stallings, McCarty, Vargas, Mayor Golding.

NAYS: None.

NOT PRESENT: Mathis.

AUTHENTICATED BY:

SUSAN GOLDING
Mayor of The City of San Diego, California

CHARLES G. ABDELNOUR
City Clerk of The City of San Diego, California

(Seal)

By: RHONDA R. BARNES, Deputy

I HEREBY CERTIFY that the above and foregoing is a full, true and correct copy of RESOLUTION NO. R-284032, passed and adopted by the Council of The City of San Diego, California on June 6, 1994.

CHARLES G. ABDELNOUR
City Clerk of The City of San Diego, California

(SEAL)

By: Rhonda R. Barnes, Deputy

B3-38
Cont.

San Diego
ASSOCIATION OF
GOVERNMENTS
First Interstate Plaza, Suite 800
401 B Street
San Diego, California 92101
(619) 595-5300 Fax (619) 595-5305

RESOLUTION

No. 94-89

MEMORANDUM OF UNDERSTANDING WITH BUREAU OF LAND MANAGEMENT

WHEREAS, the Bureau of Land Management manages approximately 180,000 acres in the San Diego region; and

WHEREAS, many, if not all, of these acres may have habitat value and thus warrant inclusion in a habitat preserve system; and

WHEREAS, the cities and County of San Diego are in the process of identifying a habitat preserve system; and

WHEREAS, the BLM agrees to make the maintenance and enhancement of the region's biological diversity a principal goal in the design and implementation of their management strategy NOW THEREFORE

BE IT RESOLVED that the Executive Director is authorized to sign the Memorandum of Understanding for Cooperation in Habitat Conservation Planning and Management.

PASSED AND ADOPTED this 24th day of June, 1994.

hereby certify this to be a true copy of ... original document on file in the ... Diego Association of Governments ...

Clerk/Board of Directors

CHAIRPERSON

ATTEST: SECRETARY

B3-38 Cont.

Comment Letter B4

DEPARTMENT OF TRANSPORTATION
DISTRICT 11
PLANNING DIVISION
4050 TAYLOR STREET, MS 240
SAN DIEGO, CA 92110
PHONE (619) 688-6960
FAX (619) 688-4299
TTY 711
www.dot.ca.gov

Flex your power!
Be energy efficient!

March 1, 2011

11-SD-8
PM 65.9
Tule Wind Project
DEIR

Mr. Iain Fisher
California Public Utilities Commission
605 Third Street
Encinitas CA 92024

Dear Mr. Fisher:

The California Department of Transportation (Caltrans) appreciates the opportunity to have reviewed the Tule Wind Project Draft Environmental Impact Report (DEIR) traversing Interstate 8 (I-8) near Ribbonwood Road/McCain Valley Road, as well as State Route 94 (SR-94). Caltrans has the following comments: B4-1

Figure D.9-1 showing that the overhead lines will cross I-8 while connecting from one substation to another. Any utility crossings of highways or freeways (ie: I-8 or SR-94) will need an encroachment permit from Caltrans. Please refer to Caltrans Encroachment Permits Manual (http://www.dot.ca.gov/hq/traffops/developserv/permits/encroachment_permits_manual/index.html) for guidance on utility encroachment. The following information is contained in Chapter 600, Table 6.7 (page 6-35) of the Encroachment Permit Manual. Line supports for overhead lines crossing freeways must comply with these requirements, they:

1. Should have a minimum lateral clearance of 30' from the edge of a through lane and 30' from the edge of a ramp lane, when possible. B4-2

2. Shall be located outside the right-of-way (R/W) or between the R/W line and access control line if different. Any other placement must be approved by the Division of Design, Chief.

3. Should not be permitted in medians.

4. Should not be permitted on cut or fill slopes.

5. Shall not impair sight distances.

6. Shall be compatible with access requirements.

Please refer to Caltrans Encroachment Permits Manual for guidance on Traffic Control on freeways. The following information is contained in Appendix E (page E-42) of the Encroachment Permit Manual. For placement of aerial lines, installation or removal of overhead conductors crossing a freeway requires traffic control by the California Highway Patrol (CHP) and usually occur on weekend mornings. The CHP can perform a rolling break in traffic on most highways to allow up to a five-minute clearing. These breaks are adequate for simple cable B4-3 installation. Utility personnel carry the conductors across the freeway lanes and hoist them into place on the opposite side of the freeway. On larger conductor crossings such as transmission lines, 1" or greater in diameter, districts may determine that safety nets are needed to prevent transmission lines from falling on traffic during cabling installations. Temporary safety-net support poles are placed at protected locations outside shoulders and in medians. If locations for temporary supports are not available, the utility company may use K-rail and sand barrel crash cushions. After rope nets are strung during CHP traffic breaks other work is then allowed to proceed. Placement of the aerial line may be by helicopter. B4-3 Cont.

Any work performed within Caltrans R/W must provide an approved final environmental document including the California Environmental Quality Act (CEQA) determination addressing any environmental impacts within the Caltrans' R/W, and any corresponding technical studies. If these materials are not included with the encroachment permit application, the applicant will be required to acquire and provide these to Caltrans before the permit application will be accepted. Identification of avoidance and/or mitigation measures will be a condition of the encroachment permit approval as well as procurement of any necessary regulatory and resource agency permits B4-4

Additional information regarding encroachment permits may be obtained by contacting the Caltrans Permits Office at (619) 688-6158. Early coordination with Caltrans is strongly advised for all encroachment permits.

If you have any questions that Caltrans has provided, please contact Trent Clark of the Development Review Branch at (619) 688-3140.

Sincerely,

JACOB M. ARMSTRONG, Chief
Development Review Branch

Cc: Mr. Greg Thomsen BLM

Comment Letter B5

From: Sevrens, Gail <gsevr@parks.ca.gov>
Sent: Friday, March 04, 2011 4:34 PM
To: ECOSUB; 'catulewind@blm.gov'
Subject: Tule Wind Energy DEIS/DEIR comments - part one
Attachments: Renewable energy map jan27th2011.pdf; CDD DPR comments Tule Wind DEIR-DEIS 3-4-11.pdf

Attached please find the following:

1. Comments on the above proposed project;
2. Map attachment to comments.

In subsequent emails please find the following:

3. Photo showing view to Carrizo Marsh and other portions of ABDSP from project site; project will be visible from all these locations.
4. Photo showing view northeast from project site into ABDSP; project will be visible from all these locations.
5. Comments submitted February 10, 2010 re the Notice of Intent to Prepare an EIS for the above project (Clark 2010), incorporated by reference in item #1 above;
6. Comments submitted August 26, 2008 (Wells 2008) re Eastern San Diego County Proposed Resource Management Plan (RMP), incorporated by reference into item #1 above;
7. Comments submitted May 18, 2007 (Wells 2007) re RMP, incorporated by reference into item #1 above.

B5-1

IMPORTANT NOTE: Duplicate copies of items #1 and #2 ONLY were also faxed to Dudek and the State Clearinghouse. Items 1-7 include the totality of our comments.

Thank you,

Gail Sevrens

District Superintendent, Acting
District Services Manager
Colorado Desert District
(760) 767-4037

State of California • Natural Resources Agency — Edmund G. Brown Jr., *Governor*

DEPARTMENT OF PARKS AND RECREATION — Ruth Coleman, *Director*

Colorado Desert District
200 Palm Canyon Drive
Borrego Springs, CA 92004

March 4, 2011

Mr. Iain Fisher/Greg Thomsen
c/o Dudek
605 Third Street
Encinitas, CA. 92024
Fax: (800) 371-8854, ext. 2
ecosub@dudek.com; catulewind@blm.gov

Subject: DEIR/DEIS for the Proposed Tule Wind Energy Project, San Diego County, California.

State Clearinghouse No. 2009121079
DOI-BLM-CA-D070-2010-0027-EIS
DOI-BLM-CA-D070-2008-0040-EIS

Dear Mr. Fisher and Mr. Thomsen:

We appreciate the opportunity to comment on the above proposed project. The proposed project is located directly adjacent to Anza-Borrego Desert State Park (ABDSP), which is part of the Colorado Desert District (CDD) of California State Parks.

The CDD submitted comments for the Notice of Intent to Prepare the EIS for the above project on February 10, 2010 (Clark, 2010), and hereby incorporates them by reference. Additionally, the CDD submitted comments regarding the Eastern San Diego County Resource Management Plan (RMP) on May 18, 2007 (Wells, 2007) and the revision to the RMP on August 27, 2008 (Wells, 2008). State Parks would like to reiterate these 2007 and 2008 comments and incorporate them by reference. We are able to provide duplicate copies of these comments on request. B5-1 Cont.

The CDD has the following concerns with the proposed project.

1. The proposed project would have adverse impacts to migratory birds protected under the Migratory Bird Treaty Act. Wind turbines have been well documented to cause mortality to a variety of migratory birds. B5-2

2. The proposed project could have adverse effects to golden eagles (Federally protected under the Bald and Golden Eagle Protection Act and Migratory Bird Treaty Act). Researchers estimate that in the Altamont Pass Wind Resource Area, wind turbines kill 40-60 sub-adult and adult golden eagles each year on average (Pier Energy-Related Environmental Research 2007). There are several nest locations of golden eagles in the southern part of the Park, within approximately 5 miles of the proposed project. We recommend eliminating all wind turbines within a 5 mile radius of any golden eagle nests, whether active or inactive. We surveyed the Anza-Borrego Desert State Park B5-3

(Wildlife Research Institute 2011) and the surrounding areas for golden eagles in 2010 and recommend removing for this reason at a minimum wind turbines in rows A, B, C1-3, D1-6, J, K, L, M, N, P, R8-10, and Q. B5-3 Cont.

3. In addition to the species mentioned above, the proposed project could adversely impact sensitive and species of special concern, such as the red diamond rattlesnake (*Crotalus ruber*), barefoot banded gecko (*Coleonyx switaki*), coast horned lizard (*Phrynosoma coronatum*), and orange-throated whiptail (*Cnemidophorus hyperythrus*). B5-4

4. The proposed project would adversely affect the federally listed Quino checkerspot butterfly (*Euphydryas editha quino*) and its habitat. A Quino checkerspot butterfly was found at the proposed location for wind turbine D1 during project surveys in 2010 (Figure D-2.9). US Fish and Wildlife Service recommends no disturbance within 1 kilometer of a Quino location based the Recovery Plan for the species. A 1 kilometer buffer around the Quino location on the proposed project site would remove turbines C1-3 and D1-4. B5-5

5. The proposed project could cause significant mortality of bats due to barotrauma (drop in air pressure causing internal hemorrhaging in the lungs). Wind turbines result in a greater number of bat mortalities than bird mortalities. How these mortalities affect bat populations are currently unknown, however; migratory bat populations seem to be the most affected by wind turbines. B5-6

   Page D2.-180 states:

   > Given the detected bat use and the potential for special-status bat species to forage in the Tule Wind Project area, the presence of wind turbines would result in a significant risk of collision to special-status species. This impact would be adverse and therefore, Mitigation Measures BIO-10a through BIO-10e and BIO-10h have been provided to mitigate this impact Under CEQA, risk of collision to special-status species would be significant but can be mitigated to a level that is considered less than significant (Class II) with implementation of Mitigation Measures BIO-10a through BIO-10e and BIO-10h.

   These mitigation measures **do not** mitigate the cause of mortality to bat species, because the predominant cause of mortality is not collision with a turbine, but the barotrauma they cause to bats. Therefore, the significant impacts to bats listed above will not be mitigated to a level that is considered less than significant with these mitigation measures, or any other measures.

6. There are two documented significant and unmitigable impacts from the ECO substation project that could adversely affect populations of Quino checkerspot butterfly and golden eagles whose ranges include Anza-Borrego Desert State Park. We are very concerned about potential adverse effects to both these populations. Page D.2-276 states: B5-7

   > Both of these alternatives (and all other alternatives) would construct and operate an aboveground transmission line through USFWS designated critical Quino checkerspot butterfly habitat between approximate MP 4.0 and Old Highway 80. Although avoidance, minimization, and compensatory mitigation would be implemented, comparable habitat compensation may not be obtainable (the

> species is found in sparely vegetated hilltops, ridgelines, and occasionally on rocky outcrops in open chaparral and coastal sage scrub habitat in western Riverside County, southern San Diego County, and northern Baja California, Mexico), and therefore mitigation has not been identified that would sufficiently offset the loss of critical habitat for Quino checkerspot butterfly. There is no feasible mitigation to reduce this anticipated impact to a level that is below a level of significance under CEQA.

Page D.2-276-277 states:

> Although the Tule Reduction in Turbines Alternative would remove all turbines considered high risk for golden eagle collision, the risk of mortality due to collision would remain adverse. While avoidance, minimization, and mitigation measures would be implemented, the operation of remaining turbines would pose a significant and unmitigable risk of collision for golden eagles, in the absence of data demonstrating low risk, due to the proximity of known active nests near the project site. In addition, all other alternatives would construct and operate 134 turbines in the McCain Valley area and therefore impacts associated with golden eagle mortality due to collision with turbines would remain significant and unmitigable. There is no feasible mitigation to reduce this anticipated impact to a level that is below a level of significance under CEQA.

B5-7 Cont.

7. The proposed project site abuts Anza-Borrego Desert State Park, and these adjacent Park lands are designated as State Wilderness. State Parks is very concerned that wind-related energy development in McCain Valley will have significant visual impacts to the adjacent State Park Wilderness and other areas within the Park. With the proposed tall wind turbine towers, there is potential for this proposed project to be visible from within the Anza-Borrego Desert State Park, and compromise the public's wilderness experience within the Park.

   Moreover, without any analysis or justification in their Resource Management Plan (BLM 2008) for the area, the BLM downgraded the Visual Resource Management Class in McCain Valley from Class II-III to Class IV. This contradicts the original purposes that the McCain Valley Conservation Area was originally set aside for with cooperation between the BLM and California Department of Fish and Game. California State Parks, in its August 26, 2008 (Wells 2008) letter to BLM, as well as other agencies, raised concerns about these changes and pointed out that it triggered the requirement for a supplemental EIS. No response was received from BLM by DPR.

   In CDD's February 10, 2010 letter in response to BLM's Notice of Intent to Prepare the EIS (Clark 2010), CDD wrote:

   > The McCain Valley abuts Anza-Borrego Desert State Park, and these adjacent lands are designated as State Wilderness. State Parks is concerned that the Tule Wind Project could have significant visual impacts to the adjacent State Wilderness. With the typical tall wind turbine towers associated with this type of development, there is the potential for this development to be visible for many miles, thus seriously compromising the public's wilderness experience within Anza-Borrego Desert State Park. Consideration should be given to preclude placing them immediately

B5-8

adjacent to State Parks lands, and to use topography, where feasible, to screen these developments from view from State Parks lands.

Locations where the ridgeline of McCain Valley is visible would include the ridges of Sombrero Peak, Jacumba Peak, Tule Mountain, the In-Ko-Pah and Jacumba Mts. sections of the Anza-Borrego Desert State Wilderness, Whale Peak and the surrounding Vallecito Mts. section of the Anza-Borrego Desert State Wilderness, Fish Creek, Carrizo Mountain, the Carrizo Badlands, Borrego Mountain, Hwy 78 east of Ocotillo Wells, and literally many thousands of acres of State Wilderness near and far from the proposed project. B5-8 Cont.

Despite this, the current DEIR/DEIS contains absolutely no analysis or recognition of this potential impact to Anza-Borrego Desert State Park. ABDSP and Sombrero Peak are mentioned in passing, but not a single Key Observation Point (KOP) was included from ABDSP, despite the potential to impact adversely thousands of acres. One KOP outside the Park was designated as a stand-in for the Park's viewshed. The Tule Wind Project Viewshed Analysis (Figure D.3-2) fails to include the vast majority of the above impacted areas of ABDSP. The impacts to these areas absolutely must be analyzed and disclosed, and therefore a recirculation of this document is required.

8. One of the prime species for which ABDSP provides protection is the endangered Peninsular bighorn sheep. Visitors come from around the world hoping to catch a glimpse of this majestic animal. CDD is concerned regarding the close proximity of project site to the Critical Habitat for this population. B5-9

9. CDD has concerns regarding the cumulative impact of this and other proposed wind energy, solar energy and other projects currently approved or proposed in the vicinity of ABDSP and this project. For example, this project along with Manzanita, Jordan and Campo wind energy projects, the existing wind turbines and proposed turbines in Mexico, would require migratory birds such as the golden eagle to run a gauntlet of deadly turbines. The aesthetic impact from the multitude of projects is cumulatively considerable. The attached map (BLM Renewable Energy Sites) demonstrates the multitude of projects proposed by BLM, the County of San Diego, and/or the County of Imperial that hug the southern portion of ABDSP. B5-10

Literature Cited

Bureau of Land Management. 2008. El Centro Field Office, Eastern San Diego County Resource Management Plan and Record of Decision.

Pier Energy-Related Environmental Research. 2007. Golden Eagles in a perilous landscape. Unpublished report. Contract # 500-97-036. 6 pp. B5-11

Wildlife Research Institute, Inc. 2011. Golden Eagle Surveys in the Anza-Borrego Desert State Park in San Diego and Imperial Counties, California.

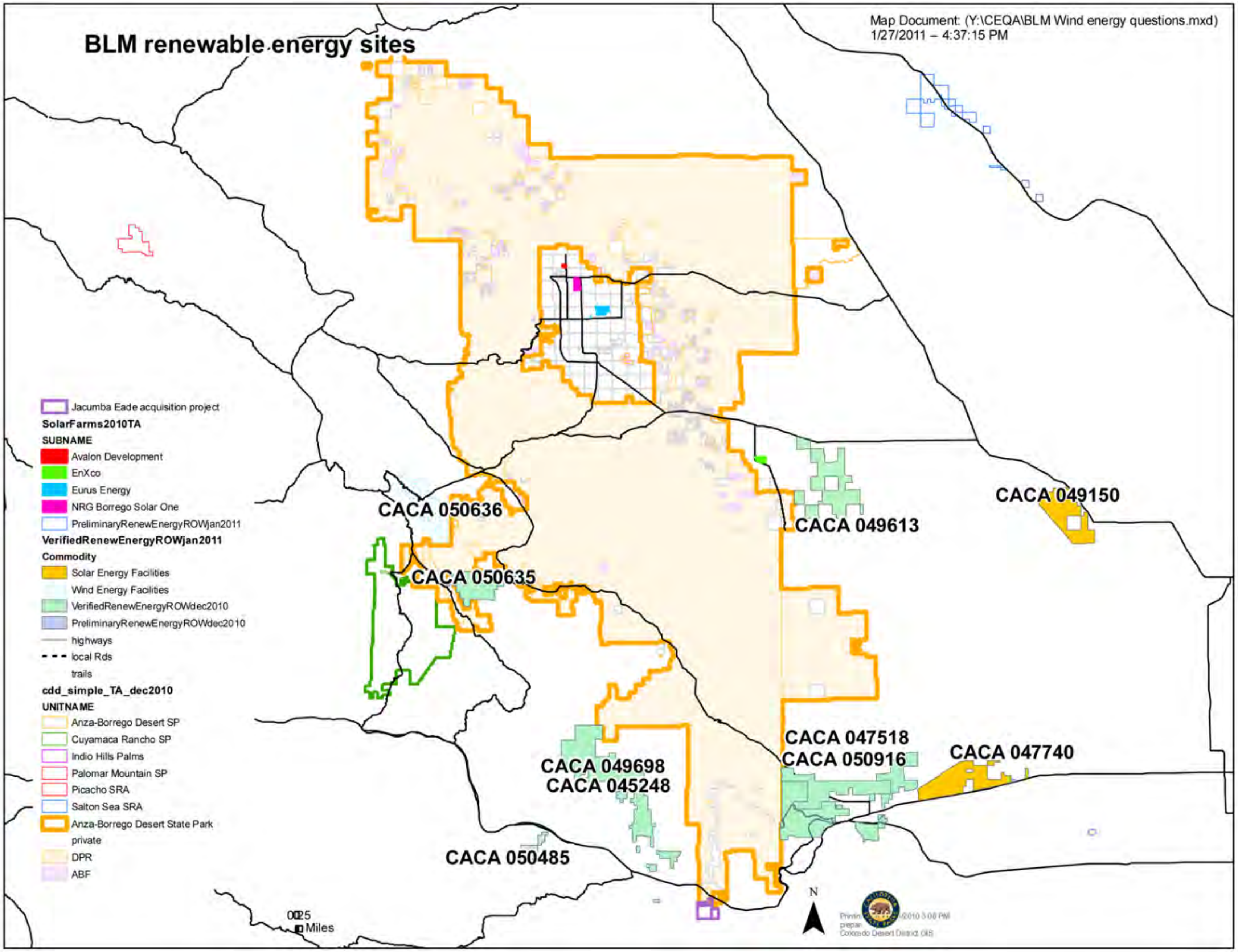
Thank you in advance for your consideration of our comments. If you have any questions or would like further information please do not hesitate to contact me at gsevr@parks.ca.gov or 760-767-4037.

Sincerely,

Gail Sevrens
District Superintendent, Acting

Cc: State Clearinghouse, via fax

The following material is considered Comment B5-11.



BLM renewable energy sites
Map Document: (Y:\CEQA\BLM Wind energy questions.mxd)
1/27/2011 – 4:37:15 PM
Jacumba Eade acquisition project
SolarFarms2010TA
SUBNAME
Avalon Development
EnXco
Eurus Energy
NRG Borrego Solar One
PreliminaryRenewEnergyROWjan2011
VerifiedRenewEnergyROWjan2011
Commodity
Solar Energy Facilities
Wind Energy Facilities
VerifiedRenewEnergyROWdec2010
PreliminaryRenewEnergyROWdec2010
highways
local Rds
trails
cdd_simple_TA_dec2010
UNITNAME
Anza-Borrego Desert SP
Cuyamaca Rancho SP
Indio Hills Palms
Palomar Mountain SP
Picacho SRA
Salton Sea SRA
Anza-Borrego Desert State Park
private
DPR
ABF
CACA 050636
CACA 050635
CACA 049613
CACA 049150
CACA 047518
CACA 050916
CACA 047740
CACA 049698
CACA 045248
CACA 050485
N
Miles
Colorado Desert District GIS

State of California • The Resources Agency
Arnold Schwarzenegger, *Governor*
DEPARTMENT OF PARKS AND RECREATION • 200 Palm Canyon Drive, Borrego Springs, CA 92004
Ruth Coleman, *Director*

February 10, 2010

Greg Thomsen
BLM California Desert District Office
22835 Calle San Juan de Los Lagos
Moreno Valley, California 92553-9046
E-mail: catulewind@blm.gov
Fax: (951) 697-5299

Via e-mail and fax

Re: Notice of Intent to Prepare an Environmental Impact Statement for the Proposed Tule Wind Project and the Proposed East County Substation Project, San Diego County, CA

Dear Mr. Thomsen:

The Colorado Desert District of the California Department of Parks and Recreation (State Parks) offers the following comments for the above project, specifically the proposed Tule Wind Project.

State Parks is a neighboring landowner to much of the BLM-owned lands in eastern San Diego County, and, as such, is keenly interested in the management planning on BLM lands that could impact State Parks lands and resources. We have partnered with the BLM in the past on projects, and will continue to do so where together we can sustain and improve the resources we manage, while providing sustainable recreational and educational opportunities for the public.

The Colorado Desert District feels the issues below require serious consideration for the project.

Incorporation of Previous Comments

The Colorado Desert District submitted comments on the Eastern San Diego County Draft Resource Management Plan (RMP) and Draft Environmental Impact Statement on May 18, 2007 (BLM designation Lett. # EC-0185, Comment #252). These comments included concerns specifically regarding visual resource management classifications, wind-related energy development, and the McCain Valley area (p. 7). Colorado Desert District submitted further comments on the revision to the RMP on August 27, 2008. State Parks would like to reiterate these 2007 and 2008 comments and incorporate them by reference. We are able to provide duplicate copies of these comments on request.

Potential Impacts to Visual Resources
The McCain Valley abuts Anza-Borrego Desert State Park, and these adjacent lands are designated as State Wilderness. State Parks is concerned that the Tule Wind Project could have significant visual impacts to the adjacent State Wilderness. With the typical tall wind turbine towers associated with this type of development, there is the potential for this development to be visible for many miles, thus seriously compromising the public's wilderness experience within Anza-Borrego Desert State Park. Consideration should be given to preclude placing turbine towers immediately adjacent to State Parks lands, and in areas visible from State Park lands. Design should incorporate the use of topography and proximity, where feasible, to screen development from view from State Parks lands.

Potential Recreational, Noise, Social and Economic Impacts
State Parks lands, including designated State Wilderness Areas, are adjacent to the BLM land in question.

Colorado Desert District of California State Parks has concerns that the proposed Tule Wind Project could impact visual resources, as well as cause potential impacts to biological resources and recreation, increase ambient noise,and cause social and economic impacts.

The Anza-Borrego Desert State Park General Plan and Final EIR (2005), which was cited as a reference in the Final EIS (p. R-3) for the RMP and in State Parks comments on BLM's Draft EIS, analyzes these resources and threats in the General Plan's Section 2.2.4 Aesthetic Resources (see also Section 1.1.4 Spirit of Place, pp. 1-5 and 1-6 of the General Plan). Visual resources of Anza-Borrego Desert State Park include all of the vistas and viewsheds, both internal and external to the State Park, and these resources are both significant and fragile. Types of potential impacts to these State Park resources are defined in the General Plan:

> Just as certain characteristics can summon positive emotions, other features can detract from the participant's pleasure in the Park experience. These undesirable (to some) features include human-fashioned intrusions like power lines, road cuts, buildings, signs, and lights. They include human activities and the impacts of these activities, including noise, traffic, waste, litter, exotic plant species, damaged plants, smog, mining and off-road scars, and crowding. (p. 2-78)

The importance of natural sounds and silence is further delineated on p. 2-81 of the General Plan. The recreational values of State Wilderness Areas are stated within Section 2.2.7 Recreational Resources (see also Section 2.4.4 Aesthetic Resource Issues, pp. 2-105 and 2-106; Section 2.4.7 Recreational Issues, pp. 2-107 and 2-108; Section 4.5.3.6 Aesthetic Resources, p. 4-15, and Section 4.5.3.7 Recreation Resources, pp. 4-15 through 4-17):

> State Wilderness Areas are…where the handiwork of humans is virtually non-existent, and natural processes prevail…. Paved roads, motorized vehicles, power lines, pipelines, radio towers, and buildings are not to be found within such wild areas. One of the primary purposes of wilderness is to provide visitors with a true "wild" experience; one in which nature and natural processes predominate without manmade intrusions distracting the visitor's senses of sight, sound, smell, and touch. (p. 2-92)

With the proposed Tule Wind Project, visitors to State Parks could be impacted by visual blight, with views from peaks such as Sombrero Peak and Whale Peak impacted, as well as potential visual impacts along ridgelines.

Associated infrastructure from the electric generation development, such as access roads and transmission lines, would lead to increased vehicle and human presence--an adverse impact consisting of degradation/alteration as stated in the RMP's Final EIS, p. 4-69.

The Final EIS of the RMP did not evaluate economic and social impacts to communities such as Borrego Springs, Shelter Valley, and Canebrake due to loss of tourism caused by the degradation of the park experience with the proposed changes. Disproportionate impacts to low income and minority populations could be caused by this degradation. Colorado Desert District of State Parks requests that these potential impacts be evaluated as part of the evaluation of the Tule Wind Project.

Wildlife and Vegetation Impacts

The Final EIS of the RMP indicated that three sensitive species of bats are known or suspected to occur within the Planning Area: Townsend's western big-eared bat (known), small footed myotis (known), and long-eared myotis (suspected). (Table 3-4, pp. 3-31 and 3-32; pp. 3-53 and 3-54)

Mortality of bats at wind energy development sites has been documented by the scientific community (See: Kunz, T.H., Arnett, E.B., Erickson, W.P., Hoar, A.R., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W., and

Tuttle, M.D. [2007]. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Front. Ecol. Environ. *5*, 315-324. Arnett, E.B., Brown, K., Erickson, W.P., Fiedler, J., Henry, T.H., Johnson, G.D., Kerns, J., Kolford, R.R., Nicholson, C.P., O'Connell, T., et al. [2008]. Patterns of fatality of bats at wind energy facilities in North America. J. Wildl. Manag. *72*, 61-78.) Newly published studies indicate that mortality results from a change in pressure near wind turbines that bat lungs are not able to accommodate by expelling air; the turbines cause the bat lungs to literally explode (Erin F. Baerwald et al. [2008]. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology, 18, R695-R696.)

The RMP's Final EIS of impacts of electric energy development under the RMP to bats consists of one sentence: "Wind energy and other utility development could result in increased mortality to individuals (e.g., bat strike, powerline electrocution)." (p. 4-27) There is no mention of these impacts in Section 4.7.3 Impacts on BLM Sensitive Species or Section 4.7.5 Unavoidable Adverse Impacts, even though there are subsections on BLM Sensitive Bats (Section 4.7.3.4, pp. 4-38 and 4-39; Section 4.7.5.2.4, pp. 4-44 and 4-45). Section 4.7.8 Cumulative Impacts does not consider bats. Impacts to bat species, including the new information regarding barotrauma to bat species designated as sensitive, should be evaluated for the Tule Wind Project.

Analysis also needs to be conducted regarding impacts to other wildlife and botanical resources. Potential impacts to vegetation, soils, water quality, air quality and wildlife (such as increase of invasive species, erosion, dust) caused by soil and habitat disturbance involved in construction of the Tule Wind Project and associated infrastructure under the proposed changes must be evaluated.

Summary

Thank you for the opportunity to provide comment. In summary, State Parks believes the proposed Tule Wind Project may have significant Visual, Wildlife, Soil, Air, Vegetation, Recreation, Social and Economic impacts. These must be carefully analyzed and fully mitigated if this project proceeds to development.

Sincerely,

Ronilee A. Clark

Ronilee A. Clark, Superintendent, Acting
Colorado Desert District

State of California • The Resources Agency
Arnold Schwarzenegger, *Governor*
DEPARTMENT OF PARKS AND RECREATION • 200 Palm Canyon Drive, Borrego Springs, CA 92004
Ruth Coleman, *Director*

August 26, 2008

Ms. Erin Dreyfuss
Planning and Environmental Coordinator
BLM El Centro Field Office
1661 S. 4th Street
El Centro, CA 92243
caesdrmp@ca.blm.gov

Via mail and fax

Dear Ms. Dreyfuss:

The Colorado Desert District of the California Department of Parks and Recreation (State Parks) has reviewed the Bureau of Land Management's (BLM) Notice of Changes to the Eastern San Diego County Proposed Resource Management Plan (PRMP) and offers the following comments.

State Parks is a neighboring landowner to much of the BLM-owned lands in eastern San Diego County, and, as such, is keenly interested in the management planning on BLM lands that could impact State Parks lands and resources. We have partnered with the BLM in the past on projects, and will continue to do so where together we can sustain or improve the resources we manage, and provide sustainable recreational and educational opportunities for the public.

The Colorado Desert District is strongly concerned with the proposed changes to Visual Resource Management (VRM) classifications and wind-related energy development proposals, and their environmental impacts.

Failure to Incorporate Previous Concerns

The Colorado Desert District submitted comments on the Draft Resource Management Plan and Draft Environmental Impact Statement on May 18, 2007 (BLM designation Lett. # EC-0185, Comment #252). These comments included concerns specifically regarding visual resource management classifications, wind-related energy development, and the McCain Valley area (p. 7). State Parks would like to reiterate these concerns, which are heightened by the proposed changes:

Visual Resources

The Preferred Alternative of the DRMP categorizes 8,362 acres of land in McCain Valley West as Visual Resource Management Class IV (Table 4-9, pgs. 4-55&56) to accommodate possible future wind-related energy development. While there are a number of potential environmental impacts that could occur from such development in this area, there is one in particular that State Parks would like acknowledged in the DRMP. The McCain Valley abuts Anza-Borrego Desert State Park, and these adjacent lands are designated as State Wilderness. State Parks is very concerned that wind-related energy development in McCain Valley will have significant visual impacts to the adjacent State Wilderness. With the typical tall wind turbine towers associated with this type of development, there is the potential for this development to be visible for many miles, thus seriously compromising the public's wilderness experience within Anza-Borrego Desert State Park. The DRMP should include some siting guidelines for wind-related energy developments in McCain Valley to preclude placing them immediately adjacent to State Parks lands, and to use topography, where feasible, to screen these developments from view from State Parks lands.

Not only did the PRMP and Final EIS of November 2007 fail to incorporate these concerns and this request, the current proposed changes would downgrade the VRM Classes for 12,195 acres in the McCain Valley areas, with further impacts.

The BLM's response to these comments was to defer analysis, assessment of impacts, and mitigation to some future time (p. 5-23), which is not adequate. Nor does BLM's response address potentially significant adverse environmental impacts to the Park at the first tier level of the Programmatic EIS. These issues must be addressed to avoid the potentially significant adverse cumulative effects of the project level proposals.

Supplemental EIS Required

State Parks requests that BLM prepare a Supplemental EIS for the proposed changes. The current changes proposed by BLM require a Supplemental EIS, as neither the Notice of Changes nor the Final EIS adequately analyze or demonstrate the basis for changing the visual inventory or VRM classes. Visual resources for Alternative D were not adequately analyzed in the Final EIS, and no supplemental analysis is provided in the Notice.

In the Final EIS, BLM stated Alternative E as the preferred alternative. In the section on Comparison of Alternatives, Section 2.3.11 describes the Visual Resource Management system and how it relates to the inventory of visual values. The section states:

> BLM prepares and maintains on a continuing basis, an inventory of visual values on all public lands in accordance with the Visual Resource Management (VRM) system (DOI BLM 1984a). The VRM system provides a way to identify, evaluate, and determine the appropriate levels of management of scenic values. The inventory of visual values has been documented for the BLM-administered lands within the Planning Area and is described in Chapter 3 and illustrated on Map 3-10. *The inventory serves as the basis for the designation of VRM management Classes I-IV,* which take into account other resource uses on public lands within the Planning Area. (p. 2-56, emphasis added)

The Notice of Changes provides no new information on the inventory of visual values. What has changed in the inventory that provides the basis for the re-designation of VRM management classes?

In the Affected Environment chapter of the Final EIS, in the section examining Visual Resources in the McCain Valley, BLM asserts that "The level of surface disturbance, loss of vegetative cover and resulting visual contrast are valid reasons for reclassifying the highest use areas as VRM Class III." (p. 3-95) Even if this were true, BLM provides absolutely no analysis for justification for reclassification to VRM Class IV. Therefore a Supplemental EIS is required for the proposed changes.

Recreational, Noise, Social and Economic Impacts of the Proposed Changes

State Parks lands, including designated State Wilderness Areas, are adjacent to the BLM land in question.

In addition to State Park concerns that the proposed changes would impact visual resources, State Parks also believes there are unanalyzed impacts to recreation, noise, biological resources, and social and economic impacts from the proposed changes.

The Anza-Borrego Desert State Park General Plan and Final EIR (2005), which was cited as a reference in the Final EIS (p. R-3) and in State Parks comments on BLM's Draft EIS, analyzes these resources and threats in Section 2.2.4 Aesthetic Resources (see also Section 1.1.4 Spirit of Place, pp. 1-5 and 1-6). Visual resources of Anza-Borrego Desert State Park include all of the vistas and viewsheds, both internal and external to the State Park, and these resources are both significant and fragile. Types of potential impacts to these State Park resources are clearly spelled out:

> Just as certain characteristics can summon positive emotions, other features can detract from the participant's pleasure in the Park experience. These undesirable (to some) features include human-fashioned intrusions like power lines, road cuts, buildings, signs, and lights. They include human activities and the impacts of these activities, including noise, traffic, waste, litter, exotic plant species, damaged plants, smog, mining and off-road scars, and crowding. (p. 2-78)

The importance of natural sounds and silence is further delineated on p. 2-81. The recreational values of State Wilderness Areas are stated within Section 2.2.7 Recreational Resources (see also Section 2.4.4 Aesthetic Resource Issues, pp. 2-105 and 2-106; Section 2.4.7 Recreational Issues, pp. 2-107 and 2-108; Section 4.5.3.6 Aesthetic Resources, p. 4-15, and Section 4.5.3.7 Recreation Resources, pp. 4-15 through 4-17):

> State Wilderness Areas are...where the handiwork of humans is virtually non-existent, and natural processes prevail.... Paved roads, motorized vehicles, power lines, pipelines, radio towers, and buildings are not to be found within such wild areas. One of the primary purposes of wilderness is to provide visitors with a true "wild" experience; one in which nature and natural processes predominate without manmade intrusions distracting the visitor's senses of sight, sound, smell, and touch. (p. 2-92)

With the proposed changes, visitors to State Parks would be impacted by visual blight, with views from peaks such as Sombrero Peak and Whale Peak impacted, as well as potential visual impacts along ridgelines.

Associated infrastructure from the electric generation development, such as access roads and transmission lines, would lead to increased vehicle and human presence--an adverse impact consisting of degradation/alteration as stated in the Final EIS, p. 4-69.

The Final EIS failed to evaluate economic and social impacts to communities such as Borrego Springs, Shelter Valley, and Canebrake due to loss of tourism caused by the degradation of the park experience with the proposed changes. Disproportionate impacts to low income and minority populations could be caused by this degradation.

Further, Alternative D results in 1,080 acres of total BLM lands for disposal (0 acres VRM Class III and 1,040 of VRM Class IV), as opposed to 490 for the

Preferred Alternative, Alternative E (450 acres class III and 0 acres class IV). This is described under the category of Irreversible/Irretrievable Commitment of Resources (p.4-73).

Wildlife and Vegetation Impacts

The Final EIS indicated that three sensitive species of bats are known or suspected to occur within the Planning Area: Townsend's western big-eared bat (known), small footed myotis (known), and long-eared myotis (suspected). (Table 3-4, pp. 3-31 and 3-32; pp. 3-53 and 3-54)

Mortality of bats at wind energy development sites has been known to the scientific community (See: Kunz, T.H., Arnett, E.B., Erickson, W.P., Hoar, A.R., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W., and Tuttle, M.D. [2007]. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. Front. Ecol. Environ. 5, 315-324. Arnett, E.B., Brown, K., Erickson, W.P., Fiedler, J., Henry, T.H., Johnson, G.D., Kerns, J., Kolford, R.R., Nicholson, C.P., O'Connell, T., et al. [2008]. Patterns of fatality of bats at wind energy facilities in North America. J. Wildl. Manag. 72, 61-78.) Newly published studies indicate that this is due to a change in pressure near wind turbines that bat lungs are not able to accommodate by expelling air; the turbines cause the bat lungs to literally explode (Erin F. Baerwald et al. [2008]. Barotrauma is a significant cause of bat fatalities at wind turbines. Current Biology, 18, R695-R696.)

The entire BLM analysis in the Final EIS of impacts of electric energy development under the RMP to bats consists of one sentence: "Wind energy and other utility development could result in increased mortality to individuals (e.g., bat strike, powerline electrocution)." (p. 4-27) There is absolutely no mention of these impacts in Section 4.7.3 Impacts on BLM Sensitive Species or Section 4.7.5 Unavoidable Adverse Impacts, even though there are subsections on BLM Sensitive Bats (Section 4.7.3.4, pp. 4-38 and 4-39; Section 4.7.5.2.4, pp. 4-44 and 4-45). Section 4.7.8 Cumulative Impacts fails to even consider bats.

Further, the EIS does not analyze how impacts to sensitive bat species may differ between Alternative D and Alternative E, nor does it incorporate the new information regarding barotrauma to bat species designated as sensitive. These impacts must be evaluated under a Supplemental EIS.

In addition to impacts to bats under Alternative D, analysis further needs to be conducted regarding impacts to other wildlife. Furthermore, impacts to vegetation and wildlife (such as increase of invasive species) caused by soil and habitat disturbance involved in construction of electric power facilities and associated infrastructure under the proposed changes must be evaluated.

Cumulative Impacts

Cumulative impacts under the existing EIS analysis are not clearly identified.

In the Final EIS, BLM acknowledged some potential cumulative impacts, presumably under the preferred alternative. "Any new wind energy projects approved on BLM-administered lands within the Planning Area could result in a cumulative increase in renewable energy generated in the Planning Area." (p. 4-94)

Additionally, this appears at odds with the BLM statement that "Any potential development of wind energy in the Planning Area is expected to be small relative to total energy consumed in San Diego County and not expected to result in significant economic impacts." (p. 4-109)

What would be the cumulative impacts under the changes to Alternative D? Have these impacts identified additional infrastructure, including power lines that may directly impact adjoining properties, including State Parks and the resources located therein?

Summary

In summary, State Parks believes the proposed changes would have significant Visual, Wildlife, Vegetation, Recreation, Social and Economic, and Cumulative Impacts; that those impacts have not been adequately analyzed, and that a Supplemental EIS is required. Further, new information regarding mortality to bat published after the Final EIS but during the comment period for the proposed changes also triggers the need for a Supplemental EIS.

Sincerely,

James C. Dice
for

Michael L. Wells, PhD
District Superintendent

State of California • The Resources Agency
Arnold Schwarzenegger, Governor
DEPARTMENT OF PARKS AND RECREATION • 200 Palm Canyon Drive, Borrego Springs CA 92004
Ruth Coleman, Director

May 18, 2007

Bureau of Land Management
El Centro Field Office
ESDC RMP Team Lead
1661 South 4th Street
El Centro, CA 92243

Comments on the Eastern San Diego County Draft Resource Management Plan and Draft Environmental Impact Statement

To whom it may concern:

The Colorado Desert District of the California Department of Parks and Recreation (State Parks) has reviewed the Bureau of Land Management's (BLM) Eastern San Diego County Draft Resource Management Plan (DRMP) and Draft Environmental Impact Statement (DEIS) and offers the following comments and recommendations. State Parks is a neighboring landowner to much of the BLM-owned lands in eastern San Diego County, and, as such, is keenly interested in the management planning on BLM lands that could affect, both positively or negatively, State Parks lands as well. We have partnered with the BLM in the past on projects, and will continue to do so where together we can sustain or improve the resources we manage, and provide sustainable recreational and educational opportunities for the public.

In general, The Colorado Desert District is supportive of the BLM's Preferred Alternative (E). However, there are several refinements or additions that should be added to improve the alternative's conservation and management strategy. These recommended additions, along with other comments, are detailed below.

Natural Resources

State Parks is particularly supportive of the proposal in the Preferred Alternative (Section 2.3.14.2 GRAZING, Alternative E) to eliminate livestock grazing on the current BLM grazing allotments in eastern San Diego County. One of the prime concerns for State Park resources relative to the BLM DRMP is the chronic livestock grazing which has been permitted for decades along the State Park borders, and by means of substantial illegal trespass, within Anza-Borrego Desert State Park.

It is not clear in the DRMP whether existing grazing allotments will be permanently cancelled, or simply put into an inactive status. State Parks requests that the grazing allotment known as Canebrake be canceled, not simply put into a category of "*vacant*" or "*temporarily inactive*." The Canebrake Allotment has heavily impacted natural and cultural resources of Anza-Borrego Desert State Park for over fifty years, never having been properly fenced, managed, or monitored. The upper pasture in South Inner Pasture, although once permitted by the BLM, caused cattle to cross one-half mile of State Park property in order to access the windmill stock watering trough on BLM land. No fence was ever erected on the allotment boundaries to protect the State Park, in spite of letters sent from the State Parks to the BLM for a period of over thirty years. A high density of archeological sites exists in both the southern and northern Inner Pasture areas, including rock art sites, burial and cremation sites, and village sites. These sites were heavily impacted by cattle grazing in the past

.

The cattle operation in Canebrake impacts a Peninsular bighorn sheep lambing area documented on the ridges within the State Park, south of the perennial water source in Canebrake Canyon. Bighorn have also been documented to use the water source in Canebrake, bringing bighorn and cattle face to face, increasing the likelihood of disease transmission into the Carrizo Canyon subpopulation of this endangered species. This mountain range has great potential to be used by bighorn throughout the year if cattle were eliminated from the area. As it is today, all bighorn leave the area after lambing season, traveling 7-10 miles back into Carrizo Canyon for the summer.

State Parks asks that the BLM also eliminate the Vallecito Grazing Allotment from any future grazing activity. State parks acquired the home ranch and 3,349 acres of the former Ranchos Vallecitos in 2004-05. Anza-Borrego Desert State Park is working with the BLM to manage the lands at Vallecito to benefit public use, recreation, riparian restoration, and work toward the return of the Peninsular bighorn sheep to this area. Anza-Borrego has acquired a $500,000 resource grant to eliminate all non-native tamarisk trees from the entire Vallecito property. This work will begin in October 2007.

Section 3-35, Section 3.7.1.1 PENINSULAR BIGHORN SHEEP. State Parks recommends updating the population estimate for the Peninsular Ranges in the document from 335 to "almost 800, as of October 2006".

In the section entitled, "Occurrence in Planning Area", we recommend changing the description near the bottom of the page to read "The Carrizo Canyon subpopulation occurs on BLM and State Park lands while the Vallecito Mts. And N. and S. San Ysidros groups occur primarily on Anza-Borrego Desert State Park land."

Section 3-50, 3.7.1.7 Unarmored Three-Spined Stickleback. In section "Occurrence in Planning Area," change ownership from "private" to "State Parks and Fish & Game lands near Scissors Crossing".

Wildlife Resource Management. The DRMP mentions under most of the proposed alternatives that the BLM will either maintain existing wildlife water sources, or maintain existing sources and consider the construction of additional water sources in the future. State Parks recommends that the BLM consider prioritizing rehabilitation of historic water sources before creating new artificial sources. This may especially be beneficial to wildlife in areas where grazing is being eliminated.

Paleontological Resources

It is impossible to critically comment on the paleontologic resource issues as presented in the existing management document. The paleontologic resources and their distribution are not described (taxa, stratigraphic data, ages or geologic formation names are not provided). Apparently, field assessment of the more sensitive areas within BLM lands in the Planning Area has not been performed at either reconnaissance or intensive levels. No paleontologic data sources, such as museum collections or published or gray literature, are referenced or listed in the appendices.

Areas with four different paleontological sensitivity levels are defined (page 2-49, 3-85, 3-86) and plotted within the Planning Area (Figure 3-10). However, specific criteria used to evaluate the resource content and sensitivity of these areas is not provided, and the definitions are unsatisfactory.

No management plan for the mitigation of the regionally pervasive negative natural impacts to sensitive and/or significant paleontologic resources is presented.

2.3.10 Paleontological Resource Management. The document states that the paleontological potential of all lands within the Planning Area are based on "existing maps" (page 2-49). A reference to these maps is not provided. We assume the authors refer to the geologic maps of Roger (1992) and Strand (1993). Although comprehensive, these sources are 25 years out-of-date. They do not address paleontologic resources or provide criteria for sensitivity evaluations. A paleontologic sensitivity map is included in Final Anza-Borrego Desert State Park General Plan (DPR 2005). However, this source does not list geologic formations, the basis of the sensitivity units described.

Under Class 3 (see discussion under chapter 3.10) it is claimed that because there is "no risk of human-caused adverse impacts" sensitivity is moderate. The risk of impact does not change the significance of fossil remains. Significant remains are sensitive to any/all adverse impacts regardless of the level of risk.

As an attribute of Class 3 and 4 sensitivity areas (see discussion under chapter 3.10) (page 2-49), appears the undefined term "low risk of natural degradation". This condition does not exist. For all of the fossiliferous geologic units present within the Planning Area, natural degradation is an omnipresent threat to fossils. The surface residency time of vertebrate remains following exposure through natural erosion is estimated at no more than 50 years (given weather/precipitation maxima, soil temperature fluctuations, slope angle, proximity to run off channels, matrix composition and texture, and the extent of specimen premineralization).

The management of potential or presumed paleontological resources, based on the assigned sensitivity levels for specific geological formations (page 2-49, 3-85, 3-86), has serious limitations. Given these limitations are recognized, potential sensitivity is only a crude method of resource evaluation. The relative paleontologic productivity of a geological formation may widely vary from exposure to exposure. Named stratigraphic formations may include both non-productive as well as highly fossiliferous beds or members. Furthermore, a sedimentary unit that is classed as *low sensitivity* may yield a few rare fossils that could be very highly significant. Sedimentary deposits with no known paleontologic signature at the surface may yield abundant and significant fossiliferous remains (e.g. Diamond Valley, Hemet, California) (Springer et al. 1998). There is no substitute for the direct field assessment of the distribution and significance of paleontological resources.

Essentially all Class 3 and 4 sensitive areas (see discussion under chapter 3.10) within the Planning Area are on Colorado Desert District (CDD) Anza-Borrego Desert State Park (ABDSP) lands (page 3-86, Figure 3-10). The ABDSP General Plan and CDD Paleontological Resources Management Plan (Department of Parks and Recreation [DPR] 2004, 2005; Jefferson 2001) address resources issues for these areas. However, these documents and the actual paleontological distribution and attribute data referenced therein (Jefferson 1999, also see Jefferson and Lindsay 2006) are not cited.

2.3.10.2 Management Actions Common to All Alternatives. Paleontologic resource assessment is a prerequisite to informed management. The presence and significance of paleontologic resources should be evaluated on all Class 3 and 4 designated lands (see discussion under chapter 3.10) as a standard element of the land use planning process. Information so derived should drive the decisions presented in resource planning documents.

3.10 Paleontological Resources. To claim that paleontologic resources are less sensitive, Class 3 rather than 4, because there is "no risk of human-caused adverse impacts" is illogical. Risk level can change with a variety of factors including land use designations and weather. The sensitivity of fossil remains is not based on the probability of damage, but on the intrinsic nature of the fossil materials to suffer damaged. The definitions of Class 3 and 4 sensitivity need to be amended and reworded accordingly.

4.10 Impacts on Paleontologic Resources. "The analysis of potential impacts to paleontological resources was based on review of existing literature and the expertise of BLM resource specialists." This "existing literature" is not cited (page 4-47). "BLM resource specialists" responsible for the drafting these sections are not referenced in 5.2 (see below).

4.10.1 Loss or Degradation of Paleontological Resources. "Livestock grazing could result in the degradation of vertebrate fossils . . . through trampling of exposed deposits, though the potential of this is low as most deposits are not exposed." This latter half of this statement (page 4-47) is a non-sequitur.

Although WAs, WSAs, and ACECs largely protect vertebrate fossils from negative human impacts (page 4-48), degradation of such remains occurs constantly through natural processes. These land designations and attendant management practices do nothing to insure the protection of such remains from the destructive forces of weathering and erosion. A proactive program of resource assessment, specimen recovery and conservation is employed by other governmental agencies such as NPS at Hagerman Fossil Beds NM and John Day Fossil Beds NM, and by State Parks CDD (Jefferson 2001). What are the BLM plans to mitigate these negative natural impacts?

5.2 List of Preparers. No on-staff BLM paleontologic experts or consultants are listed in Table 5-1. Was the author/s of sections 3.30 and 4.10 a qualified paleontologist (see definitions The Society of Vertebrate Paleontology 1991, 1995, 1996, 2007)?

Appendix B Laws, Regulations, and Executive Orders. The authorities under which the BLM manages paleontological resources listed in 2.3.10 (page 2-49) are not included in this appendix.

References. No paleontologic literature is cited for the Planning Area or region.

Cultural Resources

Section 2.3.9.1, Table 2-5: Cultural Use Allocation. All cultural resource categories should be identified as having potential to Traditional Use and Conservation for Future Use. The assumption that archaeological sites have only Scientific values is not n accordance with current professional standards nor in accordance with input from Native and other traditional communities.

Section 2.3.9.2: Goals and Objectives. Include goal: "Work with Native American communities to identify cultural resources of critical concern to Native Peoples."

Section 3.9, Table 3-5: Cultural Resources. Table 3-5 should be relabeled "Summary of Cultural Resources Previously Recorded Within the Planning Area." This table does not reflect the totality of cultural resources located within the Planning Area.

Section 3.9, Figure 3-9: Cultural Resources. Blue areas identify "Surveyed Areas." These areas have only been surveyed incompletely and often at records-only overview level. It is erroneous to state that they have been Surveyed.

Section 3.9.1: Site Significance. A page from the Paleontology discussion (Page 3-86) is mistakenly included in the Cultural Resources section.

Section 3.9.5: Historically Significant Trails System. Discussion of the San Diego and San Antonio Mail Route is in error. The third sentence should read, "The route entered the Planning Area in the south, east of where the community of Ocotillo is today." The sixth sentence should read, "At Oriflamme Canyon, one leg of the route left S-2 and proceeded up the mountains to Cuyamaca and on to San Diego." The seventh sentence should read, "Passengers dismounted from the stages for this portion of the route and proceeded on to San Diego." The eighth sentence should be deleted. The

"Jackass Mail" was a label attached to the mail line as ridicule by rival cities in the 1860s and for popularization by researchers in the 1930s.

The discussion of Butterfield Mail is in error. The fifth sentience should read, "The Butterfield followed the San Antonio and San Diego Mail in the southern potion of the Planning Area." The sixth sentence should read, "...the Butterfield stage continued north to Warner Spring and on to Los Angeles, whereas the San Antonio and San Diego Mail also went west up Oriflamme Canyon to San Diego."

Section 3.12.1: Wilderness Areas. Carrizo Gorge Wilderness, Sawtooth Mountains Wilderness, and seven Wilderness Study Areas should have included in the Wilderness Values, "Cultural Value."

Section 5.1.3: Consultation with Native Americans. As with State, County, and Local governmental agencies, the BLM should continue to coordinate with Native American tribes within the DRMP Planning Area as to their concerns. This coordination should continue on a regular basis as part of the BLM's ongoing land management decision-making process.

Special Designations

Table ES-1, page ES-7: Wilderness and Wilderness Planning Area Management. Under this section of Table ES-1 no alternatives are "X'ed" for two important categories: 1) "Acquire inholdings from willing owners.", and 2) "Perform restoration treatments where damage has occurred or where it will reduce vehicle incursions." These two management items should be included in the Preferred Alternative (E).

Mineral Resources

Section 2.3.15.3: Mineral Resource Disposal from Public Lands. The DRMP indicates that designated Critical Habitat for federally-listed threatened or endangered species would still remain open for the extraction of "locatable mineral deposits" under the Preferred Alternative (E). Under Alternative C this activity would be excluded from areas of Critical Habitat. Under the Preferred Alternative the DRMP would exclude extraction of "leasable" and "salable" minerals from Critical Habitat. The development and/or extraction of "locatable mineral deposits" should also be excluded from designated Critical Habitat areas to maximize the opportunity for listed species recovery. This action would make the DRMP consistent with its goal in Section 2.3.7, Special Status Species Management, which states, "Land use plan decisions would be consistent with BLM's mandate to protect and recover species listed under the ESA and would be consistent with objectives and recommended actions in approved recovery plans."

Visual Resources

The Preferred Alternative of the DRMP categorizes 8,362 acres of land in McCain Valley West as Visual Resource Management Class IV (Table 4-9. pgs. 4-55&56) to accommodate possible future wind-related energy development. While there are a number of potential environmental impacts that could occur from such developments in this area, there is one in particular that State Parks would like acknowledged in the DRMP. The McCain Valley abuts Anza-Borrego Desert State Park, and these adjacent lands are designated as State Wilderness. State Parks is very concerned that wind-related energy development in McCain Valley will have significant visual impacts to the adjacent State Wilderness. With the typical tall wind turbine towers associated with this type of development, there is the potential for this development to be visible for many miles, thus seriously compromising the public's wilderness experience within Anza-Borrego Desert State Park. The DRMP should include some siting guidelines for wind-related energy developments in McCain Valley to preclude placing them immediately adjacent to State Parks lands, and to use topography, where feasible, to screen these developments from view from State Parks lands.

This concludes State Parks comments and recommendations on the DRMP. We appreciate the opportunity for input in the development of the DRMP. The BLM and State Parks share a number of similar mandates as land managers in the conservation of natural and cultural resources, as well as in public recreation and education. We look forward to continued cooperation and coordination in managing our lands in eastern San Diego County. If you have any questions regarding this letter, please contact David Lawhead, District Environmental Coordinator, at (760) 767-4315 or dlawhead@parks.ca.gov.

Sincerely,

Original signed by

Michael L. Wells, Ph.D.
District Superintendent

Literature Cited

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http://www.vertpaleo.org/policy/policy_statement_conformable_Impact.htm 6 p.

cc: Mark Jorgensen, ABDSP
Jim Dice, CDD
Dave Lawhead, CDD

From: Ben Lichty <Ben.Lichty@slc.ca.gov>
Sent: Friday, March 04, 2011 4:55 PM
To: ECOSUB; catulewind@blm.gov
Cc: Jennifer DeLeon
Subject: Comment Letter SCH # 2009121079 EC Substation & Tule Wind DEIR
Attachments: 2009121079 CPUC Tule Wind DEIR (2011-03-04).pdf

All,

Please see the attached comment letter for SCH # 2009121079 EC Substation & Tule Wind DEIR.

Thank you,

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March 4, 2011

File Ref: SCH 2009121079

California Public Utilities Commission
Iain Fisher, Project Manager
505 Van Ness Avenue
San Francisco, CA 94102

Subject: Draft Environmental Impact Report/Environmental Impact Statement for the East County Substation, Tule Wind, and Energia Sierra Juarez Gen-Tie Projects

Dear Mr. Fisher:

Staff of the California State Lands Commission (CSLC) has reviewed the subject Draft Environmental Impact Report/Environmental Impact Statement (DEIR/DEIS) for the East County Substation, Tule Wind, and Energia Sierra Juarez Gen-Tie Projects (Project) prepared by the California Public Utilities Commission (CPUC) and the Bureau of Land Management (BLM) as joint lead agencies representing state and federal jurisdictions. The CPUC is the lead agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code § 21000 et seq.) with respect to the Project and the BLM is the lead agency under the National Environmental Policy Act (NEPA). B7-1

The CSLC has prepared these comments as a responsible and trustee agency because of its leasing jurisdiction over portions of the Project located on state school lands as well as its trust responsibility for any and all projects that could directly or indirectly affect state owned "sovereign" land and/or school lands, and their resources or uses (pursuant to CEQA Guidelines[1] §§ 15381, 15386, subd. (b)). The CSLC also supports environmentally responsible use of school lands for renewable energy projects (see the *Resolution By The California State Lands Commission Supporting The Environmentally Responsible Development Of School Lands Under The Commission's Jurisdiction For Renewable Energy Related Projects* [Resolution] adopted by the CSLC on October 16, 2008, at http://www.slc.ca.gov/Renewable_Energy/Documents/Resolution.pdf).

[1] The "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with Section 15000.

CSLC Jurisdiction

In 1853, the United States Congress granted to California hundreds of thousands of acres of land for the specific purpose of supporting public schools. In 1984, the State Legislature passed the School Land Bank Act (Act), which established the School Land Bank Fund (SLBF) and appointed the CSLC as its trustee (Pub. Resources Code § 8700 et seq.). The Act directed the CSLC to develop school lands into a permanent and productive resource base for revenue generating purposes. The CSLC manages approximately 469,000 acres of school lands held in fee ownership by the State and the reserved mineral interests on an additional 790,000± acres where the surfaces estates have been sold. Revenue from school lands is deposited in the State Treasury for the benefit of the Teachers' Retirement Fund (Pub. Resources Code § 6217.5).

As proposed, the Project includes seven wind turbines located on a State school land parcel acquired from the federal government in 1880 and described as Section 16, T16S, R6E, SBBM, San Diego County. Project proponents would be required to obtain a lease for all or a portion of the section in order to construct and operate those turbines or locate any other project-related facilities on the section.

Proposed Project

As proposed, the Project includes construction and operation of the East County Substation, the Tule Wind facility, and the Energia Sierra Juarez Gen-Tie. The DEIR/DEIS also includes brief overviews of three potential future wind energy projects referred to as the Campo, Manzanita, and Jordan Wind projects. Because the DEIR/DEIS provides no specific information about the latter three projects or their potential environmental effects, the CSLC cannot provide comments at this time beyond those that might be relevant to the cumulative impacts section. B7-1 Cont.

While the CPUC, as lead agency, has determined that the Project components are sufficiently connected to be considered the "whole of the action" under CEQA, the CSLC staff has focused its comments on the DEIR/DEIS on the Tule Wind component of the Project (hereinafter referred to as the "Tule Wind Project") for the following reasons:

- As a responsible agency, the CSLC is limited to considering only the effects of those activities involved in the Project which it may carry out or approve.
- As a trustee agency, the CSLC is also responsible for considering the effects of those activities involved in the Project which may impact trust resources on State-owned sovereign lands.

In this case, only the Tule Wind Project involves activities that implicate the CSLC's leasing jurisdiction and trust responsibilities and therefore the comments that follow are presented in the context of the adequacy of the disclosure and analysis of potential effects caused by that component; however, to some extent, certain discussions and mitigation measures in the document about which the CSLC is commenting apply to the East County Substation and Energia Sierra Juarez Gen-Tie components as well.

The Tule Wind Project would be primarily located in the In-Ko-Pah Mountains near the McCain Valley in southeastern San Diego County. It includes construction and operation of up to 134 wind turbines (up to 492' in height in the 1.5 megawatt (MW) to 3.0 MW range) and associated electrical systems to generate 200 MW of electricity. In addition to wind turbines and associated generator stepup transformers, the Tule Wind Project would include the following components:

- A 5-acre collector substation site and a 5-acre operations and maintenance (O&M) building site;
- A 34.5 kilovolt (kV) overhead and underground collector cable system linking the wind turbines to the collector substation (this portion would require approximately 232 poles and an unknown amount of trenching to install underground portions);
- Two permanent meteorological (MET) towers and one sonic detecting and ranging (SODAR) unit;
- A 9.7-mile-long 138 kV overhead transmission line supported by 108 steel galvanized or weather steel finished tangent poles running south from the collector substation to be interconnected with the rebuilt San Diego Gas & Electric (SDG&E) Boulevard Substation (associated with the East County Substation component of the Project);
- 36.38 miles of newly constructed access roads (166.1 acres) and 27.62 miles of temporarily widened and improved existing access roads (84.2 acres);
- Development and use of a temporary on-site concrete batch plant;
- Up to three temporary use water wells for construction on private land; and
- One permanent water well for the O&M building

B7-1 Cont.

Construction of the Tule Wind Project would require approximately 17.5 million gallons of water and approximately 3.55 million cubic yards (CY) of earthwork (3.55 million CY includes 1.0 million CY attributed to rock excavation). Construction and operation would result in the temporary loss of approximately 215 acres and the permanent loss of approximately 492 acres of native vegetation communities, including 5 sensitive natural communities. The Tule Wind Project is also expected to impact wildlife resources including mammals, birds, and insects, through habitat loss, movement restriction, and collision potential.

General Comments

Given the CSLC's support for environmentally responsible development of renewable energy related projects on CSLC school lands, the CSLC staff is concerned that the DEIR/EIS does not provide sufficient information to: (1) facilitate meaningful review of the Tule Wind Project's environmental impacts; (2) enable staff to independently conclude that the identified impacts are lessened or avoided to the extent feasible; or (3) determine that the proposed Tule Wind Project would be developed with assurances that the State's unique and sensitive environment will be protected, per the Resolution. Specifically, the DEIR/DEIS as currently written:

B7-2

- relies heavily on general characterizations of the Tule Wind Project components and impacts rather than specific data;
- does not provide project-/site-specific, readily measureable or quantifiable significance criteria to enable staff to evaluate and conclude whether or not there is substantial evidence as to why or how identified mitigation measures will avoid or reduce project-related significant impacts to a less than significant level;
- does not contain several critical plans and protocols, even in draft form, for public review and analysis, instead relying on the future development of plans, protocols, and performance/effectiveness criteria for a number of proposed mitigation measures;
- provides no explanation as to why it is infeasible at this juncture to conduct needed surveys and include survey results, identify the location or abundance of specific sensitive species, or prepare and include for public review certain plans and protocols that are the basis for the document's ultimate significance conclusions; and
- may need to be recirculated (as provided in Pub. Resources Code § 21092.1, CEQA Guidelines § 15088) to address these apparent deficiencies.

B7-2 Cont.

Overall, our concerns relate to the project description, information on environmental setting, the incremental change to the baseline caused by the Tule Wind Project, and whether the impacts resulting from that change are significant either with or without mitigation. As a result, the comments that follow are intended to highlight major issues and provide recommendations for improving the DEIR/DEIS throughout by discussing several specific examples rather than by providing an exhaustive page by page list; the CSLC staff intends these comments and suggestions to be a platform from which the CPUC and BLM can systematically revise the DEIR/DEIS across all appropriate discussions and resource areas.

<u>Project Description and Environmental Setting</u>

With respect to the Tule Wind Project description and environmental setting, the DEIR/DEIS in several instances neglects to provide specific information on activities that may affect the environment or on the status of local sensitive resources that may be affected by those activities. Without a complete and accurate project description and environmental setting, the DEIR/DEIS likely provides an incomplete picture of project-related environmental impacts.

B7-3

For example, the DEIR/DEIS indicates in Section B, Project Description, that blasting may be necessary, but does not indicate, or provide a preliminary estimate, where, when, or how much blasting may occur. As a result, the CSLC staff is unable to evaluate to what extent blasting may cause a significant effect on the public (e.g., recreation, safety) or biological resources (e.g., nesting birds, lambing Peninsular bighorn sheep). Furthermore, Section B describes the location and general nature of the turbines and transmission lines, but does not provide adequate detail regarding the methods that will be used to install those components. For instance, the use of helicopters is described as part of the 138 kV transmission line install and stringing for the East County Substation component of the Project, but potential use of helicopters is not mentioned in the discussion of the 138 kV transmission line associated with the Tule Wind Project. If helicopters in fact will be used, the omission of this detail in the DEIR/DEIS precludes an evaluation of potential impacts associated with helicopters. B7-3 Cont.

Furthermore, in Section D.2, Biological Resources, the DEIR/DEIS fails to characterize baseline abundance estimates for several species due to lack of investigation or incomplete surveys, instead simply assuming presence and categorizing the impact as "adverse." For example, the document indicates plant surveys and bat investigations were incomplete at the time of releasing the DEIR/DEIS, and therefore, quantified estimates of population abundance or specific species information are not disclosed or evaluated in the context of the scope and magnitude of potential impacts. Absent the inclusion in the document of even preliminary figures that capture a baseline or starting point from which to measure the Tule Wind Project's expected incremental effect to these resources, the CSLC staff is unable to determine whether those effects are significant and whether the proposed mitigation is effective in lessening the significant effects. Several other examples and recommendations are provided below in the "Specific Comments" section of this letter. B7-4

<u>Significance Criteria</u>

While CEQA provides lead agencies broad discretion to define significance thresholds, because CEQA's "substantive mandate" applies to significant project-related impacts, a clearly defined project-specific threshold against which the impacts are gauged is necessary. The CSLC staff is concerned that the DEIR/DEIS as currently written does not satisfy this mandate for the following reasons.

- The DEIR/DEIS does not identify a meaningful threshold by which the significance of project-related impacts is gauged.
- As a consequence, the DEIR/DEIS does not identify all significant environmental impacts.
- The ultimate significance conclusions for many affected resources lack reasoned explanations of how that conclusion is a logical outcome of factual analysis, instead relying almost entirely on unsupported "conclusory" statements B7-5

As the significance thresholds for the Tule Wind Project are identified only as the generic thresholds contained in Appendix G of the CEQA Guidelines, rather than as project-/site-specific, readily measureable or quantifiable thresholds tied to the local environmental conditions on which the Tule Wind Project will operate, the CSLC staff is generally unable to evaluate and reach its own conclusions regarding whether or not there is substantial evidence as to why or how the identified mitigation measures will avoid or reduce project-related significant impacts to a less than significant level. (Said another way, because the meaning of "adverse" is unclear in the context of site-specific factors, it is difficult to determine what type or amount of mitigation would render the impact "not adverse.") To make the Appendix G thresholds meaningful in the present document, the CSLC staff recommends identifying, for each affected resource, a value or site-specific definition of "substantial adverse" effect (e.g., loss of over "X" percent of habitat or direct mortality or abandonment of the area of "Y" percentage of the estimated local population, etc.). B7-5 Cont.

Mitigation

With respect to the mitigation measures identified in the DEIR/DEIS, the CSLC believes many constitute an impermissible deferral or are otherwise unenforceable due to a lack of specific standards or a commitment to achieve or maintain those standards. Although for CEQA purposes the mitigation measures identified in an EIR need not include all specific details when such specificity is "truly infeasible or impractical" at the time of preparation, which the DEIR/DEIS does not explain is true in the present case, the EIR does need to at least:

(i) specify performance standards which would ensure the mitigation of the significant effect, and

(ii) disallow the occurrence of physical changes to the environment unless the performance standard is or will be satisfied. (See CEQA Guidelines §15126.4.)

In the DEIR/DEIS as currently drafted, the mitigation measures related to development and implementation of plans and measures that may be devised in the future do neither of the above. As a consequence, the DEIR/DEIS denies responsible agencies and the interested public the chance to comment on the adequacy of the proposed mitigation for avoiding or minimizing a project's impacts. Specific examples and recommendations are provided below in the "Specific Comments" section of this letter, but in general, the CSLC staff recommends the DEIR/DEIS either provide the required plans in a recirculated document for public review and comment or replace unenforceable statements like "criteria will be developed," "appropriate," "may include," "to be developed," and "acceptable risk" with more meaningful, measureable, and achievable performance standards. B7-6

Similarly, a lead agency may not defer the formulation of a mitigation measure to other agencies; lead agencies must do all that is feasible on their part to address significant impacts even where a subsequent permit from another agency is necessary. Examples of improper deferral in the DEIR/DEIS of this nature are particularly evident in Section D.2, Biological Resources, related to habitat restoration (BIO-1d), jurisdictional features (BIO-2a), federal or state listed species (BIO-7f), nesting birds (BIO-7j), and Avian Protection Plan (BIO-10b). While the requirements contained in permits issued by the various regulatory agencies mentioned may ultimately provide a basis to conclude that the particular agency's permitting requirements were met, such a conclusion is not, as a matter of law, a basis to conclude that all project-related impacts on those resources are mitigated to below a level of significance under CEQA. Rather, the CPUC has the responsibility to comply with CEQA's substantive mandate to mitigate all project-related impacts to the extent feasible, not simply pass the responsibility to a responsible agency with more limited regulatory and statutory requirements.

The CSLC staff recognizes that a lead agency's obligation to disclose all that it reasonably can is tempered by feasibility and the scope and magnitude of the project. Even so, for the reasons identified above and described in more detail below, CSLC staff is concerned the apparent lack of factually based analysis in the DEIR/DEIS, including the lack of related discussion and substantive support for ultimate conclusions in the document, preclude meaningful public review of the environmental effects that my actually be caused by the Tule Wind Project. B7-6 Cont.

Specific Comments

Section ES and Section A – Executive Summary and Introduction:

1. The first paragraph of ES.5.2.2 (Tule Wind Project Alternatives) on Page ES-15 states that the CSLC, among other agencies, would be responsible for "making a decision…including which, if any, of the five alternatives or variations and/or combinations of those alternatives evaluated in this EIR/EIS should be adopted." This statement places the responsibility for determining Project alternatives on responsible agencies rather than the lead agency. The CPUC, as the CEQA lead agency for the Project, which includes the Tule Wind Project, is responsible for certification of the EIR/EIS, including selecting an alternative or combination of alternatives and incorporating appropriate mitigation measures for use as the final "Project" on which the CSLC and other responsible agencies would rely for their subsequent discretionary actions. If the CSLC determined that additional measures were necessary, those would be included in the lease as lease conditions or use restrictions on the school lands parcel; however, CSLC staff does not agree that each of the identified land owners would approve a different version of the "Project." This paragraph should be rewritten to clarify that the CPUC is the CEQA lead agency and will make a decision on which, if any, of the alternatives to incorporate into the final document it may ultimately certify. B7-7

2. Section A.5.1 (CPUC) on Page A-13 includes the statement: "The CPUC is the lead state agency for CEQA compliance in evaluation of SDG&E's proposed ECO Substation Project…" In fact, because the CPUC determined that the three components (ECO, Tule, and ESJ) were part of the "whole of the action" subject to the CPUC's lead agency action, this sentence should be rewritten to clarify that the "CPUC is the lead state agency for CEQA compliance in evaluation of the Proposed PROJECT…" The CSLC staff further suggests this paragraph be expanded to clarify that while the CPUC has the independent statutory authority to condition its approval only on the East County Substation component of the Project by requiring project changes or mitigation measures be incorporated into the final document, the CPUC is nonetheless responsible for (i) disclosing and evaluating all that it reasonably can for the entire proposed Project, (ii) identifying feasible mitigation measures, and if necessary, (iii) finding that those measures, if they are within the responsibility and jurisdiction of another agency, can and should be adopted by that agency (Pub. Resources Code § 21081, CEQA Guidelines § 15091). B7-8

Section B - Project Description:

3. As stated above in General Comments, the Project Description should be revised to include additional detail regarding the potential use of blasting (p. B-128) and helicopters (P. B-131). For instance, it would be helpful to include estimates based on preliminary site investigations regarding the expected locations and extent of blasting that could occur. This information is relevant because the location, timing, and extent of these activities could affect whether or not significant impacts result. Page B-130 makes passing reference to limiting the timing and location of blasting "in the proximity of sensitive habitat," but the discussion of potential impacts and commensurate mitigation measures, whether near sensitive habitat or sensitive species is absent from Section D.2 Biological Resources. B7-9

Section D.2 – Biological Resources:

4. Section D.2.1 Environmental Setting/Affected Environment: Pages D.2-3 – D.2-4 describe the methodology for characterizing the biological resource setting, identifying several surveys and studies relevant to the Tule Wind Project setting. However, surveys for rare plants and bat monitoring investigations are described as "ongoing" and thus, the environmental setting for these resources cannot be considered complete. As explained above in the General Comments section, the CSLC staff is concerned that because the DEIR/DEIS does not provide a complete picture of the environmental setting and the potential resources that could be found in or using the area, a number of potentially significant impacts may have been overlooked. Additionally, reports from the completed surveys and investigations are not included with the document (e.g., the final bat monitoring report). The CSLC staff recommends that any technical biological information and data reports relevant to characterizing the environmental baseline be included in appendices. B7-10

5. Section D.2.1.1 Regional Overview: The last sentence on page D.2-46 under the Golden Eagle heading states "Suitable nesting habitat (i.e., cliffs) is not known within the Proposed PROJECT area..." However, on page D.2-89 under the Golden Eagle heading in the Tule Wind Project section (D.2.1.3) the DEIR/DEIS indicates there were several active nest sites recorded in the 2010 surveys. Please correct the statement on suitable golden eagle nesting habitat to more accurately reflect the actual environmental setting. B7-11

6. Section D.2.1.1 Regional Overview: It is unclear why the pallid bat and the pocketed free-tailed bat, both low frequency echolocating bats, are the only bat species mentioned in this section (on pages D.2-53 and D.2-56, respectively), when according to the draft "Final Bat Acoustic Studies" Report (Report) prepared by WEST, Inc., the ranges of nearly two dozen bat species include the Tule Wind Project area. The CSLC staff is concerned that the DEIR/DEIS has excluded several other sensitive bat species from the analysis by improperly limiting the Existing Setting discussion in spite of direct acoustic monitoring evidence indicating use of the area by not insignificant numbers of other bats. In particular, the Report indicates that the monitoring stations recorded a high number of "bat passes" from high-frequency bats, "...suggesting that the species in the high frequency group are B7-12

generally more abundant throughout the [Tule Wind Project] area." Using these data, it is clear that the Tule Wind Project area is utilized by more species of bats than the DEIR/DEIS states, and as such, the analysis of potentially significant impacts to bat resources is deficient. The DEIR/DEIS could be improved by including more species information, obtained through direct visual or night-goggle surveys. If such surveys are infeasible, the DEIR/DEIS should at a minimum be revised to indicate that based on the acoustic monitoring, other bat species of concern occur and are likely to be impacted by construction and operation of the Tule Wind Project. B7-12 Cont.

7. Section D.2.1.1 Regional Overview: Under the Mountain Lion heading on page D.2-54, the first sentence regarding legal status should be revised to indicate that the mountain lion is designated a "Specially Protected Mammal" pursuant to Fish and Game Code section 4800 and is subject to the protections specified therein. B7-13

8. Section D.2.1.1 Regional Overview: The discussion on page D.2-60 regarding the potential for the Project area to serve as a flight corridor is only briefly and generically described in this section, and the subsequent Tule Wind Project Section (D.2.1.3) fails to discuss in any more detail the potential for operation of the turbines to affect migratory bird species (in particular nocturnal migrating songbirds and raptors, including the state-listed Swainson's hawk). As such, the document fails to disclose and evaluate the potential direct and indirect effects on these resources resulting from project operation or whether those impacts are potentially significant. The CSLC staff recommends the appropriate sections be revised to include information on whether and to what extent the Tule Wind Project, *specifically*, could result in impacts to migrating bird species and provide measures to avoid or lessen that impact should it be found significant. B7-14

9. Section D.2.1.3 Tule Wind Project Setting: On pages D.2-92 and D.2-93 the DEIR/DEIS indicates there is "moderate" potential for the pallid bat and pocketed free-tailed bat to "forage over the site" but that roosting potential, based on limited investigation of abandoned mines in the vicinity, was limited. The CSLC staff recommends this section (and Appendix 1) be updated to include other sensitive bat species, for the reasons stated in Comment 6 above. In addition, this section limits roosting potential to mines; it should also include a discussion of the presence and extent of large boulder-like rock formations scattered throughout the McCain Valley, and their potential to be used by crevice-dwelling bats. Without this information, the DEIR/DEIS likely understates both the type and extent of impacts on bats. B7-15

10. Section D.2.2 Applicable Regulations, Plans, and Standards: There are several errors and outdated references to relevant laws and regulations that should be corrected in consultation with the relevant agencies. For example, the description of the federal Endangered Species Act Section 7 consultation process and issuance standard on page D.2-16 should be revised in coordination with the U.S. Fish and Wildlife Service (Service) to state that "no jeopardy" biological opinions contain both Reasonable and Prudent Measures and Terms and Conditions to implement those measures, while a jeopardy biological opinion contains a Reasonable and Prudent Alternative to the proposed project that if implemented would avoid jeopardy. Also, B7-16

the State Laws section should be revised for more clear organization of the relevant sections of the Fish and Game Code in consultation with the Department of Fish and Game (CDFG), and to correct erroneous references to statute (e.g., reference to section 2091 should be eliminated as it has sunsetted). B7-16 Cont.

Section D.2.3 – Biological Resources Environmental Effects and Mitigation Measures:

As stated above in the General Comments of this letter, CSLC staff believes that in order for the EIR/EIS to meet CEQA's substantive mandate to mitigate or avoid significant effects to the extent feasible, substantial revision of the document is necessary. CSLC staff recommends additional consultation and coordination between the lead agencies, applicant, and the relevant wildlife agencies be initiated to develop a more meaningful, specific, and fully enforceable set of feasible mitigation measures, including more specific performance criteria, that will minimize impacts to sensitive species, avoid "take" of fully protected species, and provide compensation for impacts to affected biological resources. Specific comments and suggestions are as follows:

11. Peninsular bighorn sheep: Page D.2-160 states that because "preferred" habitat is not found in the Project area, impacts would be less than significant. However, this conclusion is unsupported by substantial evidence. While the Tule Wind Project may not result in "direct" loss of habitat, CEQA requires analysis of reasonably foreseeable indirect impacts as well. The discussion of Peninsular bighorn sheep should fully explore the potential for blasting and helicopter activities to impact sheep, especially lambing ewes, and the potential for the new project-related water sources to draw sheep into the area. If appropriate, mitigation measures should be identified, such as limiting those activities to outside lambing season and ensuring potential water sources are not accessible to sheep. B7-17

12. Special Status Bats: Page D.2-152 states that implementation of several mitigation measures will render impacts to bats less than significant. However, upon examination of the identified mitigation measures, CSLC staff does not agree that there is substantial evidence presented to support this conclusion. The measures are non-specific and are limited in large part to unidentified future plans and surveys that do not actually result in any actual reduction of the impact or compensation to offset an impact. For example, it is unclear how measures associated with habitat restoration and invasive species control lessen impacts to bats, particularly as it relates to insect production and collision potential or impacts to potential roosting crevices that may be lost during blasting activities. In regard to collision fatalities, CSLC staff believes the conclusion that impacts related to operation of the turbines will be less than significant with the proposed mitigation is deficient, because the identified measures suffer from improper deferral of specific, enforceable standards or courses of action, and because several measures cited as reducing impacts to bats appear to be related only to avian collision reduction. B7-18

13. Golden Eagle: Page D.2-157 indicates at least two nests are located in close proximity to planned turbines and suggests a number of the DEIR/DEIS mitigation measures would help reduce this impact. However, CSLC staff does not agree that B7-19

the measures are specific or enforceable enough to support the assertion that impacts to all but the closest nests would be less than significant. The section should clearly state buffer distances and seasonal restrictions rather than using unenforceable "suggestions" like "may be required." In regard to loss of nests and collision mortality, the Tule Wind Project was identified in the BLM's August 26, 2010 Eagle Act Consultation Memo to the Service as one of four proposed projects it believes "would result in take and where an [Avian Protection Plan] is unlikely to mitigate to the no net loss standard." While the DEIR/DEIS acknowledges the impacts to golden eagles from operation of the Tule Wind Project are significant and unavoidable, it does not provide information related to whether or how it could be carried out in compliance with the Service's Final Rule an Eagle Act Take Permits (74 FR 46835, September 2009). Finally, CSLC staff recommends that as part of the effort to revise and update the DEIR/DEIS to address the deficiencies described herein, that the CPUC and BLM incorporate relevant information or revise the document as necessary to reflect the monitoring and mitigation recommendations contained in the Service's 2011 draft Land-Based Wind Energy Guidelines (http://www.fws.gov/windenergy/docs/Final_Wind_Energy_Guidelines_2_8_11_CLEAN.pdf). B7-19 Cont.

14. Burrowing Owl: Page D.2-158 states that burrowing owl could occur on the site but that the mitigation measures in the DEIR/DEIS mitigate the potential impact to less than significant. However, because burrowing owls nest underground, and therefore could be subject to project-related impacts differently compared to the other raptors, the CSLC staff recommends further consultation and coordination with CDFG to identify and incorporate mitigation measures specific to burrowing owls, including flagging and avoidance of nest burrows, buffers, and compensatory mitigation if burrows are lost as a result of the Project. B7-20

15. Mitigation Measures MM BIO-1d, X, X, are all examples of measures that improperly defer the formulation of specific performance standards in favor of subjective and unenforceable "judgment calls" to be made at an undetermined point in the future.

    a. MM BIO-1d, Habitat Restoration Plan, simply sets forth a requirement that a plan be developed that "include[s] success criteria" that are "sufficient" to restore temporarily impacted areas "to the satisfaction of the permitting agencies." The measure should be revised in consultation with the relevant resource agencies to include specific criteria related to timing (how long until success must be achieved), the definition of success (percent vegetative cover), and monitoring methods. B7-21

    b. MM BIO-3a, Invasive Species Control Plan, should include a performance standard or otherwise define the meaning of "control" as used in the measure, such that if invasive species are found to exceed that threshold, additional control efforts would be conducted. B7-22

    c. MM BIO-5b, Special-status Plant Species Compensation, defers the formulation of the mitigation and as such, precludes evaluation of whether impacts to special-status plants would indeed be rendered less than significant after mitigation. Appropriate agencies (CDFG, Service) should be B7-23 consulted and a revised MM that includes specific compensation requirements should be included. Additionally, salvage and relocation should be considered a minimization measure only, not actual mitigation. B7-23 Cont.

d. MM BIO-7f, Listed Species, appears to equate compliance with a Service or CDFG take permit with CEQA compliance, when in fact, measures should be included in the DEIR/DEIS independent of agency permitting requirements, as explained above in General Comments. If a listed species were adversely impacted by the Project but actual "take" as defined by the CDFG and the Service did not occur, the permitting requirement would not be triggered, and therefore, absent stand-alone measures, up to and including compensatory mitigation, as appropriate, the DEIR/DEIS likely cannot support a conclusion of less than significant. B7-24

e. MM BIO-7j, Pre-construction Surveys, should include specific and enforceable avoidance measures that specifically demonstrate how avoidance would be achieved, rather than deferring the formulation of those measures. For example, the measure could specify specific buffer distances and prohibit the use of helicopters and blasting if active nests are identified. Without these specifics, CSLC staff is unable to concur that significant impacts to nesting birds would be made less than significant through this measure. B7-25

f. MM BIO-10b through MM Bio-10h, measures to avoid or lessen collision-related impacts: The CSLC staff believes that these measures as written constitute improper deferral of mitigation because the plans and their associated performance criteria are deferred until after completion of the CEQA process. Identification and formulation of mitigation outside the CEQA process precludes meaningful public review and input, and provides no basis on which the lead agency can conclude impacts are sufficiently mitigated. Additionally, the measures are solely related to monitoring and surveys, with only passing reference to adaptive management. There exists extensive scientific literature and guidance from experts containing reasonable, enforceable, and measureable actions that can be taken to reduce bird and bat collision fatalities, including off-site habitat improvements and protocols for fatality monitoring and adaptive management. The CSLC staff recommends revising this entire section based on additional coordination and input from the CDFG, the Service, and relevant experts to include more specific measures that can actually demonstrate that they lessen fatality effects or contribute to the body of knowledge in this area. Lastly, this section should incorporate compensatory mitigation for birds and bats. Measures could include off-site habitat protection and management, enhancement of bat roost sites, and the like. B7-26

Section D.7 – Cultural and Paleontological Resources:

16. Section D.7.2.2 State Laws and Regulations – California Environmental Quality Act, p. D.7-44, par. 1: This section should be revised to describe all the historical resources that must be considered under CEQA. Pursuant to both Public Resources Code section 21084.1 Historical Resources and CEQA Guidelines B7-27

section 15064.5 subsection (a)(1-4), consideration must be given to resources that are 1) listed in, or determined to be eligible for listing in the California Register of Historical Resources, 2) included in a local register of historical resources or identified as significant in a historical resource survey, and 3) other resources that the lead agency may determine are historical resources. For CEQA purposes, the citation to California Public Resources Code section 5020.1(j) incorrectly limits the resources that must be considered. B7-27 Cont.

17. Section D.7.2.2 State Laws and Regulations – California Environmental Quality Act, p. D.7-44, par. 2-4: The significance of an archaeological site is not determined in the first instance by whether it qualifies as a "unique archaeological resource." First, an archaeological site must be evaluated to determine if it is an "historical resource." According to the CEQA Guidelines, the following process must be followed in sequence:

(c) CEQA applies to effects on archaeological sites.

(1) When a project will impact an archaeological site, a lead agency shall ***first*** determine whether the site is an historical resource, as defined in subdivision (a) [see comment above for the list of resources that must be considered for CEQA purposes].

(2) ***If a lead agency determines that the archaeological site is an historical resource***, it shall refer to the provisions of Section 21084.1 of the Public Resources Code, and this section, Section 15126.4 of the Guidelines, and the limits contained in Section 21083.2 of the Public Resources Code do not apply.

(3) ***If an archaeological site does not meet the criteria defined in subdivision (a), but does meet the definition of a unique archaeological resource*** in Section 21083.2 of the Public Resources Code, the site shall be treated in accordance with provisions of section 21083.2....(CEQA Guidelines section 15064.5(c)(1-4), emphasis added.) B7-28

Thus, an evaluation of a resource to determine if it is a unique archaeological resource does not occur unless it has already been determined NOT to be an historical resource. If an archaeological resource has been determined to be an historical resource, the provisions concerning unique archaeological resources *do not apply.* The DEIR/DEIS should revise the analysis based on the CEQA Guideline quoted above. In numerous places, sites that are described as eligible to the NRHR (and thus the CRHR) are then erroneously further evaluated to determine if they qualify as unique archaeological resources (see pp. D.7-13, 14, 18, etc.) It is important to distinguish between these two categories of resources since the mitigation requirements are different.

This section of the DEIR/DEIS on State Laws and Regulations should also include a summary of the provisions concerning Mitigation Measures Related to Impacts on Historical Resources contained in CEQA Guideline section 15126.4(b)(1-3). This section specifies the appropriate type of mitigation for archaeological sites that are determined to be historical resources.

For additional information on the provisions in CEQA and the CEQA Guidelines concerning historical resources, archaeological resources, and unique archaeological resources please refer to the *Guide to CEQA*, by Remy, Thomas, Moose, and Manley, 11th ed., pp. 223-236. B7-28 Cont.

18. Table D.7-5, Previously Recorded Sites within the Proposed Tule Wind Project APE and ROW, and Table D.7-6, New Archaeological Sites Recorded During the Tule Wind Intensive Survey, should provide information on the potential eligibility to the California Register of Historical Resources (CRHR) of those sites that are considered ineligible to the NRHP (sites eligible to the NRHP are automatically considered eligible to the CRHR). In some cases, sites that are ineligible to the NRHP may be eligible to the CRHR since the integrity requirement may be more lenient. Additionally, all resources that are ineligible to the CRHR should be evaluated to determine if they qualify as a unique archaeological resource under Public Resources Code section 21083.2(g). B7-29

19. If any historical resources on State lands under the jurisdiction of the State Lands Commission will be affected by the proposed project, the CPUC, as the state lead agency, must consult with the State Historic Preservation Officer as described in CEQA Guidelines section 15064.5(b)(5). Please provide evidence of this consultation if appropriate. Generally, the state lead agency should request this consultation concurrently with the Section 106 review required of federal agencies under the National Historic Preservation Act to avoid duplication of effort. B7-30

20. California Public Resources Code, p. D.7-48, the first full paragraph referring to section 30244 should be deleted. Although CEQA requires mitigation measures for significant impacts to archaeological resources as described in earlier comments, this specific provision is part of the Coastal Act and does not apply to this project. B7-31

21. Table D.7-9, Cultural and Paleontological Resource Impacts, and Table D.7-11, Tule wind Project Alternatives, should be clarified to show the impact classification before and after mitigation is applied. The stated classification appears to be after mitigation is applied. Some of the Descriptions should also be clarified to indicate whether the impacts are certain to occur ("would cause and adverse change") or are potential impacts. For potential impacts, the word "could" should be substituted for "would." For example, the description for TULE-PALEO-1 states that "Construction of the project would destroy or disturb significant paleontological resources," yet no paleontological resources were identified that would be affected. B7-32

22. Tule Wind Project, Mitigation Measure CUL-1A, p. D.7-104: B7-33

    (a) The CSLC is not a party to the MOA/PA; however, CSLC staff request a copy of the Historic Properties—Cultural Resources Treatment Plan for review and comment.

    (b) Should data recovery be required on State land under the jurisdiction of the CSLC, the CSLC staff requests that copies of research designs and reports be provided to the CSLC for review and comment.

(c) The disposition or curation of any artifacts collected on State-owned land must be approved in advance in writing by the CSLC. Artifacts collected from sites that are not considered eligible to the NRHP or CRHR and are not unique archaeological resources shall be transferred to the CSLC on request at a mutually agreeable location. B7-33 Cont.

23. Under Mitigation Measure CUL-2, Human Remains, the section on the Tule Wind Project states that "two sites have the potential to contain human remains" (page D.7-63). However, in the section under Proposed Project, which includes the Tule Wind Project, it states "one site has the potential to contain human remains in the Tule Wind Project" (page D.7-64). Please clarify the number of sites that have the potential to contain human remains in the Tule Wind Project. B7-34

24. Also under Mitigation Measure CUL-2, Human Remains, the section under Proposed Project states that "the potential exists for human remains to be found during survey of the unsurveyed portion of the Proposed Project" (paragraph 1) and that "most of the unsurveyed land lies within the Campo and Manzanita reservations, with a portion in the CSLC jurisdiction. Please clarify when the survey of the unsurveyed portion of the Proposed Project will be completed and how the CSLC will be notified of the survey results/potential for human remains on lands under CSLC jurisdiction. B7-35

25. Mitigation Measure CUL-2, Human Remains, p. D.7-105: Please clarify that NAGPRA does not apply on State-owned lands. If human remains are discovered on State-owned lands, then the proper procedure is to follow the steps in the CEQA Guidelines 15064.5(e). Please clarify that the county coroner must notify the Native American Heritage Commission within 24 hours if the coroner determines that the remains are Native American, not "within a reasonable time frame" as stated in the mitigation measure. Please also add a requirement that CSLC staff shall be notified within 24 hours of the discovery of Native American human remains on State-owned lands under its jurisdiction. B7-36

26. Mitigation Measure PALEO-1A, 1B, p. D.7-106, 107: Upon completion of the paleontological resources inventory for the Tule Wind Project area, if paleontological resources are identified on lands under the jurisdiction of the CSLC, please provide a copy of the report to CSLC staff, and a copy of the Paleontological Monitoring and Treatment Plan to CSLC staff for review and comment. B7-37

27. Mitigation Measure PALEO-1D, p. D.7-107: The disposition or curation of any paleontological resources collected on State-owned land under the jurisdiction of the CSLC must be approved in advance in writing by the CSLC.

28. Please correct numerous typographical errors located throughout the chapter for terms in quotation marks with a dashed line instead of the first set of quotation marks (e.g., –built" in second paragraph of D.7.1). B7-38

29. Many acronyms are used throughout the chapter and in Table D.7-13 that cannot be found in the acronym list in the table of contents. Please add to the Acronyms and Abbreviations list all acronyms used in the chapter and in Table D.7-13 including: B7-39

1) AAA–American Antiquities Act
2) AHPA–Archaeological and Historic Preservation Act
3) APE–Area of Potential Affect
4) ARPA–Archaeological Resources Protection Act
5) BMS–bedrock milling station
6) CRHR–California Register of Historic Resources
7) ESAs– Environmentally Sensitive Areas
8) HPRD–?
9) HPTP-CRTP–Historic Properties-Cultural Resources Treatment Program
10) MOA/PA–Memorandum of Agreement/Programmatic Agreement
11) NADB–National Archaeological Database
12) NAGPRA–Native American Graves Protection and Repatriation Act
13) NAHC–Native American Heritage Commission
14) NRHP–National Register of Historic Places
15) OPLA-PRP–Omnibus Public Lands Act- Paleontological Resources Preservation
16) PFYC–Potential Fossil Yield Classification
17) PMTP–Paleontological Monitoring and Treatment Plan
18) PRPA–Paleontological Resources Preservation Act
19) SCIC–South Coastal Information Center
20) SDSU–San Diego State University
21) SEIC–Southeast Information Center
22) SVP–Society of Vertebrate Paleontology
23) TCP–traditional cultural properties

B7-39 Cont.

<u>Section D.10 – Public Health and Safety:</u>

30. Section D.10.2.1, page D.10-13 Abandoned Mines: The CSLC staff is concerned that the Tule Wind Project will increase human activity not only with those workers involved in construction and operation but also an increased level of public visitation to view the wind turbines. The DEIR/DEIS states that "The Bureau of Land Management Eastern San Diego County Resource Management Plan and Record of Decision Public Health and Safety section identifies goals, objectives, and management actions associated with abandoned mines…" CSLC staff agrees that BLM's incorporation of the goals, objectives and management actions associated with abandoned mines would reduce potential safety hazards to workers or the general public in the project vicinity to a less than significant level. B7-40

31. Since 2002, the CSLC has also managed an Abandoned Mine Program to identify and remediate abandoned mine features that may pose a hazard to the public or wildlife. In July of 2007, CSLC staff inspected the Metal Mountain and Buckthorn Mines and posted warning signs at many of the shafts and adits to help safeguard the public. The CSLC staff recognizes, however, that more permanent remediations such as fencing or bat compatible closures could help protect public safety and sensitive bat species. As stated above in the comments related to Section D.2, Biological Resources, the CSLC staff recommends abandoned mine closure as a potential measure that could reduce operational impacts related to turbine collisions. Implementation of some or all of these mine management activities could therefore be helpful in both increasing public safety on the site and minimizing effects to bat resources. B7-41

32. Applicant Proposed Measure Tule- PHS-2 states that a Health and Safety Program would be developed to protect both workers and the general public during construction, operation and decommissioning of the project to reduce impacts to public health/safety (Mitigation Measure HAZ-1b). We recommend that an element of this program be that all workers as well as the public avoid areas containing abandoned mines and that pamphlets with the "Stay Out-Stay Alive" information used by federal and state governments be distributed to inform people of the dangers these mines may pose. B7-42

Section D.18 – Climate Change:

33. CSLC staff is concerned that the DEIR/DEIS misclassifies the greenhouse gas (GHG) impacts, related to its threshold determination and improperly limiting the scope of the emissions considered. The document classifies all GHG impacts as Class III (less than significant) or Class IV (beneficial). The October 2008 California Air Resources Board (CARB) preliminary draft threshold is 7,000 Mtons/year. Given that the GHG emissions for construction are likely to exceed CARB's tentative operational threshold of 7,000 tons per year, they should be considered Class II (significant but can be mitigated to below significant). The DEIR/DEIS assumes the threshold to be 10,000 Mtons/year based on the December 2008 SCAQMD interim threshold. The draft EIR apparently used the higher threshold "because CARB has yet to adopt a threshold" (D.18-13), but the choice could be seen as motivated by the desire to change the impacts for turbine installation from Class II (significant before mitigation) to Class III (less than significant). As stated above in the General Comments section of this letter, while CEQA allows lead agencies latitude in setting significance thresholds, ultimately the conclusions reached about significance must be based on substantial evidence. To the extent CARB's lower threshold could raise questions about the conclusions in the present document, the decision to use the SCAQMD interim threshold instead should be more thoroughly discussed. Please confirm the CEQA significance threshold with CARB, verify whether CARB has finalized its significance threshold, and add discussion about whether wind energy might result in net reduction in GHGs (by offsetting fossil fuel energy generation). B7-43

34. The CSLC staff is also concerned that the analysis is conclusory because it (i) does not include a complete accounting of the emission sources, and (ii) does not illustrate how the GHG emissions totals were derived. Most importantly, the project calculations do not seem to consider the GHG emissions of manufacturing the turbines, pads, anchors, etc. including the effects of the cement mixing and use, or emissions related to the release of carbon through habitat conversion. As stated in the DEIR/DEIS: "GHG emissions were simulated for the construction phase of the Tule Wind Project. These GHG emissions will occur as a result of burning the fuel required to operate the on-site construction equipment and mobilize work crews to and from the Tule Wind Project site." (D.18-17). Although some effort is made in Appendix 8 to explain how the GHG totals were reached, there is no evidence that construction of the turbines (and associated energy consumption) was included in the calculations. The DEIR/DEIS should more clearly describe the GHG emissions from the production of 65,794 cubic yards (Appendix 8-4) of cement and factory B7-44

construction of 134 wind turbines. Additionally, the analysis neglects to account for the potential release of GHG or loss of sequestration capacity caused by the permanent loss of several hundred acres of desert habitat. This source of emissions should be included. B7-44 Cont.

35. Timing: The GHG analysis should be updated to reflect the current project timeline. For example, it is currently 2011, yet some of the calculations show emissions beginning in 2010. B7-45

36. The DEIR/DEIS should specifically indicate which alternatives and project detail assumptions were used to calculate the GHG numbers, and perhaps offer several different sets of calculations for different alternatives/details. At the very least, the document should include a simple comparison chart of the GHG emissions per energy generation of the Tule Wind Project compared with other feasible/existing energy alternatives. The document should demonstrate a robust, serious effort to inform decision-makers and the public about the GHG impacts of this project versus what positive benefits may flow (in terms of offsetting emissions from fossil fuel or other energy sources). B7-46

Thank you for the opportunity to review and make comments on the DEIR/DEIS for the Project. As a Responsible and Trustee Agency, the CSLC will need to rely on the EIR for the issuance of a lease for any portion of the Project that occupies school lands. We request that you consider our comments and implement these recommendations prior to adoption of the Final EIR. B7-47

If you have any questions regarding sovereign lands subject to the CSLC's jurisdiction, please contact Jim Porter, School Lands Unit at (916) 574-1865 or by e-mail at Jim.Porter@slc.ca.gov. If you have any questions regarding the environmental review comments, please contact Jennifer Deleon at (916) 574-0748 or by e-mail at Jennifer.Deleon@slc.ca.gov.

Sincerely,

Cy R. Oggins, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
J. Porter, CSLC
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P. Griggs, CSLC
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Comment Letter B8

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March 4, 2011

Iain Fisher
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COMMENTS ON THE JOINT DRAFT ENVIRONMENTAL IMPACT REPORT AND STATEMENT FOR THE SDG&E EAST COUNTY SUBSTATION, TULE WIND, AND THE ENERGIA SIERRA JUAREZ (ESJ) GEN-TIE PROJECTS

Dear Mr. Fisher,

The County of San Diego (County) reviewed the Joint Draft Environmental Impact Report and Draft Environmental Statement (DEIR/DEIS) published December 24, 2010, for the above listed projects. The County provides these comments as a Responsible Agency under the California Environmental Quality Act (CEQA) and as a Cooperating Agency in accordance with the National Environmental Policy Act (NEPA).

As you are aware, the County has discretionary permitting authority over aspects of the Tule Wind project and the entirety of the ESJ project in California. This letter includes an attached matrix that address technical deficiencies in the DEIR/EIS and revisions that are needed to make the DEIR/EIS comply with CEQA (See Attachment A). This letter also includes reference to several technical documents that were provided to the County a few days prior to the circulation of the DEIR/EIS. These technical documents are specific information related to the ESJ water extraction site and Tule Wind Project and should be considered when making clarifications to the DEIR/EIS (See Attachments B-G). B8-1

As a permitting agency and CEQA Responsible Agency, the County has serious concerns related to the adequacy of the DEIR/EIS unless changes are made that provide sufficient information to support the analysis and conclusions. Specifically, the County has major concerns about the lack of information and analysis of the projects' impacts, and the lack of conclusions as to the significance of the impacts for the two following issues: (1) Construction water sources; and (2) Low Frequency Noise analysis. The DEIR/EIS fails to identify the amount of construction water needed and the location of the source of the construction water for the East County Substation and B8-2 the Tule Wind projects. These projects are located well east of the County Water Authority's service area. Consequently, if groundwater resources are proposed for construction water, the impact on groundwater should have been analyzed in the DEIR/EIS, which would require additional permitting by the County. The DEIR/EIS also does not include an analysis of high and low frequency noise sources (dBC weighted noise analysis) for the wind turbines located within the County's jurisdiction. The DEIR/EIS should have analyzed whether the project would cause a substantial permanent or periodic increase in ambient noise levels (high or low frequency) in the project vicinity above existing noise levels (CEQA Guideline Appendix G (Section XII)). B8-2 Cont.

The examples provided below regarding deficiencies in the DEIR/EIS generally fall within the following two categories: Deferral of Analysis and Mitigation, and Unsubstantiated Conclusions for Significant and Unmitigated Impacts.

1. **Deferral of Analysis and Mitigation:** Many of the sections of the DEIR/EIS fail to include a full analysis of the impact because of the lack of technical documentation of the potential impact. Consequently, these sections lack sufficient information to support the conclusion as to the significance of the potential impact. In some sections, the technical analysis has been deferred and is to be prepared in the future as part of a mitigation measure. In other sections, the necessary studies and field surveys were not fully completed before the DEIR/EIS was released for public review. The failure to include sufficient analysis of the projects' potential impacts is a violation of CEQA. All subject areas should have been fully analyzed with supporting technical studies before the DEIR/EIS was released for public review. The point of public review is to allow the public and responsible agencies to review and comment on the adequacy of the analysis. Omitting the complete analysis or providing it in the future defeats one of the main purposes of public review. B8-3

   An EIR must "describe feasible mitigation measures which could minimize significant adverse impacts." CEQA Guidelines, section 15126.4(a)(1). "Formulation of mitigation measures should not be deferred until some future time." CEQA Guidelines, section 15126.4(a)(1)(B). See Sundstrom v. County of Mendocino, 202 Cal.App.3d 296, 306-307 (1988). An EIR can "defer" mitigation in the sense that mitigation measures "may specify performance standards which would mitigate the significant effect of the project and which may be accomplished in more than one specified way." Ibid.

   As the court in Endangered Habitats League, Inc. v County of Orange 131 Cal.App. 4th 777, 793 (2005), explained, "Deferral of the specifics of mitigation is permissible where the local entity commits itself to mitigation and lists the alternatives to be considered, analyzed and possibly incorporated in the mitigation plan. On the other hand, an agency goes too far when it simply requires a project applicant to obtain a study or report and then comply with any recommendations that may be made in the report."

Furthermore, although mitigation measures may be "deferred" under certain limited circumstances as explained above, the analysis of the project's potential impacts may not be deferred. "In general 'the EIR must contain facts and analysis, not just the agency's bare conclusions or opinions.'" Citizens of Goleta Valley v. Board of Supervisors, 52 Cal.3d 553, 568 (1990). See also CEQA Guidelines, section 15126.2(a). B8-3 Cont.

a. MM HYD-3 Identification of sufficient water supply, states, "Prior to construction, the applicant will prepare comprehensive documentation that identifies one or more confirmed, reliable water sources that when combined meet the project's full water supply construction needs. Documentation will consist of the following: Preparation of a groundwater study or Documentation of Purchased Water Source(s)." The DEIR/EIS fails to analyze the impacts to Groundwater Resources. The required analysis is improperly deferred to a mitigation measure and also provides unanalyzed options in-lieu of preparation of a study. The DEIR/EIS should have identified all sources of water for construction, should have identified the amount of water needed for construction, should have analyzed potential impacts of using that amount of water and should have identified feasible mitigation measures to reduce any potential significant impacts. B8-4

b. MM BIO-1d requires the impact to be mitigated by revegetation pursuant to a future Habitat Restoration Plan. This mitigation simply requires the applicant to obtain reports and then to comply with whatever recommendations are made in the reports. In fact, the mitigation measure even defers the development of success criteria and monitoring specifications to the future Habitat Restoration Plan. As explained above, this is improper deferral of mitigation. Furthermore, the DEIR/EIS' failure to comply with CEQA's mitigation requirements will make it impossible for the County to make the required finding that this mitigation measure is effective. Without more specific details to measure success of the revegetation (performance standards), it is not clear that the plan is achievable. See CEQA Guidelines, section 15091(a)(1). B8-5

The County requests that the schedule for preparing the Final EIR/EIS allow sufficient time for the project applicants to complete and provide the required technical studies, implementation plans, or specific information that would provide sufficient documentation to support the analysis of the project impacts and to provide the basis for the conclusions regarding the significance of the impacts for the following subject areas: MM BIO-4a Dust Control Plan, MM BIO-2b Wetland Mitigation Plan, MM BIO-10b Avian Protection Plan, MM TR-1, a Conceptual Traffic Control Plan, MM HYD 5-6 SWMP, and MM HYD-3 Groundwater Study or specific comment numbers : 6-8,9,12-15, 18,23, 26, 27, 31-35, 37, 75, 114-116, 118, 119, 121, 132, 133, 152, 171-175, 177-179, 182, 186, 187, 197, 199-201. B8-6

2. Unsubstantiated Conclusions for Significant and Unmitigated Impacts:

In accordance with CEQA, the DEIR/EIS must include substantial evidence to support the conclusions that ALL impacts identified as Class I are significant, unmitigable, and that all methods for protecting the environment have been considered (CEQA Guidelines Section 15002.h). The analysis of each potentially significant impact must include a discussion of potential mitigation measures, why each mitigation measure would be effective, why the mitigation measure would be infeasible or why there are no feasible mitigation measures. The DEIR/EIS does not provide sufficient facts and analysis to support the conclusions that certain significant impacts can be mitigated and that certain other significant impacts cannot be mitigated. If the impact cannot be mitigated, then the DEIR/EIS needs to clearly state this conclusion and provide the facts and analysis to support the conclusion that mitigation is infeasible. B8-7

The comments below provide examples of how the DEIR/EIS does not provide appropriate conclusions supported by all possible mitigation opportunities:

a. Section D.3, Visual Resources, Table D.3-7 describes significant and unmitigable impacts associated with the ECO Substation component of the Proposed PROJECT; however, the discussion should also include any potential mitigation measures, such as screening or different and less impactive designs and treatments. The DEIR/EIS states, "other than undergrounding the transmission line... the impact could not be reduced to below a level of significance." This statement refers to an alternative to the Proposed PROJECT, which would reduce the impact. The required discussion of potentially feasible mitigation measures is missing. B8-8

b. Section D.7 Impact CUL-3: Traditional Cultural Properties Impact. The DEIR/EIS states, "The scope, nature, and extent of any TCPs associated with the APE are not presently known. Therefore, potential NRHP eligibility of unknown TCPs must be assumed...Under CEQA, impacts would be significant and cannot be mitigated to a level that is considered less than significant." In this case, there is a lack of information and analysis of the potential impacts. Instead, the document jumps to an unsubstantiated conclusion that there would be residual impacts to the unknown areas. As explained above, an EIR must include facts and analysis and not just use bare conclusions opinions. Preparation of the Final EIR/EIS should allow adequate time to obtain the proper information to determine if TCPs are present and, if so, if they impacts to them would still be significant and unmitigable. B8-9

In order for the County to make the required CEQA Findings in accordance with CEQA Guidelines, section 15091, the discussion of potential mitigation measures must include facts and analysis to explain that the mitigation measures will be effective, that is that the impacts have been or could be reduced below a level of significance. The DEIS/EIR should provide a clear and specific rationale explaining how each mitigation measure avoids, minimizes, B8-10 rectifies, and/or reduces the significant environmental effect to a level below significance. The document should also include a specific CEQA conclusion that states the implications of the unmitigated impact and the reasons why the project is still being proposed without an alternative design (CEQA Guidelines §15126(b). Many of the sections analyzing potential impacts need to be revised accordingly. See the following comments in the checklist for an exhaustive list of the sections that need to be revised pursuant to this comment: 6-8, 9, 12-15, 18,23, 26, 27, 31-35, 37, 75, 114-116, 118, 119, 121, 132, 133, 152, 171-175, 177-179, 182, 186, 187, 197, 199-203.1

A mitigation measure must be "required in, or incorporated into, the project," and the measure "must be fully enforceable through permit conditions, agreements, or other legally binding instruments." (14 CCR section 15126.4). The following are to examples provided below that have unsubstantiated conclusions:

B8-10 Cont.

- Section D.3, Visual Resources, Table D.3-6 presents the mitigation monitoring, compliance, and reporting program for each impact and mitigation measure included in that chapter. However, the preceding text in the analysis for each section fails to provide factual support and rationale for all the CEQA conclusions/determinations stated. Specifically, each mitigation measure described in this table includes "effectiveness criteria" but these statements merely restate the impact and mitigation measure without providing the needed rationale as to why or how these measures would serve to reduce the impact. Consequently, his mitigation measure cannot be found (or relied upon) to mitigate impacts to a less than significant level. B8-11

- MM BIO-5b references an "agency-approved plan" for special status plant species compensation. Further, it states that this plan will occur through plant salvage, relocation, and off-site land preservation. The County typically does not accept plant salvage and relocation as feasible mitigation because of the low success rate of transplantation and the fact that it does not create the same viable habitat that was lost. However, if the Conceptual Revegetation Plan provides evidence that relocation is feasible, such mitigation may be accepted. This information must be included in the Final EIR/EIS in order for a CEQA finding to be made that impacts to these resources would be mitigated to a level less than significant. B8-12

- FF-3 Impacts to Fire Fighting Effectiveness: The mitigation provided for this impact does not directly mitigate the impact, but merely reduces the risk for initially striking a fire. The DEIR/EIS must provide mitigation that directly decreases the level of significance of the facilities affecting fire-fighting ability. If further mitigation cannot be provided because it is infeasible, then the DEIR/EIS must disclose this. B8-13

The County appreciates this opportunity to provide comments on the DEIR/EIS and looks forward to working with the CPUC to resolve any questions that may arise from the provided comments. If you have any questions please contact the County Project Manger Patrick Brown at (858) 694-3011, or by email at: Patrick.Brown@sdcounty.ca.gov B8-14

Sincerely,

for

Eric Gibson, Director
Department of Planning and Land Use
Attachments:

A. Public Review Comment Matrix B8-15

Electronic Attachments:

B. Groundwater Investigation Report, Tule Wind LLC, prepared by Geo-Logic Associates, dated December 2010.
C. Traffic Impact Study, Tule Wind LLC, prepared by Linscott Law and Greenspan, dated September 13, 2010.
D. Stormwater Management Plan, Tule Wind LLC, prepared by HDR Engineering Inc. dated November 2010.
E. CEQA Drainage Study, Tule Wind LLC, prepared by HDR Engineering Inc. dated November 2010.
F. Archaeological and Historical Investigations for the ESJ Gen-Tie Project prepared by AECOM dated March 2011.
G. Biological Letter Report for ESJ Gen-tie Project prepared by AECOM dated February 2011.

B8-16

cc:

Alberto Abreu, Director Project Development, Sempra Generation, 101 Ash Street, HQ14A San Diego, CA 92101
Tule Wind Development LLC, Jeffrey Durocher, Iberdrola Renewables, 1125 NW Couch Street Suite 700, Portland, Oregon 97209

Email cc:

Donna Beddow, Planning Manager, Department of Planning and Land Use
Rich Grunow, Chief, Department of Planning and Land Use
Patrick Brown, Project Manager, Department of Planning and Land Use
Mark Mead, Senior Deputy County Counsel, Office of County Counsel
LeAnn Carmichael, Department of Planning and Land Use

Attachments B–G are considered Comment B8-16.

GROUNDWATER INVESTIGATION REPORT

TULE WIND FARM
EAST SAN DIEGO COUNTY, CALIFORNIA

Project Proponent:
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Iberdrola Resources
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Case No. 3300-09-019
ER No. 09-21-001

Prepared for:
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DECEMBER 2010

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GLOSSARY OF TERMS, ACRONYMS, AND ABBREVIATIONS

af	Acre feet
APN	Assessor's Parcel Number
CIMIS	California Irrigation Management Information System
DWR	Department of Water Resources
ETo	Evapotranspiration
Ft	Feet
gpd	Gallons per day
gpm	gallons per minute
msl	mean sea level
SCS	Soil Conservation Survey
t/t'	Time since pumping started divided by time since pumping stopped

EXECUTIVE SUMMARY

A groundwater investigation was conducted to evaluate the groundwater resources within Thing Valley on the Ewiiaapaayp Reservation and Rough Acres Ranch in McCain Valley. The purpose of the investigation was to assess the availability of groundwater as a resource in support of the Tule Wind Farm construction project, which proposes to be extracted at these locations over a nine-month construction period. The groundwater investigation included long-term 72-hour constant rate pumping tests and subsequent analysis of the data to assess the hydraulic properties of the aquifer at each of these locations.

Results of the groundwater investigation suggest that both locations provide viable groundwater resources in support of project construction. Although groundwater resources on Tribal land are not within the jurisdiction of the County, pumping test results indicate that the Reservation well appears to be somewhat limited at the test pumping rate of 80 gallons per minute (gpm). Based on a boundary condition identified during the course of the aquifer pumping test, it is recommended that a reduced pumping rate and a reduced frequency be used at this well. However, pumping from other Reservation wells may be used to supplement pumping from the test well.

At the Rough Acres Ranch, pumping at 50 gpm showed no evidence of well interference, or significant depletion of the groundwater in storage within the pumping well. In fact, analysis of the data suggests that pumping could be doubled without any significant impact. Based on the results of the aquifer test, no significant impacts to this groundwater resource are anticipated associated with pumping at the Rough Acres Ranch test well.

1.0 INTRODUCTION

1.1 Purpose of the Report

This groundwater investigation report describes field conditions, and presents the results of field and analytical procedures used to evaluate groundwater resource availability within the Thing Valley area of the Ewiiaapaayp Reservation and the Rough Acres Ranch area of McCain Valley to support construction of the proposed Tule Wind Project. The Tule Wind Project will include the construction of 134 wind turbines, and associated service roads, transmission lines and ancillary structures over a period of approximately nine months during which time groundwater will be extracted from the underlying aquifers to support construction activities. This investigation also addresses the sustainability of groundwater withdrawal from the aquifers with respect to the existing and proposed future uses. Construction is slated to begin in the third quarter 2011, and the wind turbine facility is scheduled to come on line in the fourth quarter 2012.

Engineering estimates indicate that construction, and associated groundwater extraction, is expected to last approximately nine months. According to the project developer, groundwater demand for the project is expected to occur in four phases. Initially the project will require approximately 120,000 gallons of water per day (gpd) during road building (60 gallons per minute [gpm]), increasing to 250,000 gpd (equivalent to a constant rate of 124 gpm) while both road and turbine foundation construction and construction-related dust suppression. Water demand will then decrease to approximately 130,000 gpd (a constant rate of 65 gpm) following completion of the 72-day road construction portion of the project, while turbine foundation construction continues, and finally decrease to 100,000 gpd (50 gpm) for dust control during the remainder of the project. Subsequent site work is not expected to require additional groundwater supply. The total volume of extracted groundwater to support the project is anticipated to be approximately 65 to 125 acre-feet.

When the Tule Wind Project turbines become operational, only a limited quantity of water will be required, estimated at 2,500 gallons per day to supply the operations and maintenance building services and support staff.

1.2 Project Location and Description

The Tule Wind Farm will be developed on 15,350 acres in eastern San Diego County. The project area is located approximately one mile north in Interstate 8 (I-8), generally between La Posta Truck Trail on the west and McCain Valley Road on the east (Figure 1). Given the large size of the project area and the need for water throughout, two sites were identified for water production: Thing Valley and McCain Valley (Rough Acres Ranch). These areas are described in more detail in the following sections.

1.2.1 Thing Valley Water Production Area

The Thing Valley Water Production Area is located approximately 10 miles north of I-8 off La Posta Truck Trail/Thing Valley Road on the Ewiiaapaayp Reservation (Figure 2A). The reservation is located in an isolated, triangular-shaped, southeasterly-draining valley near the headwaters of La Posta Creek. Ground surface elevations range from 5000 to 5100 feet on the valley floor, but rise to over 6200 feet along the surrounding ridgelines. Reservation structures dot the valley floor, and include a fire station, an abandoned water bottling facility, and several abandoned, vacant, or partially-occupied residential structures. Two groundwater production wells ("north well" and "south well") were constructed in August 1980 near the center of the valley. The "south well" is connected to a series of solar panels that power an electric submersible pump. This well pumps water to a storage tank at the northwestern end of the valley, and the stored water supplies the Reservation. The "north well" is located approximately 60 feet northeast of the "south well". It is equipped with an electric submersible pump, but it is not currently used for water production. According to personal communications with the tribal representative and review of the tribal website, there are no permanent inhabitants within the valley, through tribal members visit the location periodically. The nearest residence is approximately 4 miles south of the subject valley in the larger Thing Valley. The "north well" and "south well" occupy Assessor's Parcel Number (APN) 4130800300, and the remainder of the valley spans APNs 4131503000, 4130800100, and 4130800200. The "far field" observation well is located within APN 4131503200.

1.2.2 Rough Acres Ranch Water Production Area

The Rough Acres Ranch Water Production Area is located approximately one mile north of I-8 between Ribbonwood Road on the west and McCain Valley Road on the east (Figure 2B). This site occupies the broad alluviated, southeasterly-draining McCain Valley that, within the project area, is bounded on the north and south by low-relief granitic hills. Ground surface elevations in the valley range from approximately 3600 feet above mean sea level at the northwestern corner of the project area and along the northern bounding hills to about 3450 feet above mean sea level at the southeastern corner of the project area. Within the project area, Rough Acres Ranch is surrounded by scattered residences on the west and south, a low-security detention facility and landing strip on the east, and open space on the north. The valley floor is used for livestock grazing. The Rough Acres Ranch property is crossed by a series of graded dirt roads, and contains a number of active and idle groundwater production wells that are used for domestic and agricultural supply. The area of the aquifer test spans APNs 6110600300, 6110700100, 6110900200, 6110900300, 6110900400, 6110901800, and 6111100100.

1.2.3 Project Description

The Tule Wind Farm project will include the construction of up to 134 wind turbines and associated roads, transmission lines and support facilities. Based on information provided by the project developer, IBR, the following water requirements have been estimated for the project construction (all work is anticipated to be performed over five-day work weeks):

1. Road Construction – Up to 120,000 gallons per work day will be required over a 72-day construction period. This translates to an average pumping rate of approximately 60 gpm assuming sufficient storage is available to allow for pumping seven days a week (83 gpm if the pumps are only active during work days).

2. Turbine Foundation Concrete Mixing – Turbine foundation construction is estimated to require 7,500 to 15,000 gallons of water per foundation. With 134 foundations to build, water demand will be approximately 15,000 and 30,000 gpd (assuming that two foundations are constructed each day in accordance with the 72-day work schedule). This much water use equals an average maximum pumping rate of approximately 15 gpm. The maximum continuous pumping rate (24-hours per day, seven days per week), required to support concrete mixing for three turbine foundations per day (45,000 gallons) is equivalent to 31 gpm.

3. Dust Control – During subsequent construction activities, approximately 50,000 to 100,000 gallons of water per working day will be required for dust control on project roads. The average continuous pumping rate required during these activities would be 50 gpm for an estimated nine-month construction period.

The pumping rates stipulated above are based on the assumption that there will be sufficient storage space to allow for groundwater extraction 24 hours per day, seven days per week. If there is insufficient water storage capacity to allow for continuous pump operation, higher incremental pumping rates would be required. Based on the aquifer testing performed for this report, the wells may not be able to pump at higher incremental pumping rates for peak demand.

1.3 Applicable Groundwater Regulations

Groundwater utilization for projects within the County of San Diego must address the requirements in the *County of San Diego Groundwater Ordinance No. 9826*, which stipulates that development and utilization of groundwater will not affect those who are dependent upon groundwater unless it can be demonstrated that there is an adequate supply to provide both the project and the existing users. In addition, since the project is proposing to use more than 20,000 gallons per day, it is considered a water intensive project according to the Groundwater Ordinance, and requires an evaluation of the cumulative groundwater impacts. The Ordinance provides for methods of analysis to determine potential impacts to the groundwater resource, and this investigation endeavors to address those potential impacts following the Ordinance-prescribed guidelines.

This project will result in groundwater extraction and utilization that may affect the local environment, a unique resource, and groundwater-dependent habitats. As a result, the California Environmental Quality Act (CEQA) requires an evaluation of environmental impacts associated with groundwater extraction, as well as other components of the project.

2.0 EXISTING CONDITIONS

This section of the water investigation report describes the existing conditions of the project areas, including topography, climate, geology and hydrogeology, surrounding land use, hydrology, and water quality.

2.1 Topographic Setting

2.1.1 Thing Valley Water Production Area

The Thing Valley Production area is situated in a triangular shaped valley near the headwaters of La Posta Creek. Ground surface elevations range from approximately 5100 feet above mean sea level (amsl) at the north end of the valley floor to about 5000 feet amsl at the south end of the valley floor (Figures 3A). Bounding ridgelines rise to over 6300 feet amsl. The watershed for the production area is approximately 2310 acres, draining the area to the northwest that includes the eastern flanks of the Laguna Mountains to the west and the southwestern flanks of the Sawtooth Mountains to the northeast.

2.1.2 Rough Acres Ranch Water Production Area

The Rough Acres Ranch Water Production Area is situated in McCain Valley, a broad south- to southeasterly trending valley that is generally bounded by the eastern flanks of the Laguna Mountains to the west and the In-Ko-Pah Mountains to the north and east. The valley is over 13 miles long, extending from the In-Ko-Pah Mountains to the north, and draining into Tule Canyon and Carrizo Gorge at the southeast. McCain Valley includes a large number of tributaries, including Tule Creek that passes through the Rough Acres Ranch study area as a dry wash at most times of the year. Because of the vast expanse of the drainage area, for purposes of this investigation and following guidance from the County Hydrogeologist, the watershed area is defined as an area of one-half mile radius surrounding the proposed production well (Figure 3B).

2.2 Climate

For purposes of this water supply study, the climate factors of most concern include precipitation and evapotranspiration. Data provided in this section comes from the County of San Diego Department of Planning and Land Use General Plan Update – Groundwater Study, State of California Department of Water Resources, and the California Irrigation Management System (CIMIS) databases.

2.2.1 Climate of the Thing Valley Water Production Area

At elevations of over 5000 feet, the Thing Valley WPA has a relatively mild climate. The site is located just east of the Laguna Mountains, and as a result, it sits in the rain shadow of these mountains. Historical climate data from the Campo area were used to conservatively represent conditions at this site. Based on information available from the California Department of Water Resources, the area receives an average of 15.6 inches of rainfall per year, with 80 percent of the rainfall occurring between November and March of each year. According to the State of California Reference Evapotranspiration Map developed by CIMIS, the site is located in Evapotranspiration Zone 16, with an average of 62.5 inches of evapotranspiration per year.

2.2.2 Climate of the Rough Acres Ranch Water Production Area

While 2000 feet lower in elevation, and about 10 miles east of the Thing Valley WPA, the Rough Acres Ranch WPA has similar values for rainfall and evapotranspiration. Using historical precipitation records from a monitoring station in Boulevard, California (approximately 2 miles south of the site), the average annual precipitation for the area is approximately 15.8 inches. The Rough Acres and Thing Valley WPAs are located in the same Evapotranspiration Zone, which indicates an average annual evapotranspiration of 62.5 inches.

2.3 Land Use

2.3.1 Land Use Surrounding the Thing Valley WPA

The Thing Valley WPA is located within the Ewiiaapaayp Reservation. According to the San Diego County General Plan, the site is located within the Mountain Area Community Planning Area with a land use designation as Indian Reservation. The highlands of the watershed area are located within the Cleveland National Forest, and the San Diego County General Plan identifies this area as the Central Mountain Community Planning Area, with an open space forest designation.

There are no full-time residents or industries within the Reservation limits, though the Reservation includes several abandoned structures and structures that are used periodically, as well as a fire station and a structure that was to be used as a water bottling plant. Aside from these structures, the surrounding land is undeveloped mountain and valley terrain. The nearest residents are located approximately 3 miles south of the WPA at Thing Valley Ranch.

2.3.2 Land Use Surrounding the Rough Acres Ranch WPA

The Rough Acres Ranch WPA is located in a sparsely populated region of the county. According to the San Diego County General Plan, the site is located within the Mountain Area Community Planning Area and has a land use designation as general agricultural. Properties surrounding the site are designated as general rural, and one parcel to the east is designated as National Forest/State Parks.

Consistent with the designated land uses, the Rough Acres Ranch is used for livestock grazing, and this property is surrounded by large lot residences to the west and south, a low-security detention center and rural air field to the east, and high desert open space to the north and east.

2.4 Water Demand

Because there are no residents or uses for groundwater within the Thing Valley WPA, and the County has no jurisdiction over groundwater use on tribal lands, there is no requirement to evaluate water demands in this area.

For the Rough Acres Ranch WPA, a conservative approach was used to ensure that the proposed project would not affect adjacent groundwater users. It is assumed that all groundwater for this project will be derived from the Rough Acres Ranch WPA even though the project will also utilize water from the Thing Valley WPA.

As recommended by the County Groundwater Geologist, the water production area was restricted to a one-half mile radius surrounding the production wells (the estimated maximum area of interference from the pumping well). However, to evaluate other groundwater uses, the evaluation radius was extended in some instances to about three quarters of a mile. Within this evaluation area, seven single family residences were identified, including one residence that operates an apparent poultry farm. In addition to the residences, the Rough Acres Ranch property is utilized for free-range livestock grazing, with an estimated head count of 100 animals. Using residential water demand values provided by the County's Guidelines for Determining Significance and published values for livestock water usage, the groundwater demand for the project is estimated in the following table:

Water Use	Demand (Acre-Feet per Year)	Demand (Acre-Feet per Month)
Proposed Project Construction (9 month duration)	60	6.7
Post-Project Maintenance	2.8	0.23
Residential Water Use (7 residential properties; 0.5 acre-feet per year per residence)	3.5	0.29
Livestock Grazing (100 head; 19 gallons per day per animal)	2.13	0.18
Poultry Raising (500 birds; 770 liters per 1000 birds per day)	0.11	0.01
Totals:	**65.74**	**7.18**

2.5 Geology and Soils

The Thing Valley and Rough Acres Ranch WPAs are situated within batholithic rocks of the Peninsular Ranges Geomorphic Province. Batholithic rocks were generally emplaced in the late Mesozoic to early Cenozoic eras. Post-emplacement uplift, weathering, and erosion has resulted in formation of surficial soils and alluvial deposits that mantle the crystalline bedrock. Due to the remote locations and paucity of mineral resources, neither site has been studied in detail, and most of the available geologic information comes from regional geologic studies, including the "Preliminary Geologic Map of the 30' x 60' El Cajon Quadrangle" (Todd, 2004) and "Mineral Resources of the Sawtooth Mountains and Carrizo Gorge/Eastern McCain Valley Wilderness Study Areas (Todd, et al., 1987). Soils information is provided by the United Sates Department of Agriculture - Soil Conservation Service and Forest Service. Geologic and soils conditions specific to each WPA and its watershed are described below.

2.5.1 Geology and Soils of the Thing Valley WPA

The Thing Valley WPA is flanked by the Laguna Mountains to the west and the Sawtooth Mountains to the north and east. Based on the available geologic information, in the vicinity of the WPA, the two mountain ranges are geologically similar, and are composed of the early Cretaceous-age Las Bancas Tonalite, an assemblage of lightly foliated tonalite, granodiorite, and quartz diorite. In addition, at the northernmost portion of the watershed, the Sawtooth Mountains are also underlain by a variety of Triassic and Jurassic-age metasedimentary rock units.

Along the valley floor, the crystalline bedrock is overlain by recent alluvium. Based on the logs of the groundwater production wells, the thickness of alluvium is estimated to be approximately 30 to 50 feet.

Based on maps prepared by the Soil Conservation Service (now Natural Resources Conservation Service), and presented on Figure 4A the following table presents the soil types and their properties within the Thing Valley WPA watershed area:

Soil Type	Moisture Holding Capacity (in)	Runoff Potential	Maximum Runoff Percentage	Area (acres)
Acid Igneous Rock Land (AcG)	0.10	Rapid	100%	250
Bancas Stony Loam (BbG)	3-5.5	Rapid to Very Rapid	81%	1000
Crouch Coarse Sandy Loam (CtE)	4.5-7	Medium	71%	50
Crouch Coarse Sandy Loam (CtF)	4-6	Rapid	74%	40
Crouch Rocky Coarse Sandy Loam (CuE)	3.5-5	Medium	78%	30
Crouch Rocky Coarse Sandy Loam (CuG)	3.5-5	Rapid to Very Rapid	78%	100
Mottsville Loamy Coarse Sand (MvC)	4-5	Slow to medium	74%	40
Mottsville Loamy Coarse Sand (MvD)	4-5	Medium	74%	30
Sheephead Rocky Fine Sandy Loam (SpG2)	2-3	Rapid to Very Rapid	87%	750
Steep Gullied Land (StG)	Not Available	Rapid	100%	10

2.5.2 Geology and Soils of the Rough Acres Ranch WPA

The Rough Acres Ranch WPA is located at the eastern edge of the Peninsular Ranges. Available geologic information in the vicinity of the WPA indicates that the area is underlain by the early to late Cretaceous era La Posta Tonalite, an assemblage of horneblende-biotite trondhjemite and granodiorite that is exposed on the low-relief highlands surrounding and within McCain Valley. Along the valley floor, the crystalline bedrock is overlain by recent alluvium. Based on the logs of the groundwater production wells in the valley, the thickness of alluvium is estimated to be 30 and 70 feet.

Based on maps prepared by the Soil Conservation Service (now Natural Resources Conservation Service), presented on Figure 4B, the following table presents the soil types and their properties within the Rough Acres Ranch WPA watershed area:

Soil Type	Moisture Holding Capacity (in)	Runoff Potential	Maximum Runoff Percentage	Area (acres)
Acid Igneous Rock Land (AcG)	0.1	Rapid	100%	10
Calpine Coarse Sandy Loam (CaC)	4.5-6.5	Slow to medium	72%	5
La Posta Loamy Coarse Sand (LaE2)	2-3	Medium	87%	60
La Posta Rocky Loamy Coarse Sand (LcE2)	1-2	Medium	94%	150
Loamy Alluvial Land (Lu)	6-9	Slow	62%	120
Mottsville Loamy Coarse Sand (MvC)	4-5	Slow to medium	75%	110
Tollhouse Rocky Coarse Sandy Loam (ToE2)	1-2	Medium to rapid	94%	50

2.6 Hydrogeologic Units

This section of the water investigation report describes the water-bearing units at each site and their general hydraulic properties.

2.6.1 Hydrogeologic Units of the Thing Valley WPA

The hydrogeologic units of the Thing Valley WPA include the recent alluvial soils and the underlying fractured Las Bancas Tonalite. The alluvium is restricted to the lowest portion of the valley floor; based on available geologic maps and Soil Conservation Service surveys, it underlies less than 10 percent of the watershed. In contrast, the Las Bancas Tonalite underlies the entire watershed area, either directly or beneath the alluvium.

A California State Department of Water Resources well completion report (no. 058539) is available for the "south" well that was used as the observation well for the aquifer testing in this study. Drilling logs for the "north" aquifer pumping test well and far-field observation wells were not available. Based on the log for the south well, the alluvium at this location is approximately 12 feet thick. Relatively weathered "granitic" bedrock extends from 12 to 50 feet below ground surface, and relatively unweathered "granitic" rock was encountered from 50 feet to the bottom of the hole at 400 feet. The geologic conditions at the north and far-field wells would be expected to be generally similar based on inspection of the surface geology.

A static water level was measured at each of the three test wells prior to the start of the step-drawdown test (Section 2.7). The static water levels in each well were sufficiently deep, and is likely below the base of alluvium. This suggests that alluvium groundwater is ephemeral, and does not contribute significantly to the available groundwater resource at this site.

The fractured Las Bancas Tonalite appears to be the most significant aquifer within the Thing Valley WPA. Using the recommendations from the County Groundwater

Geologist, a specific yield of 0.1 percent has been established for this unit. Figure 6 presents a conceptual hydrogeologic cross section through the Thing Valley WPA.

2.6.2 Hydrogeologic Units of the Rough Acres Ranch WPA

The hydrogeologic units of the Rough Acres Ranch WPA include the recent alluvial soils and the underlying weathered and fractured La Posta Tonalite. As shown on Figure 7, the alluvium covers the broad valley floor, and based on available geologic maps and Soil Conservation Service surveys (Figure 4B), it underlies approximately 50 to 60 percent of the watershed. The alluvium is directly underlain by the Las Bancas Tonalite, which is also exposed as outcroppings throughout the watershed. Figure 8 depicts a conceptual hydrogeologic cross section through this WPA.

While seven wells were used for the aquifer test in this study area, only the pumping well and two observation wells are within the prescribed one-half mile radius watershed. A California State Department of Water Resources well completion report (no. 1089956) is available for the pumping well. Geologic information suggests that the alluvium in the center of the valley is approximately 70 to 80 feet thick. Weathered bedrock extends to a depth of about 230 feet, and below that depth to the total depth of boring (420 feet), the crystalline rock is relatively unweathered. Static water levels measured in the pumping and observation well suggest that the lower 45 to 50 feet of alluvium is saturated. Little alluvium is noted on the logs for other observation wells in the test area, and well depths typically range from 400 to 900 feet, indicating that the fractured La Posta Tonalite is the primary source of groundwater for production wells in the area.

The fractured La Posta Tonalite appears to be the most significant aquifer within the Rough Acres Ranch WPA, with the alluvium providing at least seasonal recharge to the subjacent bedrock aquifer. Using the recommendations from the County Groundwater Geologist, a specific yield of 0.1 percent has been established for this bedrock aquifer. Published specific yield values for mixed sand and gravel aquifers (Driscoll, 1986) indicate a range of 10 to 25 percent.

2.7 Hydrologic Inventory and Groundwater Levels

2.7.1 Thing Valley WPA Hydrologic Inventory

As described in Section 2.6.1, two groundwater production wells are located within the Thing Valley WPA watershed. The wells are owned by the Ewiiaapaayp Tribe. The "south" well is currently used for as-needed water supply and pumps water to a storage tank. The "north" well was constructed to supply water to a proposed water bottling facility, but it is not currently used. Outside of the project watershed area, approximately one mile south of the north and south wells, is the "Thing Valley" observation well that is located near the confluence of La Posta Creek and an unnamed tributary. No other wells are known to exist within the watershed area. Well construction information and static water levels are provided in the following table.

Well Name	Total Depth (ft)	Seal Depth (ft)	Production Rate (gpm)	Water Level – August 2010 (feet below top of casing)
"North" Well	400	22	Idle	54.81
"South" Well	Unknown	Unknown	Up to 30 gpm	49.34
"Thing Valley" Well	Unknown	Unknown	Idle – No Pump	77.62

Locations for these wells are shown on Figure 5. The locations and elevations of these wells are not surveyed; however, using approximate ground surface elevations to establish an approximate groundwater elevation, a hydraulic gradient of 0.05 feet per foot is estimated. The approximated groundwater elevations suggest a southeasterly flow direction down Thing Valley.

According to a report provided by the Ewiiaapaayp Tribe, the "South" well has the potential to produce water at a rate of about 30 gpm. It is used to provide water to a storage tank that supplies water to tribal members at the residences and the fire station. Since there are no permanent residents in the reservation, the south well only pumps occasionally to maintain the water level in the tank.

The North well is capable of producing groundwater at up to 90 gpm, and a pumping test conducted on the well following its construction indicates a specific yield of 55 gpm. The North well was constructed to provide water to a commercial water bottling facility constructed adjacent to the tribal fire station, though the bottling facility never opened and the North well remains idle.

The Thing Valley well is located approximately one mile south of the north and south wells and is not equipped with a pump or power. The well has no cap, and is open to the atmosphere and needs to be secured to be in compliance with California State Well Standards (Bulletin 74-90).

Surface water bodies within the Thing Valley WPA watershed include the ephemeral La Posta Creek and its unnamed, ephemeral tributaries. La Posta Creek passes within approximately 400 feet to the west of the south well. There are no reservoirs or ponds within the watershed, and no springs have been mapped in the area.

2.7.2 Rough Acres Ranch WPA Hydrologic Inventory

While only two wells (Wells 6 and 6a) are located within the prescribed 502-acre watershed area, seven wells surrounding the project area were evaluated during this project. Of these, four are equipped with pumps and are actively used for municipal water supply or to provide water to livestock. The remaining three well are either equipped with pumps and are not currently used, or have not been equipped with pumps. Well construction, current estimated production, and static water levels are provided on the following table.

Well Name	Total Depth (ft)	Seal Depth (ft)	Production Rate (gpm)	Water Level – August 2010 (feet below top of casing)
Well No. 6a “North” Well	385	75	1	28.0
Well No. 6 “South” Well	Unknown	Unknown	1	27.80
Walker Residence Well	Unknown	Unknown	<0.5	54.78
Well No. 9 Livestock Supply Well	Unknown	Unknown	<0.5	29.45
Well No. 2	185	24	No Power	23.92
Well No. 4	185	91	No Pump	10.98
Well No. 8	970	50	Pump	17.95

Locations for these wells are shown on Figure 7. The locations and elevations of these wells are not surveyed; however, using approximate ground surface elevations to establish an approximate groundwater elevation, a hydraulic gradient of 0.01 feet per foot is estimated. The approximated groundwater elevations suggest convergent flow toward McCain Valley, with a general southeasterly flow within the valley.

Based on aquifer testing conducted as part of this investigation and well testing conducted during construction, Well No. 6 and No. 6a are capable of producing groundwater at 50 to 60 gpm. The well test conducted on well No. 6a after construction indicates a specific yield of 60 gpm. Currently these wells are principally used to supply water to grazing livestock, and are estimated to provide water at a rate of about 1500 gallons per day, or 1.05 gpm on average.

Well logs were not available for the Walker residence well, which provides potable water for a single-family residence. Using recommendations provided by the County Groundwater Geologist for a typical residential well, it is estimated that this well produces about one-half acre-foot per year, or about 0.5 gpm on average.

Well logs were also not available for the “Livestock” Well No. 9 located between the Walker residential well and Wells No. 6 and No. 6a. This well provides water for grazing livestock in troughs located throughout the ranch. It is estimated that this well produces water at a rate of about 500 gallons per day, or about one third of a gpm on average.

Well No. 2 is located approximately one mile northeast of Wells No. 6 and No. 6a. First groundwater was encountered at a depth of 70 feet below ground surface in “black and white rock” interpreted to be the La Posta tonalite. Well tests conducted during construction indicate a specific yield of 10 gpm over a three hour test period. Currently, the well is idle.

Well No. 4 is located approximately one mile north of Wells No. 6 and No. 6a. First groundwater was encountered at a depth of 35 feet in “decomposed granite”. Well tests conducted during construction indicate a specific yield of 15 gpm over a one hour test period. There is no pump in this well.

Well No. 8 is located about 3 miles east of Wells No. 6 and No. 6a, just east of McCain Valley Road. First groundwater was encountered at a depth of 30 feet in "weathered granitic rock". A specific yield was not achieved during the post-construction well test, which pumped the well at 50 gpm for 8 hours and recorded 800 feet of drawdown.

In addition to the wells within the prescribed watershed and those used as observation wells during the aquifer testing conducted as part of this study, there are seven residences within three-quarters of a mile of the project site, and each has its own water supply well. It is estimated that each of the seven additional residences utilizes about one-half acre-foot of water per year, and one of the residences has a small poultry farm with an estimated 500 birds that utilizes an additional 0.11 acre-foot of water per year. In total, the additional water use in the vicinity of the site is estimated to be about 3.61 acre-feet per year, or about 2.25 gpm on average.

Surface water bodies within the Rough Acres Ranch WPA watershed include the ephemeral Tule Creek. Although the USGS topographic map of the area identifies a small reservoir near the northwestern portion of the watershed, that feature was not observed within the study area. Rough Acres Ranch discharges water from Wells No. 6 and No. 6a to a small livestock watering reservoir about 2000 feet north of these wells. The reservoir is not lined, and as a result, water infiltrates rapidly into the ground. A groundwater spring was observed on the canyon wall adjacent to Well No. 4. The estimated flow rate from the spring is less than 1 gpm. No other surface water bodies are present within the watershed or surrounding study area.

2.8 Water Quality

Because this water development project is intended to provide water for construction rather than for potable use, no water quality evaluation has been conducted.

3.0 WATER QUANTITY IMPACT ANALYSIS

Water quantity impact analyses were performed in accordance with the County of San Diego *Groundwater Ordinance*, the County's *Guidelines for Determining Significance and Report Format and Content Requirements – Groundwater Resources* and the approved Groundwater Investigation Workplan and Well Test Plan developed for the Tule Wind Project. Based on the County guidelines for determining significance and correspondence with the County, the water quantity analysis section must address well interference, and 50 percent reduction of groundwater in storage associated with groundwater extraction for construction. In addition, in accordance with the County's Groundwater Ordinance, because it is anticipated that groundwater extraction will exceed 20,000 gpd, which is considered a water intensive use, a cumulative groundwater evaluation is required.

This section provides an analysis of the groundwater conditions and a determination of significant impacts to the groundwater resources, based on CEQA guidelines. It should be noted however that the County does not have jurisdiction over water use on tribal lands, including the wells in Thing Valley on the Ewiiaapaayp Reservation. Aquifer testing on the Reservation was performed to assess available water for the project construction and a summary of these results is included herein.

Because the Thing Valley WPA is located within the Ewiiaapaayp Reservation, there is no regional authority governing the use of this water. As a result, the water quantity impact analysis has been limited to performance of a 72-hour aquifer pumping test from the North Well at a rate of 80 gpm followed by measurements of recovery back to static conditions. Over the test, the water level was drawn down approximately 80 feet in the pumping well, and about 17 feet in the nearest observation well, and less than one quarter of a foot in the Thing Valley observation well about one mile downgradient of the pumping well. Analysis of the test data as presented in Appendix A.

Thing Valley Water Quantity Impact Analysis. Thing Valley test data were recorded by Solinst Levelogger Gold pressure transducer data loggers placed in the pumping well and two observation wells. The aquifer transmissivity (the capacity of the well to transmit water) was calculated by a variety of methods using AquiferTest Pro, Version 3.5, numerical modeling software (Röhrich and Waterloo Hydrogeologic, 2002) and ranges from about 100 to 835 ft^2/day depending on the data (early, middle, late portions of the test) obtained during pumping and recovery; the average transmissivity was calculated to be 393 ft^2/day. A summary of the calculated transmissivity values and additional calculated values from the pumping test are provided in Appendix A.

A plot of time versus drawdown was developed from the aquifer pumping test data. Based on the data, a projected total drawdown in the pumping well of 190 feet is expected. A negative boundary condition occurs after 1700 minutes (about 28 hours) and pumping of 136,000 gallons of water. During the intial 1700 minutes of the pumping test, the drawdown cone around the pumping well was likely pulling water from the portion of the fractured rock within Thing Valley. As the cone developed further, the cone is interpreted to have intercepted less fractured bedrock (most likely along the canyon walls) resulting in diminished production (the negative boundary effect).

Considering that the pump has been inoperable for some time prior to the aquifer pumping test, it may be beneficial to remove the pump and conduct an inspection of the well casing and pump for corrosion damage and encrustation to ensure that the well(s) are optimally operable for the duration of the construction program.

3.1 Guidelines for Determination of Significance

For groundwater extraction projects in this fractured rock basin such as the Tule Wind Project, the County Guidelines state:

> “groundwater impacts will be considered significant if a soil moisture balance, or equivalent analysis, conducted using a minimum of 30 years of precipitation data, including drought periods, concludes that at any time groundwater in storage is reduced to a level of 50 percent or less as a result of groundwater extraction. Groundwater impacts are considered significant if a soil moisture balance or equivalent analysis conducted using a minimum of 30 years of precipitation data,

> including drought periods, concludes that at any time groundwater in storage is reduced to a level of 50 percent or less as a result of the project groundwater demands."

The Guidelines also state:

> "As an initial screening tool, offsite well interference will be considered a significant impact if after a five year projection of drawdown, the results indicate a decrease in water level of 20 feet or more in the offsite wells. If site-specific data indicates water bearing fractures exist which substantiate an interval of more than 400 feet between the static water level in each offsite well and the deepest major water bearing fracture in the well(s), a decrease in saturated thickness of 5% or more in the offsite wells would be considered a significant impact."

In addition, based on conversations with the County Groundwater Geologist, a basin-wide cumulative analysis is not required because the project's groundwater extraction period is limited to approximately 9 months. For purposes of the cumulative analysis, with the approval of the County Groundwater Geologist, the Rough Acres Ranch Water Production Area boundary has been defined as an area with a one-half mile radius surrounding the projected ranch groundwater extraction well No. 6a.

3.2 Methodology

In accordance with the approved well test plan for the Tule Wind Project, a step test followed by a 72-hour constant rate aquifer pumping test was conducted at Well No. 6a at the Rough Acres Ranch to evaluate hydraulic characteristics in this proposed construction supply well. Prior to initiating the pumping test, area residents were contacted to request their participation in the test. In order to participate, the resident was asked to discontinue pumping and allow measurement of changes in water levels in their supply well over the testing period. The following residents listed with their Assessor's Parcel Number (APN) were contacted:

Resident	APN	Response
Dave and Linda Shannon	611-091-14	No domestic water storage on site
Dennis and Celeste Wilson	611-091-15	No domestic water storage on site
York Heimerdinger	611-091-02	Has storage but refused the test
Jeff and Peggy Garber	611-090-15	Has storage but refused the test
Lynn Wilson	611-050-24	No domestic water storage on site
Wayne and Frankie Thibodeau	611-091-07	No return call

As presented in this table, none of the surrounding residents agreed to participate in the test. However, because the well pumping test was being performed on the Rough Acres Ranch, most of the available wells on the ranch were made available for monitoring. In addition, the Ranch Manager, Mr. Walker, made his residential supply well available for the duration of the test. A Solinst Levelogger Gold data logger was placed in each of the available ranch wells prior to the long-term constant rate pumping test. These well locations are presented on Figure 7.

The 72-hour aquifer pumping test was conducted between August 24, and 27, 2010, followed by measurement of well recovery to static conditions. Direct water level measurements could not be performed in 4-inch diameter cased pumping well No. 6a, because of limited access through the well head, with only sufficient room to place the levelogger pressure transducer into the well to a depth of 114 feet below the water level for measurements of the water level in this well. Because of limited access through the wellhead at Well No. 6, located approximately 36 feet from the pumping well, water levels in this observation well were measured manually with an electric water level meter. Flow from the pumping well (at about 50 gpm) was measured with an in-line flow meter and water was discharged to a stock pond location approximately 2000 feet northeast of the pumping well. In addition, barometric pressure was measured with the Solinst Barologger Gold transducer, placed in the pumping well pump house adjacent to the pumping well. The pumping well static water level at the start of the test was about 28 feet below ground surface (bgs) and the pump depth was reportedly positioned at an estimated depth of 350 feet, though the pump depth could not be verified. During the pumping test, the maximum drawdown in the pumping well was 77.5 feet. In the nearest observation Well No. 6, the water level was drawn down a maximum of 3.7 feet. An estimated 216,000 gallons of water was pumped to the stock pond.

Results of the pumping and recover tests were plotted on semilog plots to evaluate the data. County Guidelines were reviewed and incorporated into the analysis. In addition, the long-term aquifer test data were analyzed using AquiferTest Pro, Version 3.5, numerical modeling software (Röhrich and Waterloo Hydrogeologic, 2002) to calculate aquifer hydraulic properties.

3.3 Well Test Results

As required by the County Guidelines, a plot of the pumping test time versus drawdown curve in the pumping well was used to estimate the drawdown in the pumping well after five years (2,600,000 minutes) of pumping at an average of 50 gpm as performed during the pumping test. From the graphed pumping data, the projected draw down is 87 feet after five years (Figure 3; Appendix B). Recognizing the project water requirements are needed over an estimated 9-month construction period, 84 feet of drawdown is predicted. In the event that during the construction, a higher pumping rate is needed, using proportions, doubling the pumping rate to 100 gpm would produce a drawdown of 174 feet after five years.

Using the plot of the drawdown plotted against time presented logarithmically since pumping started (Figure 3; Appendix B), aquifer transmissivity can be calculated using the Cooper-Jacobs approximation to the Theis equation:

$$T = \frac{2.3Q}{4\pi\Delta s}$$

where,

T = transmissivity in square feet per day
Q = average pumping rate in ft^3 / day (e.g., 50 gpm multiplied by 193 = 9650 ft^3 / day)
π = 3.14
Δs = change in drawdown over one logarithm of time (3.13 ft. from Appendix B, Figure 3)

Based on this equation, a transmissivity of 563 square feet per day is calculated from the pumping data. Using Aquifer Test Pro numerical modeling software, curve matching methods were used on the time versus drawdown plots to calculate transmissivity, hydraulic conductivity, and storativity by different methods. The transmissivity values obtained from the pumping well ranged from between 26.9 and 630 square feet per day. The analytical results show higher transmissivity (and hydraulic conductivity values) for curves matched to the observation well No. 6 and range from 0.375 to 3750 square feet per day. It is believed that the relatively thick alluvial section in this area of McCain Valley acts as a reservoir recharging the underlying fractured bedrock system. If the fractures in the bedrock are limited, the actual volume of groundwater available may be controlled by these thicker sections of alluvium and the more highly fractured bedrock. A summary of the calculated hydraulic properties from the aquifer tests, are presented in Table 1 included in Appendix B.

The recovery data were evaluated to assess long-term affects on the groundwater aquifer. The plot of residual drawdown versus t/t' (the ratio of time to time since pumping stopped) plotted on a logarithmic scale was used to evaluate aquifer storage. At t/t' equal to 1, a residual drawdown would indicate permanent dewatering of the aquifer and greater than 2 feet of residual drawdown would indicate a failed pumping test. As shown on Figure 4 in Appendix B, when the resultant recovery curve is projected back to t/t' equals 1, a residual drawdown of 0.33 feet is obtained indicating a successful test.

Based on the lack of significant drawdown (3.7 feet) in the nearest observation well 36 feet away, and no evidence of an effect in more distal observation wells suggests that the there is significant water within this water production area. Interference with the nearest off-site wells approximately one half mile from the pumping well are not anticipated from the level of pumping proposed during project construction.

3.4 Cumulative Impacts Analysis

Because the project water needs exceed 20,000 gallons of water per day, a cumulative basin analysis is required. To address these cumulative requires, GLA worked directly with the County's Groundwater Geologist, Mr. Jim Bennett, to develop a reasonable approach. Because the McCain Valley is an extensive groundwater basin and pumping is proposed from a limited area of the basin, it was agreed that the cumulative analysis would be limited to a ½ mile radius about the pumping Well No. 6A. The cumulative analysis was performed using spreadsheets and calculations initially developed by Mr. Bennett.

Initially, project groundwater extraction at 50 gpm (72,000 gpd) and area residential and operational water demands were evaluated against monthly groundwater recharge during a drought condition to determine if project extraction will exceed 50 percent of the total storage capacity within an effective area of McCain Valley defined as approximately within one half mile of the proposed pumping Well No. 6a. A second analysis was performed with double the pumping (100 gpm) to further evaluate increased water utilization at this well. Using drought year precipitation data from the Boulevard gauging station (July 1998 through June 2005), when groundwater recharge is minimal and water is extracted from storage, a conservative assessment of possible groundwater impacts was developed.

3.4.1 Groundwater Recharge

In the spreadsheet, groundwater recharge was estimated from available precipitation data for the Boulevard gauging station over a seven year drought period from July 1998 through June 2005, provided by the County Groundwater Geologist. The recharge area was considered to be an area encompassing the ½-mile radius surrounding the pumping well, equivalent to 502 acres. The groundwater recharge also accounts for evapotranspiration based on an average of 62.5 inches per month as established by California Reference CIMIS ETo map, Zone 16.

3.4.2 Groundwater Demand

For the groundwater demand, the project water needs were incorporated with standard assumptions of water needs for other known potential groundwater users including residents, livestock, and other users identified within approximately ½ of the pumping well. To be conservative some land uses within ¾ mile of the pumping well were included into the overall area groundwater demand calculations. The groundwater demand calculation assumed that there were seven residents using 0.5 acre feet of water per year in accordance with County Guidelines. From literature (The Ohio State University Extension, 2002), an estimated 100 head of cattle graze on the Rough Acres Ranch, would require an estimated daily intake of 19 gallons per animal per day (the maximum estimated daily water intake required for a bull in 90 degree temperatures), equivalent to 2.13 acre feet of water. It should be noted that slightly lower water consumption values (up to 15 gallons per day) are estimated for various classes of horses that may also be grazing on the Ranch lands. A poultry farm, estimated to include 500 poultry, is located to the south of Rough Acres Ranch and based on available literature from Pennsylvania State University (2002), a conservative estimate of 100 gallons per day or 0.11 acre feet of water consumption each year is assumed to support these animals.

These water quantities in combination with the estimated 9-month construction schedule of water demand from the pumping well on Rough Acres Ranch of 50 gpm resulted in an overall groundwater demand of 7.18 acre-feet per month, or 65.74 acre-feet per year. The groundwater demand would increase to 13.88 acre-feet per month and 125.74 acre-feet per year with a corresponding doubling of the production from the pumping well to 100 gpm.

3.4.3 Groundwater in Storage

The groundwater storage capacity was calculated using conservative estimated of the saturated thickness of each of the hydrogeologic units underlying the water production area as observed in boring logs within the McCain Valley. For this analysis, it is assumed that the saturated thicknesses include 20 feet of alluvium, 10 feet of residuum, and 500 feet of fractured bedrock. Assuming that these materials are continuous over the 502 acre water production area, conservative estimates of the specific yield for each unit was obtained from the County. As summarized in Table 1 in Appendix C, the greatest specific yield is associated with the alluvium at 10%, the specific yield for the residuum is 5%, and because the fractured bedrock yields water only within the fractures, the specific yield for this unit is 0.10%.

By multiplying the 502 acres by the specific yield and by the saturated thickness for each hydrogeologic unit, the total groundwater in storage within the ½-mile water production area is 1002 acre feet of water.

3.4.4 Long-Term Groundwater Availability

Based on the proposed 9-month construction period and the project groundwater demand along with adjacent water users, subtracted from the existing groundwater in storage, in combination with the anticipated groundwater recharge generated over a seven year drought cycle, there will be no long-term groundwater requirements in support of the project. As shown on Table 2 in Appendix C, the maximum drawdown within the subject area is about 66 acre-feet, well above the 50% basin depletion level of 500 acre-feet. Even if project pumping were to be increased to 100 gpm, a maximum of 136 acre-feet of drawdown is calculated within the basin (Table 3; Appendix C). In fact, until pumping is increased by eight times to 54 acre-feet per month or nearly 486 acre-feet per year would the basin approach the 50% depletion level of 500 acre-feet (Table 4; Appendix C).

Based on these analyses, the long-term result of pumping at 50 gpm reduces the groundwater in storage to 94% and a maximum reduction to 92% of the total groundwater in storage during the 7-year drought period. Under an increased (100 gpm) pumping scenario, the groundwater in storage is reduced to 86% of the total with an average of 89%.

Following the project construction phase, the estimated water demand for the project site is estimated to be 2500 gallons per business day or about 2 acre-feet per year, associated with the operations and maintenance facility for the wind turbines. Based on the calculations of groundwater availability this level of use would have no significant impact on the groundwater in storage within McCain Valley.

3.5 Significance of Impacts Prior to Mitigation

Based on the results of the aquifer pumping test at the Rough Acres Ranch well No. 6a, the criteria for well interference and 50% depletion of groundwater in storage associated with the proposed project will not be met. No significant impacts to groundwater are anticipated associated with the project.

3.6 Mitigation Measures and Design Considerations

Based on the lack of significant impacts to groundwater associated with the proposed project, no groundwater mitigation measures are proposed for the project.

3.7 Conclusions

Based upon the analyses performed, well interference is not anticipated to be a significant impact for the Tule Wind Farm construction project. During the pumping test, a maximum of 3.7 feet of drawdown was observed in the nearest observation well 36 feet away from the pumping well. No observed drawdown was identified in wells located within one third and one half mile of the pumping well.

The potential for depletion of groundwater in storage within the McCain Valley is not anticipated. Results of the groundwater demand during a drought period indicate that eight times the anticipated groundwater pumping would be required to drawn groundwater to the 50% depletion level.

4.0 SUMMARY OF PROJECT IMPACTS AND MITIGATION

Based on the results of pumping tests and analysis of the data, there is sufficient groundwater to meet the project demands. Review of cumulative analyses performed within a ½ mile radial area of McCain Valley about the aquifer pumping test well indicates based on the available groundwater storage within McCain Valley, it is possible to increase pumping at the Rough Acres Ranch aquifer test well significantly without well interference or significant groundwater depletion.

Although there are no requirements for analysis of groundwater use on tribal lands, the aquifer pumping test and analyses indicate that there is sufficient storage for use of groundwater within Thing Valley and no significant impacts to groundwater storage are anticipated. However, the pumping test data and the noted boundary condition identified during the test after 1700 minutes suggests that to support the project water needs, it may be necessary to pump at a lesser rate or lesser frequency at the aquifer pumping test well, and supplement the water from this well with water from another well within Thing Valley such as the observation well. In addition, because the well has been inoperable for some time, it is recommended that this well and pump be inspected and rehabilitated as necessary to ensure that the well operates optimally for the duration of the construction project.

5.0 CLOSURE

This report was prepared in general accordance with acceptable professional geotechnical and hydrogeologic principles and practices. This report makes no other warranties, either expressed or implied as to the professional advice or information included herein. Although the groundwater investigation performed included constant rate pumping over a 72-hour period, it is not possible to fully anticipate an aquifer's behavior over the proposed 9-month construction period. It is understood that the project intends to obtain will serve letters to purchase water from off-site vendors if it is needed. The use of off-site water suppliers is recommended in the event that groundwater supplies are not fully supportive of the project. Our firm should be notified of any pertinent change in the project, or if conditions are found to differ from those described herein, because this may require a reevaluation of the conclusions. This report has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

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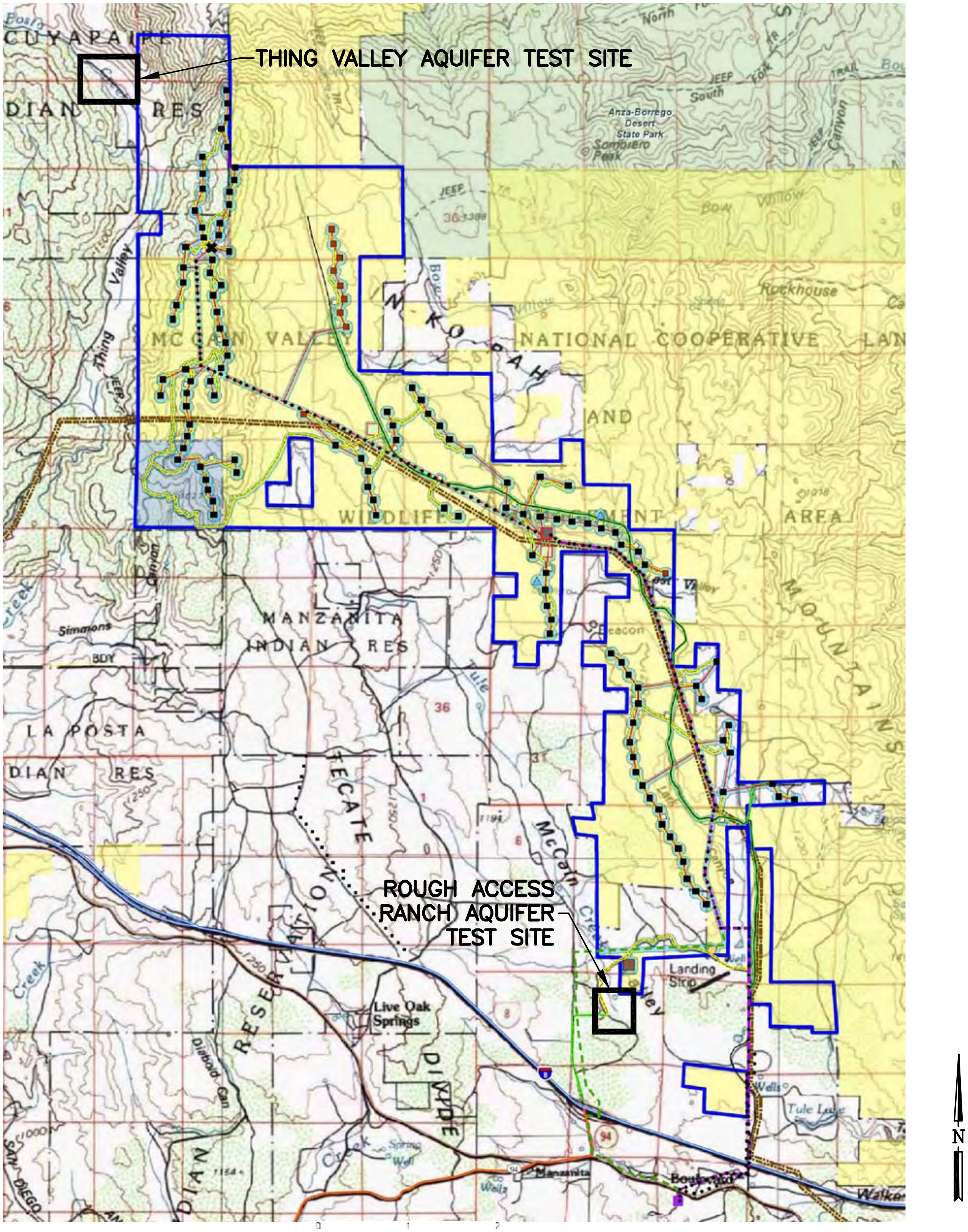
Mr. Robert Walker
Rough Acres Ranch Manager

Desi Vela
Field Technician, Ewiiaapaayp Band of Kumeyaay Indian

FIGURES



0 1 2
Miles

FIGURE 1

Legend

- Proposed Turbine
- Alternate Turbine
- Proposed Met Tower
- Proposed Junction Box
- Proposed Overhead Structure
- Preferred 138-kV Transmission Line
- Alternate 138-kV Transmission Line
- Proposed Underground 34.5-kV Line
- Proposed Overhead 34.5-kV Line
- Existing Road - Improvements Needed
- Proposed New Access Road
- Freeway
- Highway
- Major Road
- McCain Valley Road
- Proposed 10-acre Parking Area
- Proposed 2-acre Lay Down Area
- Proposed Batch Plant
- Preferred O&M and Substation
- Alternate O&M and Substation
- Existing Substation
- Proposed Sunrise Powerlink Transmission ROW
- Development Corridor
- Project Area
- CA State Lands Commission
- BLM Land

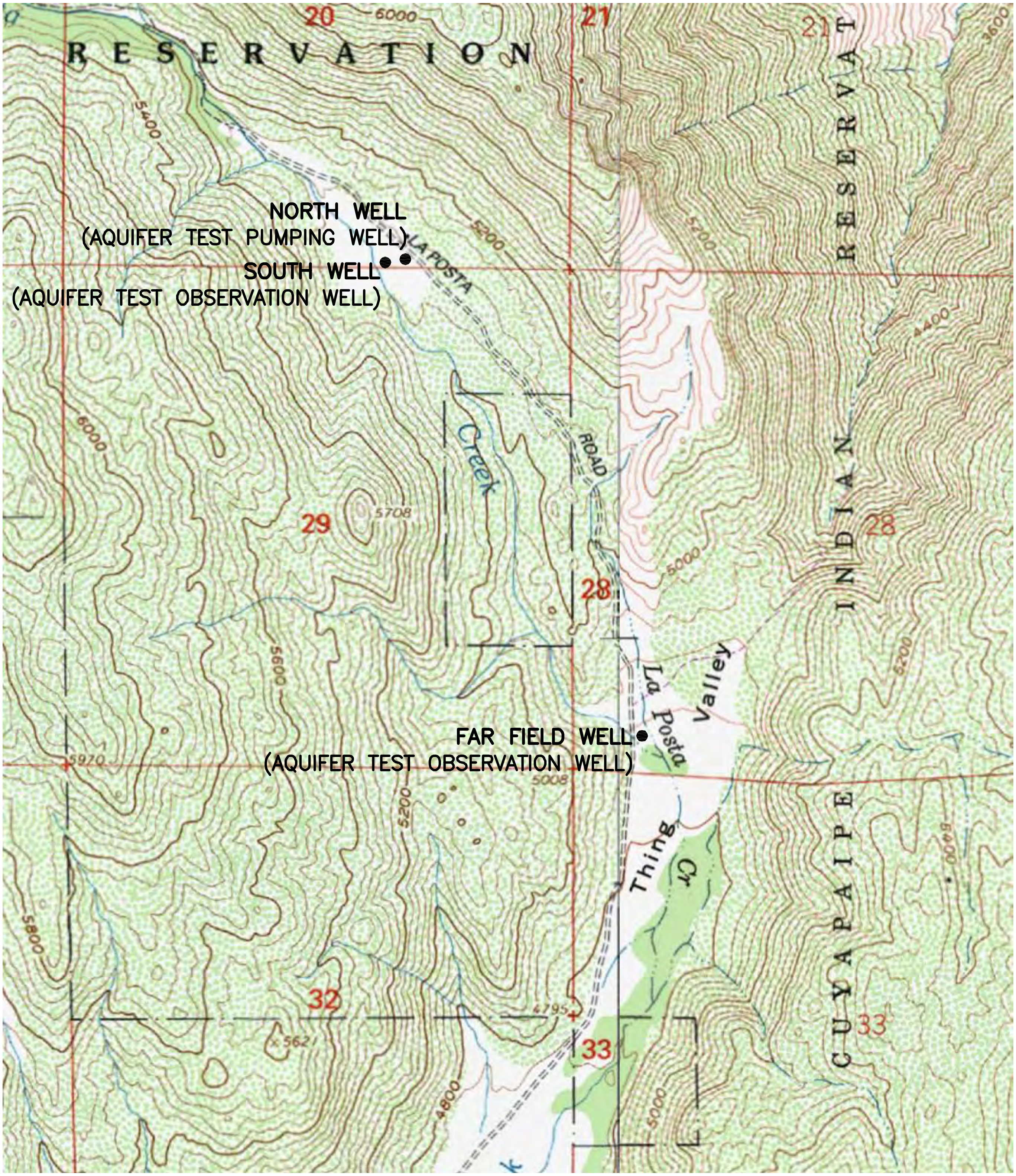
REFERENCE:
IBERDROLA RENEWABLES, 2009

PROJECT LOCATION MAP

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

Geo-Logic
ASSOCIATES

DRAWN BY: VL	DATE: NOVEMBER 2010	JOB NO. 2010-005



GRAPHIC SCALE

750 0 375 750 1500

(in feet)

1 inch = 1500 ft.

N

REFERENCE: 7.5 MINUTE SERIES (TOPOGRAPHIC) MOUNT LAGUNA (1997) AND SOMBRERO PEAK (1975) CALIFORNIA QUADRANGLES

FIGURE 2A

WELL LOCATION MAP
THING VALLEY AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

Geo-Logic ASSOCIATES

DRAWN BY: VL	DATE: NOVEMBER 2010	JOB NO. 2010-005

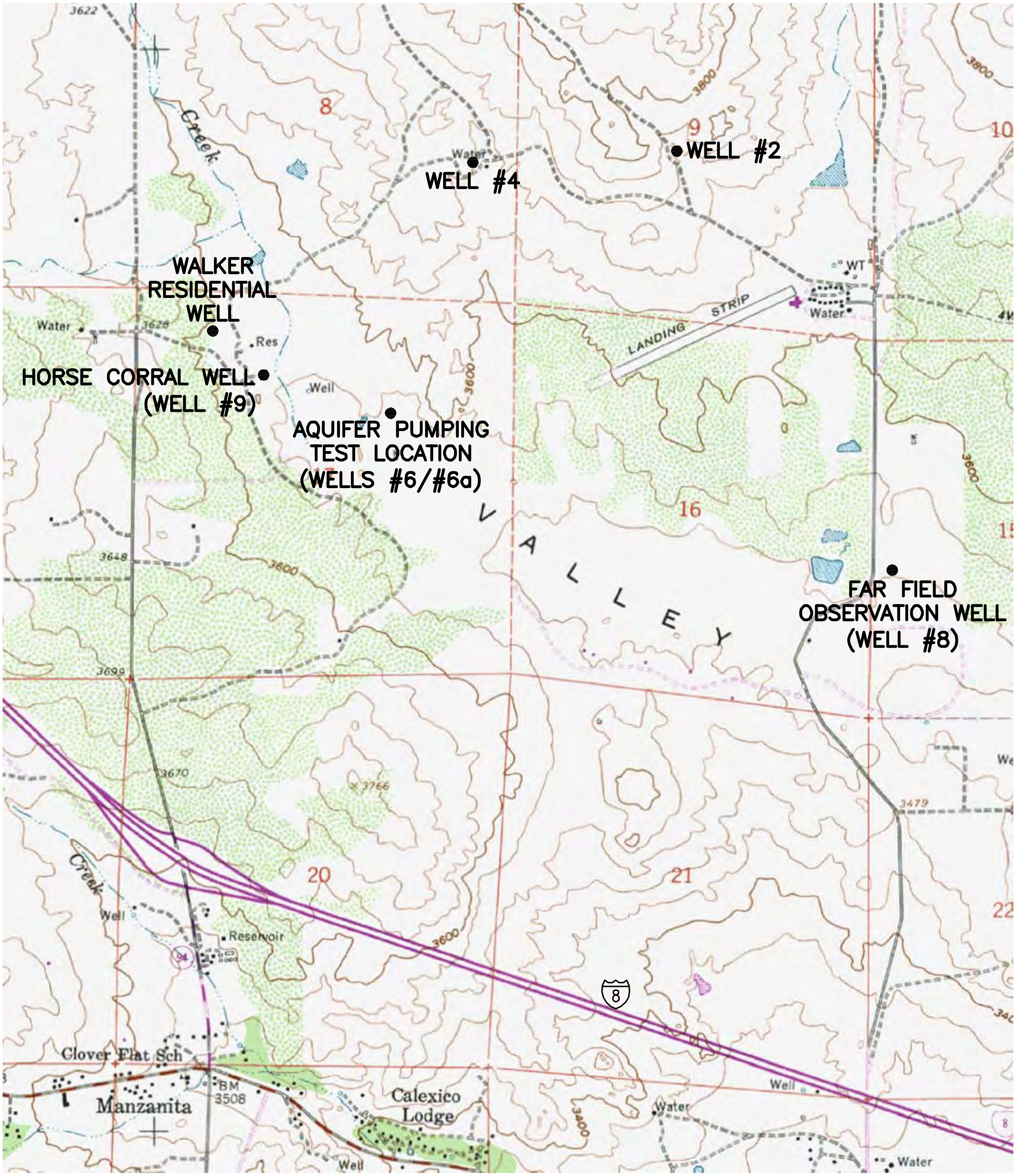


FIGURE 2B

WELL LOCATION MAP
ROUGH ACRES RANCH AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

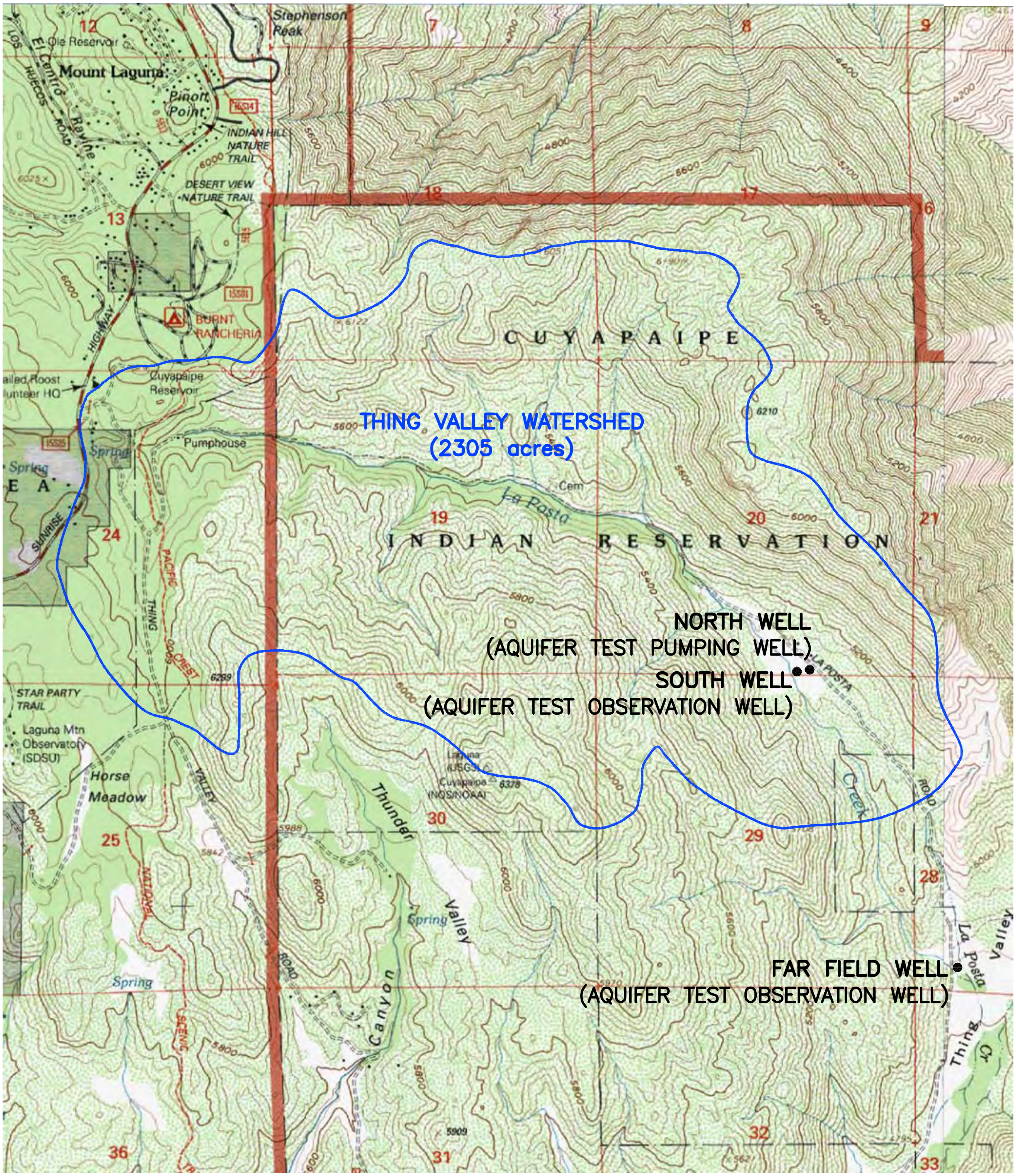
GRAPHIC SCALE
1000 0 500 1000 2000
(in feet)
1 inch = 2000 ft.

N

REFERENCE: 7.5 MINUTE SERIES (TOPOGRAPHIC) LIVE OAK SPRINGS (1975) CALIFORNIA QUADRANGLE

Geo-Logic
ASSOCIATES

DRAWN BY: VL	DATE: NOVEMBER 2010	JOB NO. 2010-005



GRAPHIC SCALE

1200 0 600 1200 2400

(in feet)

1 inch = 2400 ft.

N

REFERENCE: 7.5 MINUTE SERIES (TOPOGRAPHIC) MOUNT LAGUNA (1997) AND SOMBRERO PEAK (1975) CALIFORNIA QUADRANGLES

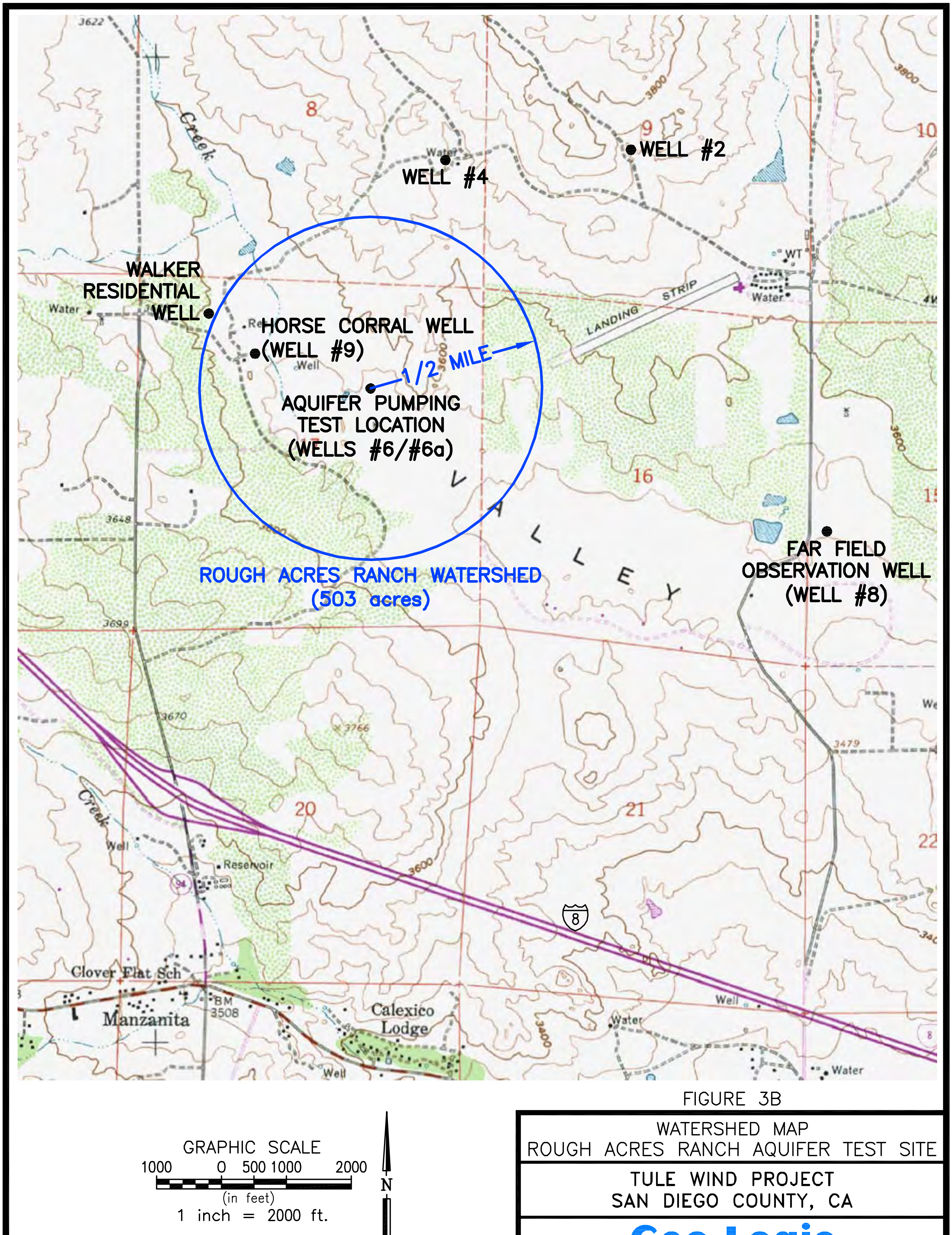
FIGURE 3A

WATERSHED MAP
THING VALLEY AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

Geo-Logic ASSOCIATES

DRAWN BY: VL	DATE: NOVEMBER 2010	JOB NO. 2010-005



REFERENCE: 7.5 MINUTE SERIES (TOPOGRAPHIC) LIVE OAK SPRINGS (1975) CALIFORNIA QUADRANGLE

FIGURE 3B

WATERSHED MAP
ROUGH ACRES RANCH AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

Geo-Logic ASSOCIATES

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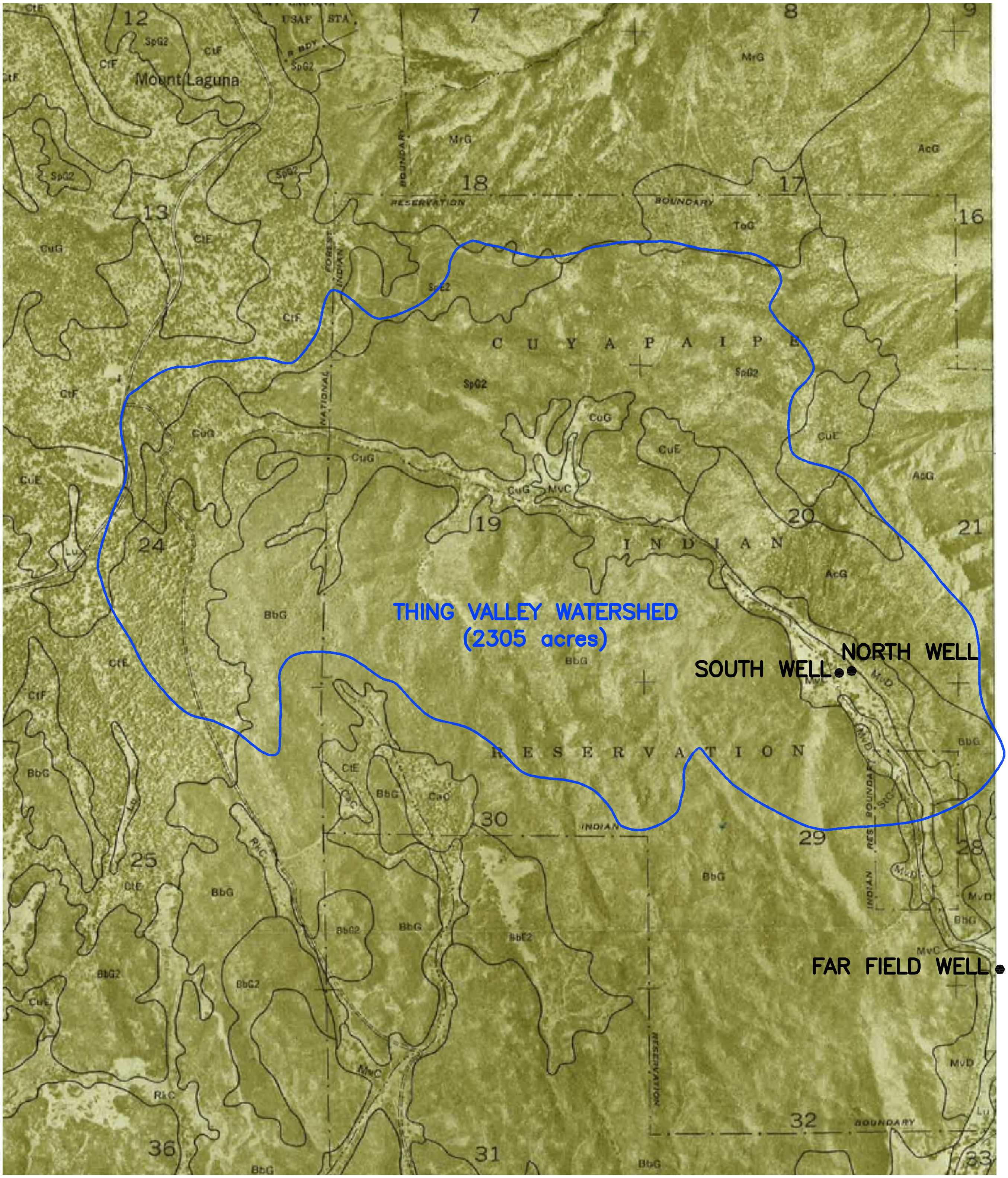


FIGURE 4A

SOILS MAP
THING VALLEY AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

Geo-Logic ASSOCIATES

REFERENCE: SOIL SURVEY, SAN DIEGO AREA SOIL CONSERVATION SERVICE, 1973 (SEE TEXT SECTION 2.5 FOR EXPLANATION)

DRAWN BY: VL	DATE: NOVEMBER 2010	JOB NO. 2010-005

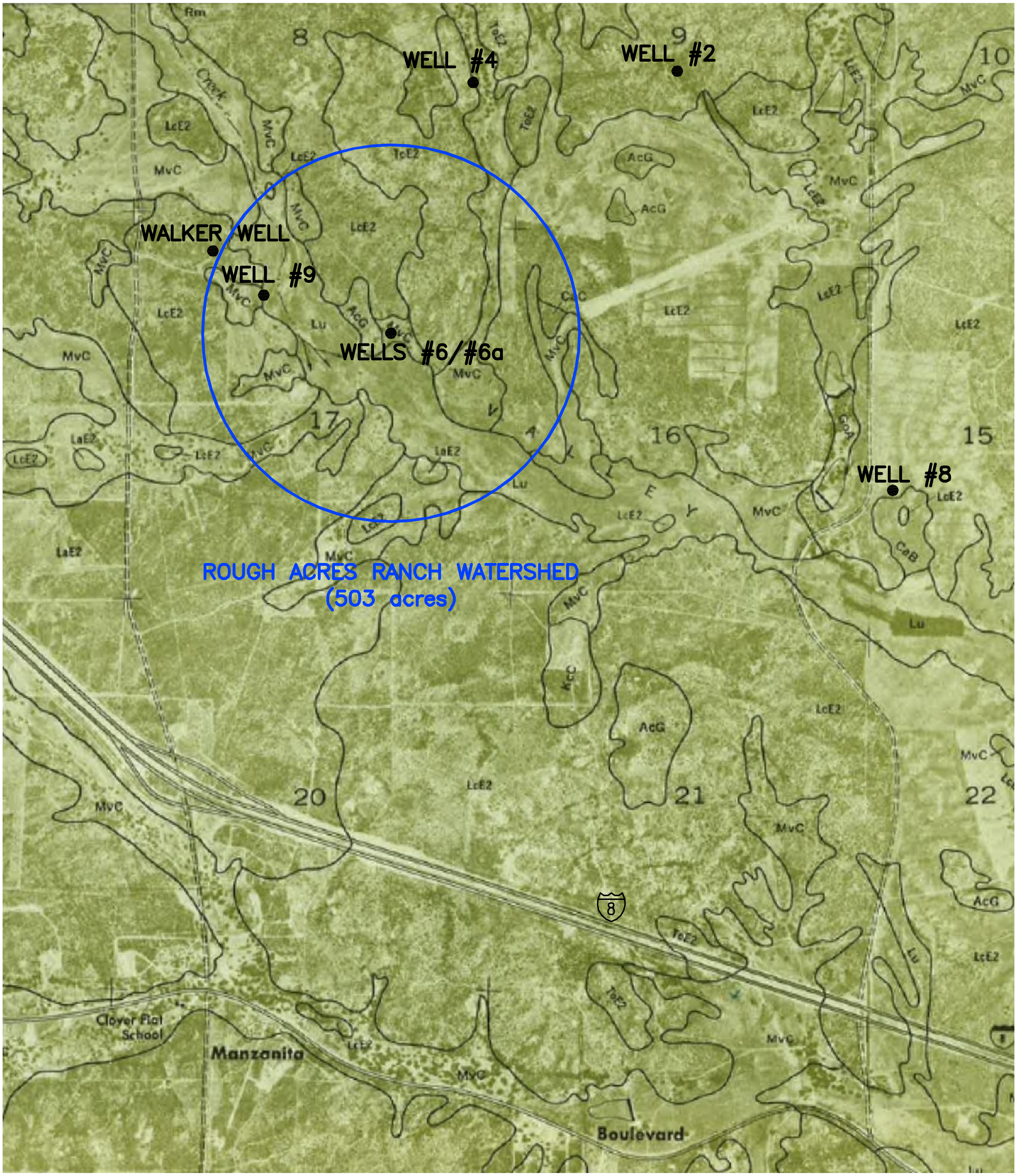


FIGURE 4B

SOILS MAP
ROUGH ACRES RANCH AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

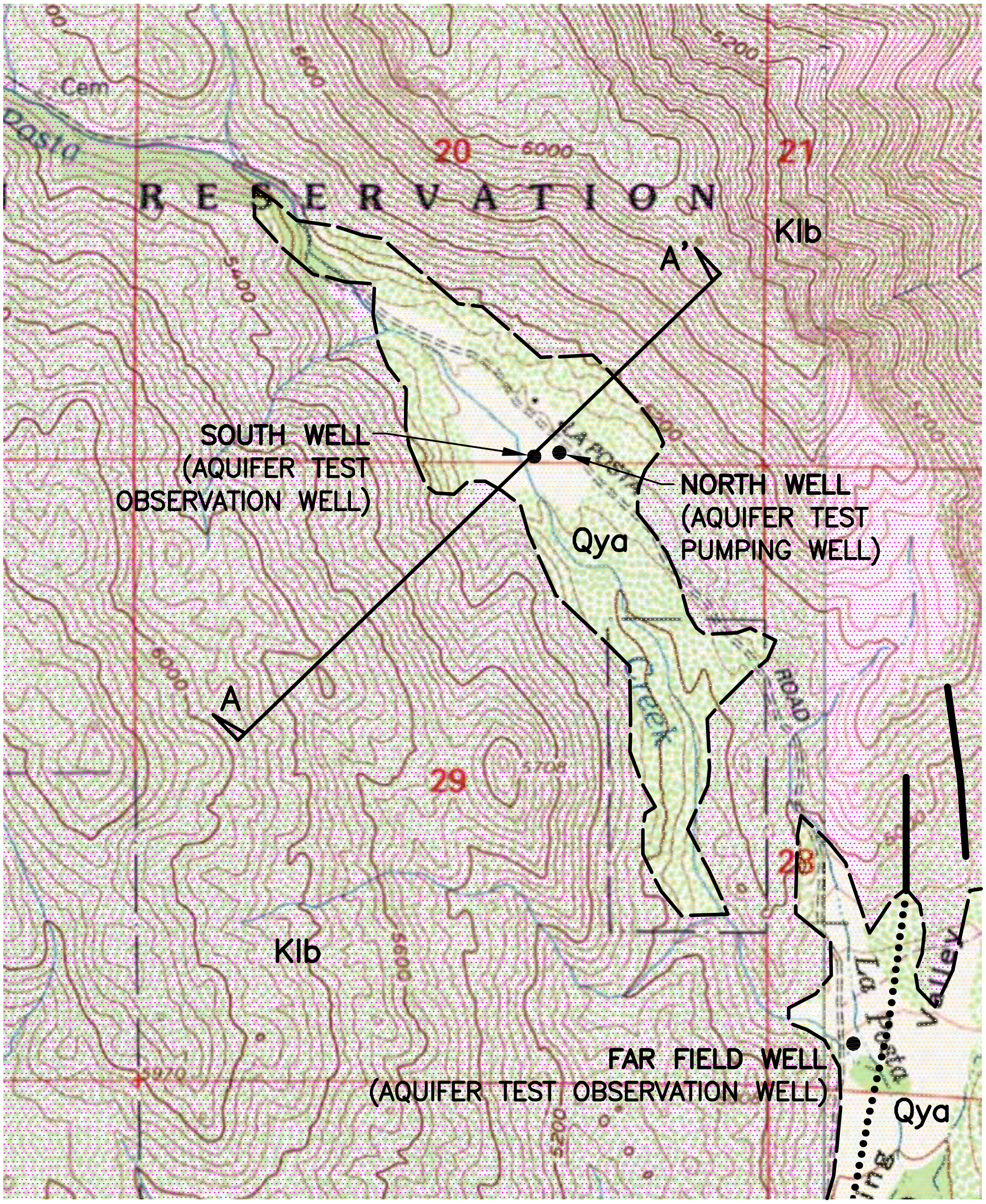
Geo-Logic
ASSOCIATES

GRAPHIC SCALE
1000 0 500 1000 2000
(in feet)
1 inch = 2000 ft.

N

REFERENCE: SOIL SURVEY, SAN DIEGO AREA SOIL CONSERVATION SERVICE, 1973 (SEE TEXT SECTION 2.5 FOR EXPLANATION)

DRAWN BY: VL | DATE: NOVEMBER 2010 | JOB NO. 2010-005



EXPLANATION:

Qya YOUNG ALLUVIUM (HOLOCENE)

Klb TONALITE OF LAS BANCAS (EARLY CRETACEOUS)

APPROXIMATE GEOLOGIC CONTACT

FAULT, DOTTED WHERE CONCEALED

A A' CROSS-SECTION LOCATION

GRAPHIC SCALE
750 0 375 750 1500
(in feet)
1 inch = 1500 ft.

REFERENCE: PRELIMINARY GEOLOGIC MAP OF EL CAJON 30' x 60' QUADRANGLE, SOUTHERN CALIFORNIA, V. R. TODD, 2004

FIGURE 5

GEOLOGIC MAP
THING VALLEY AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

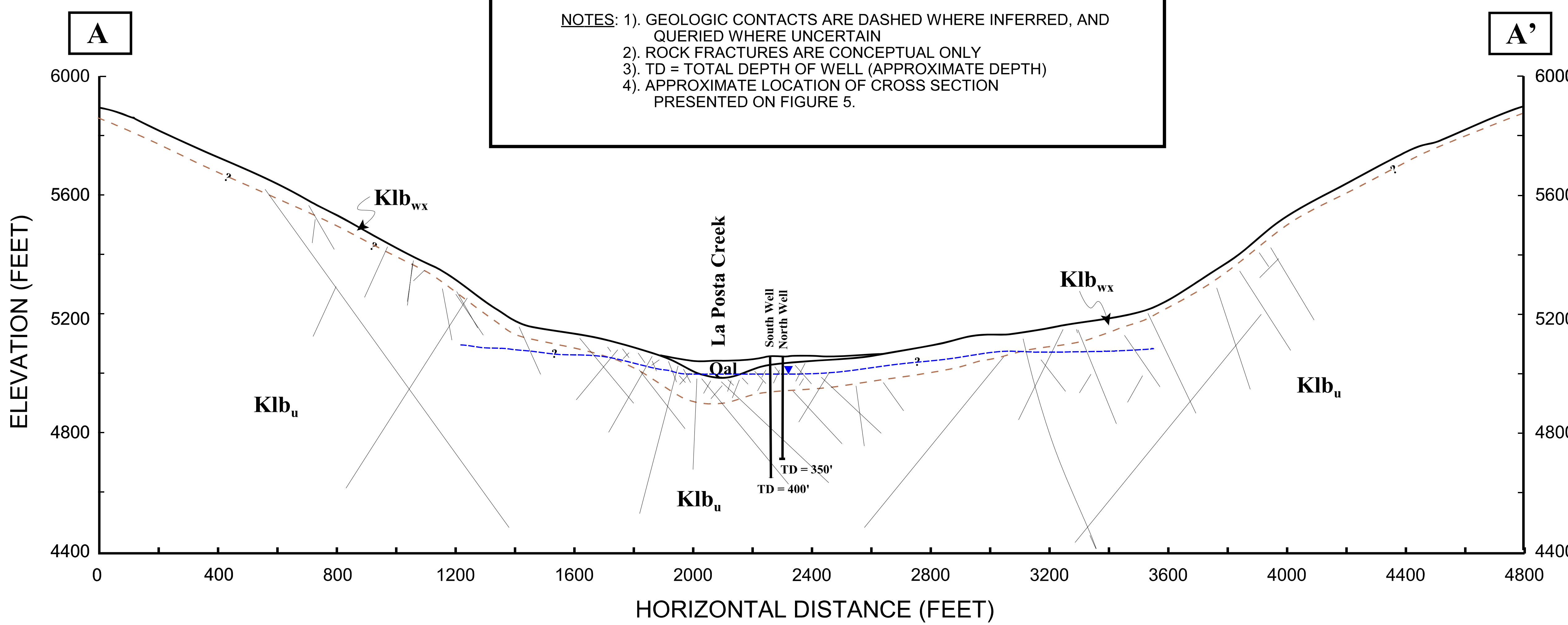
Geo-Logic ASSOCIATES

DRAWN BY: VL	DATE: NOVEMBER 2010	JOB NO. 2010-005

LEGEND

Qal	RECENT ALLUVIUM
Klb_{wx}	LOS BANCOS TONALITE, WEATHERED
Klb_u	LOS BANCOS TONALITE, UNWEATHERED
	APPROXIMATE GROUNDWATER TABLE
	ROCK FRACTURES

NOTES: 1). GEOLOGIC CONTACTS ARE DASHED WHERE INFERRED, AND QUERIED WHERE UNCERTAIN
2). ROCK FRACTURES ARE CONCEPTUAL ONLY
3). TD = TOTAL DEPTH OF WELL (APPROXIMATE DEPTH)
4). APPROXIMATE LOCATION OF CROSS SECTION PRESENTED ON FIGURE 5.



NORTH 45° EAST

HORIZONTAL SCALE: 1 INCH = 400 FEET
VERTICAL SCALE: 1 INCH = 400 FEET
(11 X 17 INCH FORMAT ONLY)

FIGURE 6

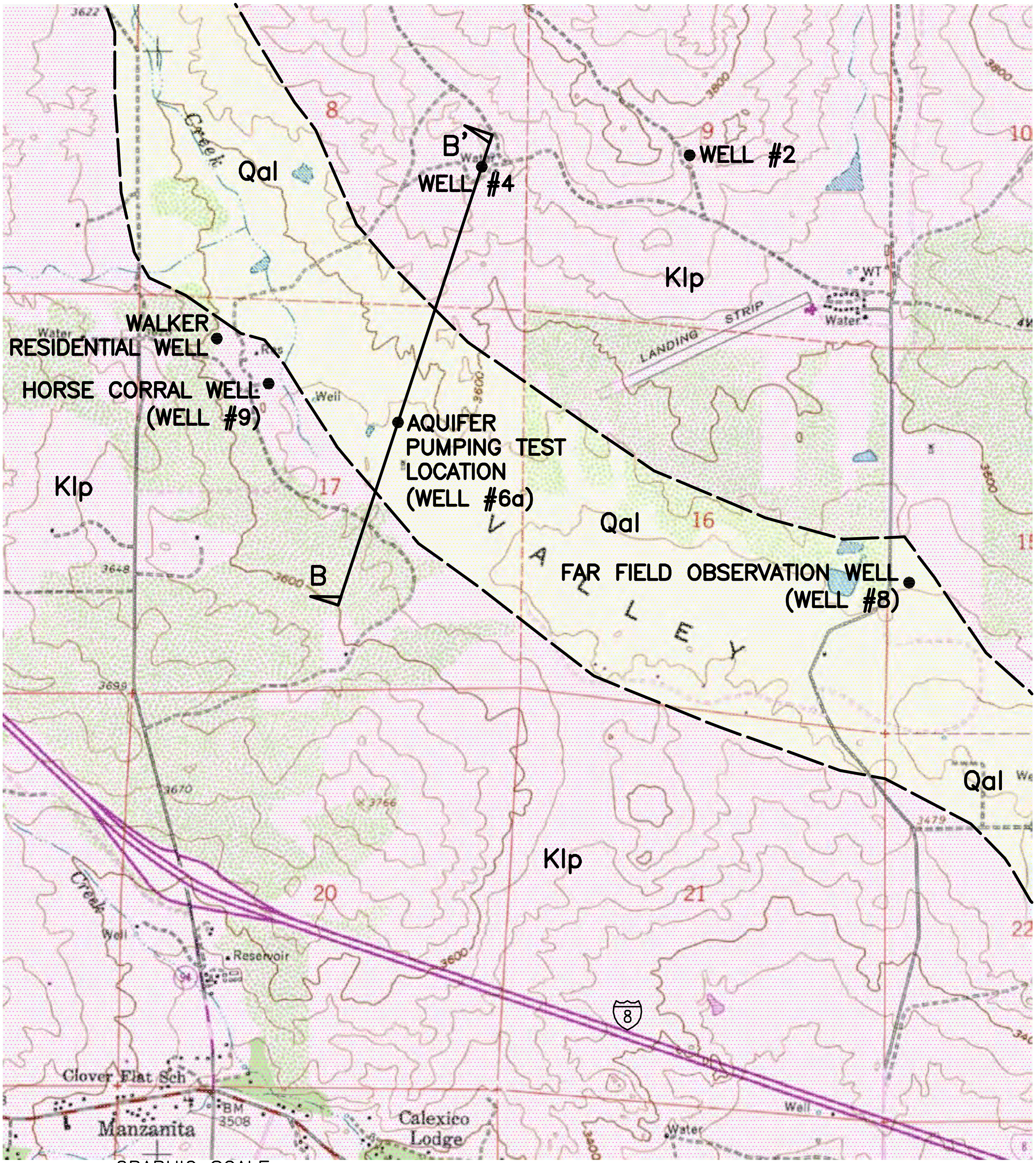
CONCEPTUAL HYDROGEOLOGIC CROSS SECTION

THING VALLEY STUDY AREA
SAN DIEGO COUNTY, CALIFORNIA

Geo-Logic ASSOCIATES

Draft	Date	Project No.
JGF	OCT 2010	2010-0005

References: USGS, 1997, 7.5' Mount Laguna and USGS, 1975, 7.5' Sombrero Peak, CA Quadrangles.



GRAPHIC SCALE

1000 0 500 1000 2000

(in feet)

1 inch = 2000 ft.

N

REFERENCE: PRELIMINARY GEOLOGIC MAP OF EL CAJON 30' x 60' QUADRANGLE, SOUTHERN CALIFORNIA, V. R. TODD, 2004

EXPLANATION:

Qal	ALLUVIUM
Klp	TONALITE OF LA POSTA (EARLY AND LATE CRETACEOUS)
— — —	APPROXIMATE GEOLOGIC CONTACT
B B'	CROSS-SECTION LOCATION

FIGURE 7

GEOLOGIC MAP
ROUGH ACRES RANCH AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

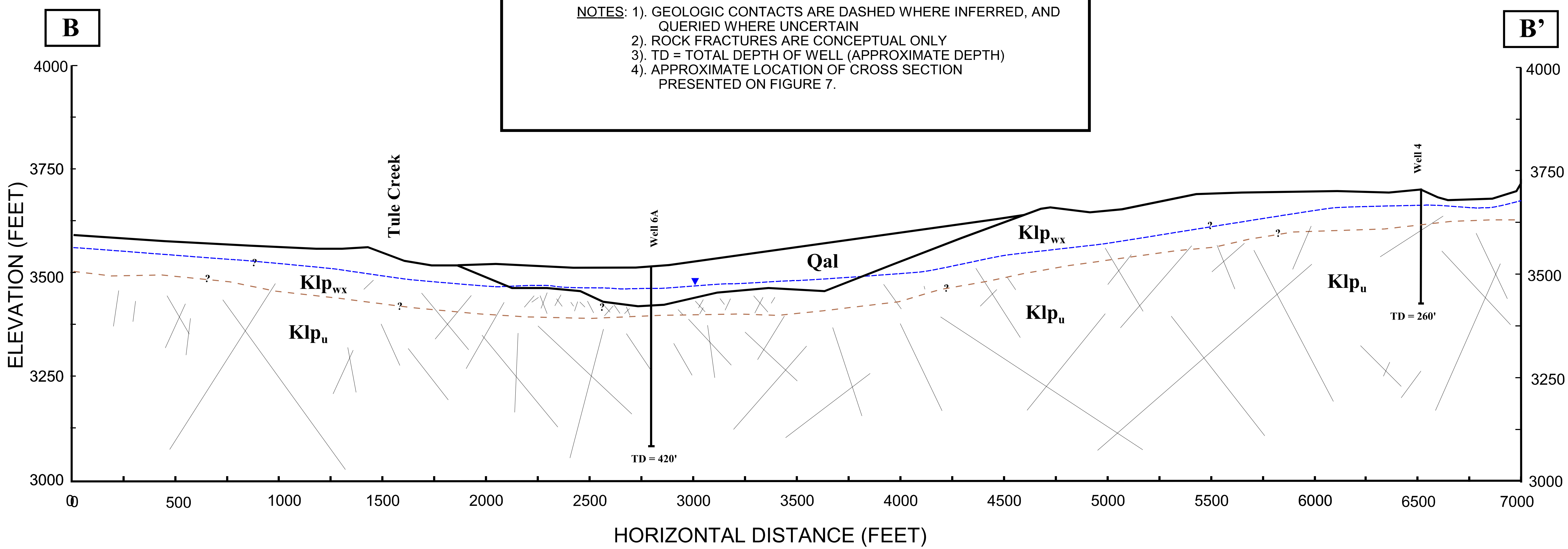
Geo-Logic
ASSOCIATES

DRAWN BY: VL	DATE: NOVEMBER 2010	JOB NO. 2010-005

LEGEND

Qal	RECENT ALLUVIUM
Klp_{wx}	LA POSTA TONALITE, WEATHERED
Klb_{u}	LA POSTA TONALITE, UNWEATHERED
	APPROXIMATE GROUNDWATER TABLE
	ROCK FRACTURES (SCHEMATIC ONLY)

NOTES: 1). GEOLOGIC CONTACTS ARE DASHED WHERE INFERRED, AND QUERIED WHERE UNCERTAIN
2). ROCK FRACTURES ARE CONCEPTUAL ONLY
3). TD = TOTAL DEPTH OF WELL (APPROXIMATE DEPTH)
4). APPROXIMATE LOCATION OF CROSS SECTION PRESENTED ON FIGURE 7.



NORTH 18° EAST

HORIZONTAL SCALE: 1 INCH = 500 FEET
VERTICAL SCALE: 1 INCH = 250 FEET
2x VERTICAL EXAGGERATION
(11 X 17 INCH FORMAT ONLY)

References: USGS, 1975, 7.5' Live Oak Springs, CA Quadrangle.

FIGURE 8

CONCEPTUAL HYDROGEOLOGIC CROSS SECTION

ROUGH ACRES STUDY AREA
SAN DIEGO COUNTY, CALIFORNIA

Geo-Logic ASSOCIATES

Draft	Date	Project No.
JGF	OCT 2010	2010-0005

APPENDIX A

OBSERVATIONS AND ANALYSIS OF AQUIFER CHARACERISTICS

EWIIAAPAAYP RESERVATION

THING VALLEY, EAST SAN DIEGO COUNTY, CALIFORNIA

Geo-Logic
ASSOCIATES
Geologists, Hydrogeologists and Engineers

Date: November 8, 2010
Project No.: 2010-0005

To: John Hower, CEG
Sarah Battelle, CHG

From: Mark Vincent, CHG

Regarding: **Observations and Analyses of Aquifer Characteristics
Thing Valley, San Diego County, California**

INTRODUCTION

This memo presents a summary of observations and analyses made following a stepped and a constant rate aquifer pumping and recovery test in wells located in Thing Valley located approximately 10 miles north of I-8 off La Posta Truck Trail/Thing Valley Road in the Ewiiaapaayp Reservation, in eastern San Diego County, California. The tests were performed to determine whether sufficient volumes of water are available for the Tule Wind Farm construction projects. Analyses performed included calculation of transmissivity, hydraulic conductivity, and storativity for a pumping well and observation wells.

WELL AND AQUIFER CONDITIONS

A well labeled as South Well was used as the pumping well for this test. Another well labeled as North Well is located 61.5 feet to the west of the pumping well and was monitored and analyzed as an observation well. A third well identified as Thing Valley Well is located approximately 5,517 feet south-southeast of the pumping well and was also used as an observation well (Figure 1).

Records for drilling and construction of the wells used for these pumping tests are incomplete or nonexistent. A well identified on Department of Water Resources (DWR) records as the "Cuyapaipe Community Well" (identified as Form No. 058539) is believed to be the log for South Well. No records are available for North Well or Thing Valley Well.

Although DWR records indicate that slotted well casing was installed to a depth of 122 feet, they do not indicate whether or not casing exists below that depth or if the casing was installed prior to drilling the well to a total depth of 400 feet. The North and South Wells used in this pumping test have existing electric submersible pumps installed in them. Based on the production rates achieved during the tests performed, the wells are likely to be outfitted with four-inch diameter electric submersible pumps. Based on the depth and pressure head on the transducers installed in the wells for the test, it was assumed that all of the boreholes are 400 feet deep and are 10-inches in diameter. It was further assumed that the wells were constructed with 6-inch diameter well casing and that they are perforated or screened over the entire saturated thickness. Details of well construction could not be verified in the field because of the presence of pumps, discharge pipes, electrical wires, and surface sanitary seals.

The area immediately around North Well and South Well is underlain by alluvium comprised of poorly sorted sand, gravel, and silt derived from the crystalline basement rock exposed on the adjacent canyon sidewalls. The crystalline basement rocks are classified as tonalite and yield groundwater from fractures. The well log reportedly recorded for South Well indicates that there are about 12 to 15 feet of alluvium overlying the tonalite. An alternative interpretation of the log is that some of the materials described in the log to a depth of 50 feet could also be coarse-grained alluvium locally derived from the surrounding tonalite. Groundwater was measured at a depth of 54.81 feet below the top of sanitary seal on North Well (approximately 8-inches above ground surface) and was measured at a depth of 49.34 feet below the sanitary seal in South Well (also about 8-inches above ground surface). Groundwater was measure at a depth of 77.62 feet below the top of the conductor casing on Thing Valley Well (the conductor casing extends approximately 6-inches above ground surface).

TEST METHODS

Observations of groundwater elevation were recorded in a pumping well and two observation wells in Thing Valley. Data was collected using pressure transducers connected to data loggers. Barometric pressure changes were recorded during the test and corrections were made to the pressure head data collected during the tests.

A stepped aquifer pumping test was performed using North Well to determine the optimum pumping rate for a longer duration test. The pressure transducers were deployed and began recording data on August 12, 2010 to perform the stepped pumping test. The stepped pumping test was performed at pumping rates of 72 gallons per minute (gpm), 88 gpm, and 90 gpm. The pump could not be throttled down below 72 gpm without water exiting a by-pass / check valve and had a maximum yield of 90 gpm. A semi-logarithmic plot of elapsed time versus drawdown for the stepped pumping test is shown on Figure 2.

The constant rate pumping and recovery test was performed from August 16 through 19, 2010. The pump was powered-down on August 19, 2010 and allowed to recover until August 23, 2010 when the pressure transducers were removed from the wells. South Well was initially pumped at an average rate of 88 gpm and was corrected to 80 gpm during a period from about 1 to 2 hours into the test. Recovery tests were performed by turning off the pumps and recording the increasing head levels over time.

DATA ANALYSIS

Changes in groundwater level data recorded during this test were corrected for barometric pressure changes and used to generate a file containing tabulated time and changes in pressure head. The data was used to generate time-drawdown graphs for the pumping and observation wells and imported into computer software used to calculate the transmissivity and storativity of the fractured tonalite.

The stepped pump test analysis consists of plotting the drawdown versus time for each pumping rate on a time versus drawdown plot with time plotted on a logarithmic scale. Forward projections of each segment representing a different pumping rate can be used to predict the likely drawdown for the pumping well during for the selected duration of the test. A pumping rate of 80 gpm was selected as the target pumping rate because it would allow for ample drawdown without the well running dry during the test.

The method of Schafer (1978) was employed to determine how much of the data set for North Well was impacted by casing storage effects. The method is a simplification of the method first developed by Papadopulos and Cooper (1967) but does not require prior knowledge of the transmissivity or well efficiency. The point at which casing storage effects are overcome was calculated to occur approximately 12 to 14 minutes into the test based on the assumptions about well construction practices, pumping rates, and drawdown. Very early pumping data was ignored in the analyses described below due to casing storage effects and the non-uniform drawdown curve caused by the change in the pumping rate from 88 to 80 gpm.

Time versus drawdown plots were prepared for the pumping and observation wells for the pumping and recovery portions of the test. The plots are shown with the time axis plotted on a logarithmic scale and drawdown on a linear scale.

Figure 3 shows the time-drawdown plot for North Well during pumping. The first 12 to 14 minutes of the test show the effects of attempting to establish a constant pumping rate and casing storage effects. A slight recovery in the drawdown is noted from around 14 minutes to approximately 33 minutes due to a reduction in the pumping rate from 88 to 80 gpm. The North Well drawdown plots as a straight line on the time-drawdown chart representing constant aquifer properties during that portion of the drawdown cone development. A sudden change in the drawdown curve starts at approximately 1,700 minutes and changes again at approximately 3,000 minutes. The steepening of the time drawdown curve noted at approximately 1,700 and 3,000 minutes likely indicates a negative boundary effect.

A residual drawdown plot for the North Well is shown on Figure 4. The plot shows the change in drawdown versus the ratio of the time since the pump test started divided by the time since the recovery portion of the test started (t/t`). An inflection point is noted at approximately t/t`=100 possibly due to some type of boundary effect. The residual drawdown at a t/t` ratio of 1 extends through the origin and there is no discernable change in storage noted in the pumping well over the course of the pumping and recovery portions of the aquifer stress test.

A time-drawdown plot of South Well located 61.5 feet away from the pumping well shows a sharp decrease in drawdown from approximately 51 minutes to approximately 65 minutes which is considered to be the result of the decrease in pumping rate from 88 to 80 gpm (Figure 5). The South Well plot shows a slight increasing slope to the semi-logarithmic plot but shows a very strong inflection point at approximately 1,700 minutes into the test. This is interpreted to be the result of a negative boundary effect similar to that observed on the time-drawdown plot from North Well (compare Figures 3 and 5).

The South Well recovery portion of the test is plotted as the residual drawdown versus t/t` shows a concave upwards curvature to the semi-logarithmic plot (Figure 6) indicative of changing aquifer conditions from a t/t` ratio of about 10 to 200 into the recovery test period. The line segment from a t/t` ratio of 200 the end of the test is a straight line plot indicative of constant aquifer conditions. The residual drawdown value measured for a t/t' ratio of 1 is about -3.5 feet. Though this value is not within about one half of a foot as would be expected from a successful test, it may not be especially significant for an observation well when the pumping well shows no changes in storage effect.

The Thing Valley Well located approximately 5,517 feet south of the pumping well was monitored for changes in head. A possible cumulative drawdown of approximately 0.25 feet was observed from approximately 400 minutes until the end of the test (Figure 7). The recovery portion of the well is shown on Figure 8 and is shows a large sudden change in measured head near the end of the monitoring period. This is interpreted as a slippage of the transducer cable and is probably not a valid recovery curve.

Water level drawdown data were evaluated using the computer software program AquiferTest version 3.5 (Waterloo Hydrogeologic, 2002). The program performs curve matching of the time drawdown data to calculate transmissivity, hydraulic conductivity, and storativity using different methods. The methods employed included Cooper-Jacob (1946), Moench (1993), Neuman (1975), and Theis (1935).

DISCUSSION

As shown on Table 1, the calculated hydraulic conductivity values for all of the analytical methods employed ranged from a low of 0.285 feet/day for data collected from North Well using Neuman's method for the data collected from the end of the data set to a high of 2.39 feet/day for the early time recovery phase of South Well using the Theis Recovery method. An average conductivity of 1.122 feet/day was calculated from all methods from both South Well and North Well. The Storativity values range from a low of 3.33E-09 for North Well middle to late time data and a high of 4.19E+01 for a match to the very late time data recorded in South Well.

All of the analytical results show a higher transmissivity and hydraulic conductivity value for matches to the early time drawdown data and show lower values for matches to late time drawdown data. This is most likely the result of a higher degree of fracturing in the rock around the wells. North Well and South Well are located in a portion of Thing Valley which is entirely covered in up to 50 feet of alluvium (Figure 9). Inspection of aerial photographs from Google Earth show the local canyons and drainages are controlled by large scale joint sets. Areas of maximum fracturing will have higher transmissivity and hydraulic conductivity associated with them and also will be more prone to erosion.

During the pumping test, a cone of depression developed radially around the well until the cone intercepted lower transmissivity/less fractured rock at the canyon side walls (the negative boundary effect observed approximately 1,700 minutes into the test). After that time, the majority of the water entering the wells is coming from directly up and down canyon. A later stage negative boundary effect near the 3,000 minute mark observed in North Well may be a secondary negative boundary effect associated with translation of the cone of depression outside the portions of the canyon overlain by alluvium. Although the alluvium was not thought to be saturated during the test it is likely to act like a sponge slowing the downgradient flow of groundwater.

Because the fractures in the bedrock appear to be of aerially limited extent, the actual volume of groundwater available may be limited with larger volumes of groundwater available within the canyon areas where fracturing may be most prevalent.

CLOSURE

This summary of observations and analyses has been prepared in general accordance with accepted professional geotechnical and hydrogeologic principles and practices. This report makes no other warranties, either expressed or implied as to the professional advice or information included in it. Our firm should be notified of any pertinent change in the project, or if conditions are found to differ from those described herein, because this may require a reevaluation of the conclusions. This report has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

Geo-**L**ogic **A**ssociates

Mark W Vincent

Mark W. Vincent, PG 5767, CEG 1873, CHg 865
Senior Geologist

Attachments: Table 1 - Aquifer Stress Test Results
Figure 1 - Well Location Plan
Figure 2 - Step Test Time Drawdown Plot
Figure 3 - North Well Time Drawdown Plot Pumping
Figure 4 - North Well Time Drawdown Plot Recovery
Figure 5 - South Well Time Drawdown Plot Pumping
Figure 6 - South Well Time Drawdown Plot Recovery
Figure 7 - Thing Valley Well Time Drawdown Pumping
Figure 8 - Thing Valley Well Time Drawdown Recovery
Figure 9 - Geologic Map
Appendix A - Analytical Results from Aquifer Test Program

REFERENCES

Cooper, H.H., Jr. and Jacob, C.E., 1946, A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well Field History, *Transactions, American Geophysical Union*, Vol. 27, No. 4.

Driscoll, D.G., 1986, Groundwater and Wells, Johnson Filtration Systems Inc., St. Paul, Minnesota.

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Papadopulos, I.S. and Cooper, H.H., Jr., 1967, Drawdown in a well of large diameter, *Water Resources Research*, vol. 3, pp 241-244.

Schafer, D.C., 1978, Casing Storage Can Affect Pumping Test Data, *Johnson Drillers' Journal*, Jan/Feb, Johnson Division, UOP Inc., St. Paul, Minnesota.

Theis, C.V., 1935, The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage, *American Geophysical Union Transactions*, Vol. 16, pp. 519-524.

Waterloo Hydrogeologic (co-developed with Thomas Roerich), 2002, AquiferTest version 3.5, Advanced Pumping Test and Slug Test Analytical Software.

Table 1
Aquifer Stress Test Results
Thing Valley

Well Designation	Condition	Distance From Pumping Well (feet)	Groundwater Depth from TOC (feet)	Groundwater Depth from Ground Surface (feet)	Assumed Aquifer Thickness (feet)	Average Pumping Rate (gpm)	Analytical Method	Transmissivity (feet^2/day)	Conductivity (feet/day)	Storativity	Comments
North Well	Pumping	1	54.81	54.14	350	81	Cooper-Jacob	488	1.390	3.33E-09	Match to mid-late data.
North Well	Pumping	1	54.81	54.14	350	81	Cooper-Jacob	176	0.502	3.05E-02	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Moench	261	0.741	4.45E-04	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Neuman	**99.8 Minimum**	**0.285 Minimum**	3.82E-04	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Theis	256	0.733	3.57E-04	Match to late data.
North Well	Pumping	1	54.81	54.14	350	81	Walton	115	0.327	2.41E-02	Match to late data.
North Well	Recovery	1	54.81	54.14	350	81	Theis Recovery	669	1.910	NA	Match to early data.
North Well	Recovery	1	54.81	54.14	350	81	Theis Recovery	473	1.350	NA	Match to middle data.
North Well	Recovery	1	54.81	54.14	350	81	Theis Recovery	337	0.963	NA	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Cooper-Jacob	513	1.470	8.29E+00	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Cooper-Jacob	294	0.841	4.19E+01	Match to very late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Moench	467	1.330	1.35E-05	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Neuman	469	1.340	9.12E-04	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Theis	477	1.360	2.10E-03	Match to late data.
South Well	Pumping	61.5	49.34	48.67	350	81	Walton	477	1.360	8.76E+00	Match to late data.
South Well	Recovery	61.5	49.34	48.67	350	81	Theis Recovery	**835 Maximum**	**2.39 Maximum**	NA	Match to early data.
South Well	Recovery	61.5	49.34	48.67	350	81	Theis Recovery	508	1.450	NA	Match to middle data.
South Well	Recovery	61.5	49.34	48.67	350	81	Theis Recovery	311	0.888	NA	Match to late data.
							Average Values	**393**	**1.122**	**3.88E-03**	

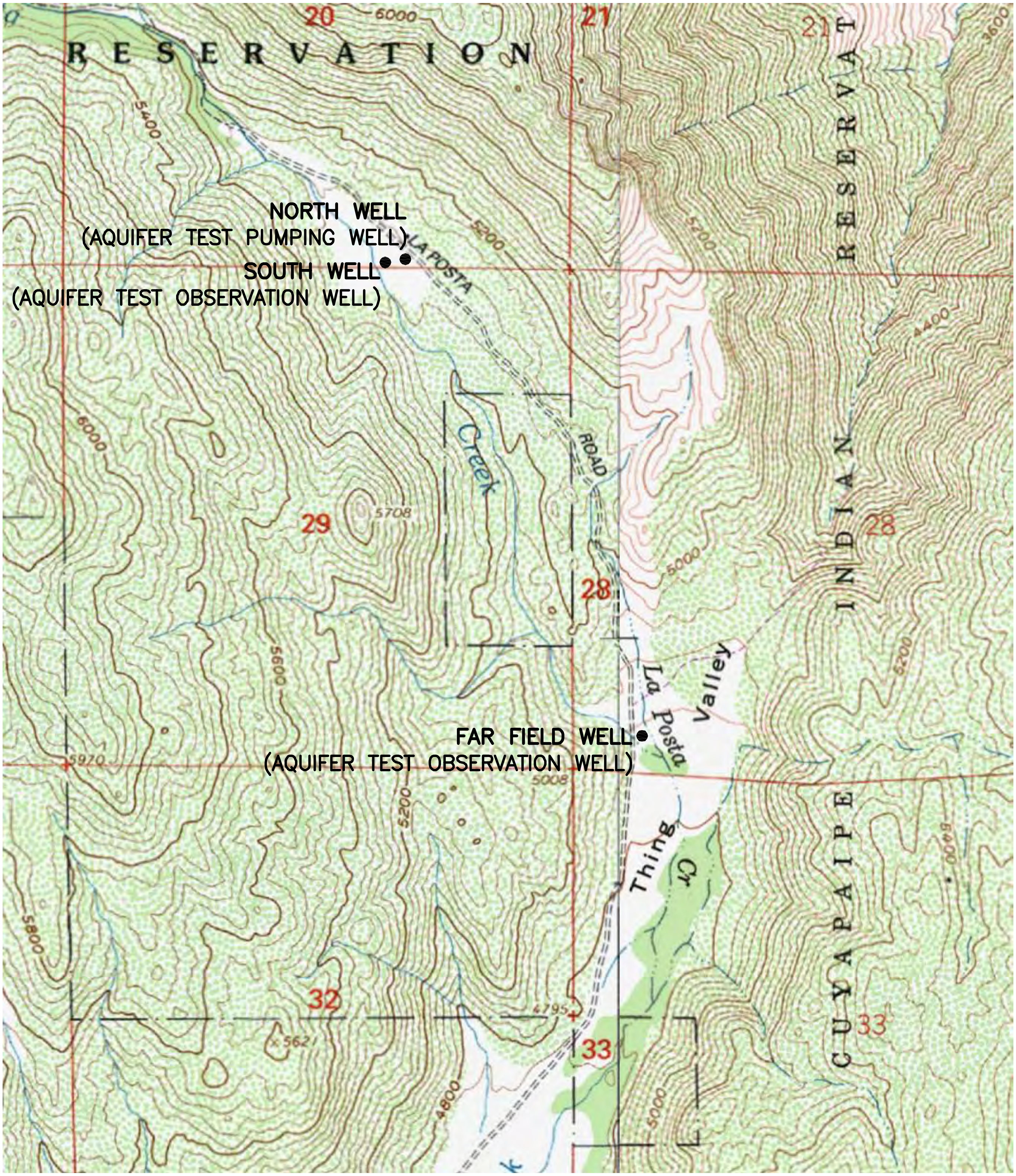


FIGURE 1

WELL LOCATION MAP
THING VALLEY AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

GRAPHIC SCALE
750 0 375 750 1500
(in feet)
1 inch = 1500 ft.

N

Geo-Logic Associates
Geologists, Hydrogeologists, and Engineers

DRAWN BY:	DATE:	JOB NO.
VL	NOVEMBER 2010	2010-005

REFERENCE: 7.5 MINUTE SERIES (TOPOGRAPHIC) MOUNT LAGUNA (1997) AND SOMBRERO PEAK (1975) CALIFORNIA QUADRANGLES

Figure 2
North Well
(Pumping Well)
Time Drawdown Plot for Stepped Pump Test

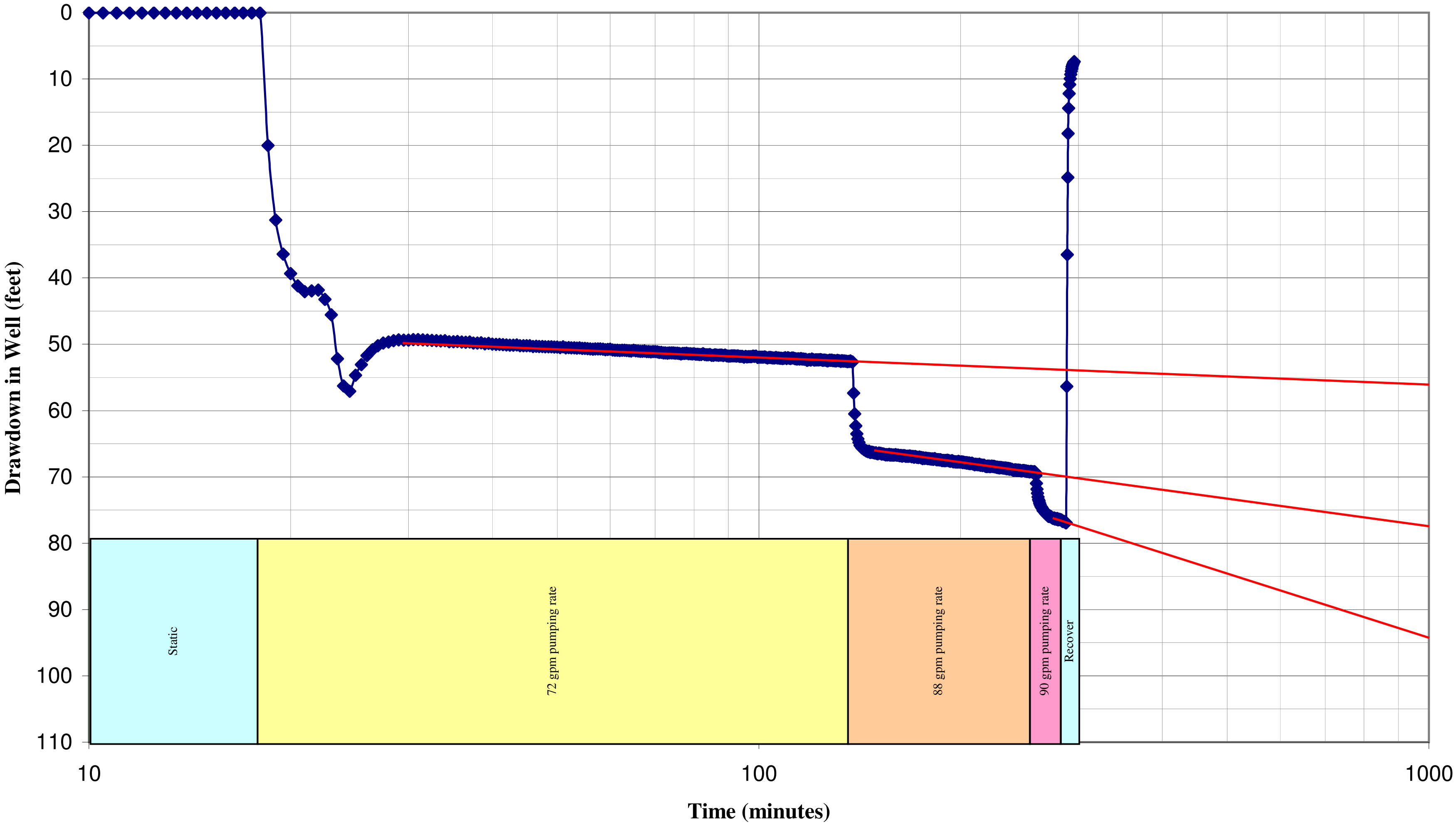


Figure 3
North Well
(Pumping Well)
Time-Drawdown Plot

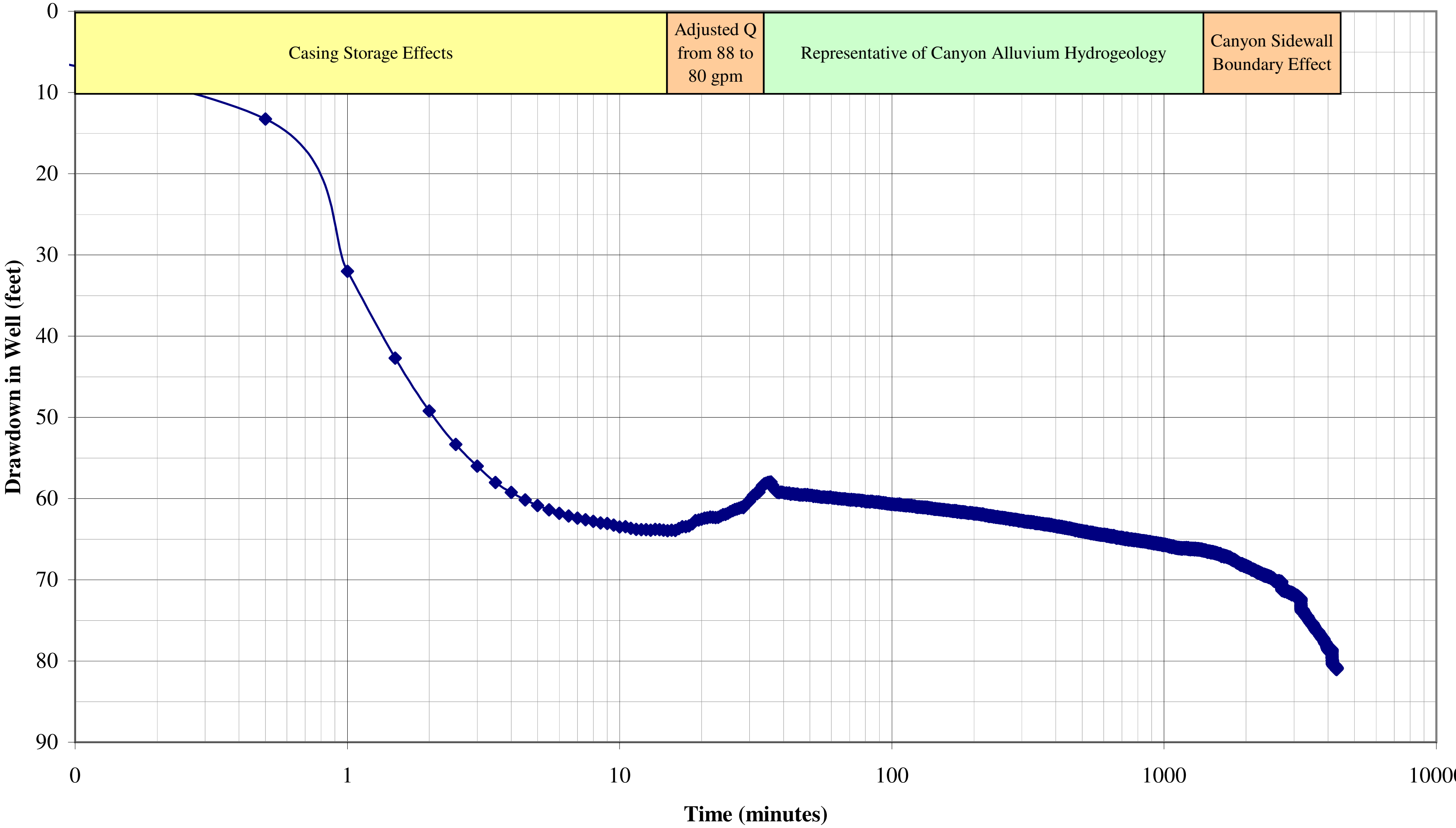


Figure 4
North Well
Recovery
Time-Drawdown Plot

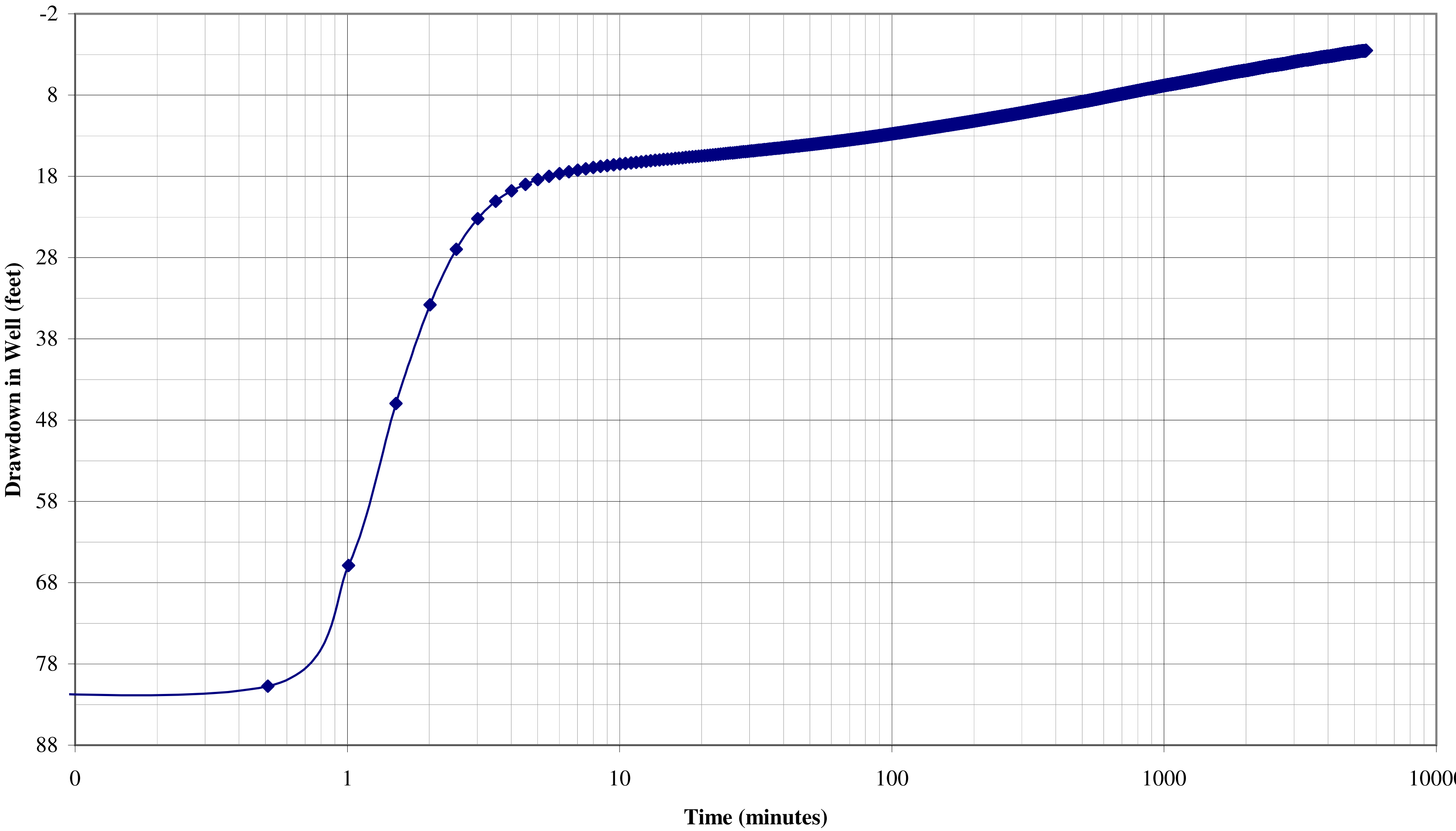


Figure 5
South Well
(Observation Well)
Time-Drawdown Plot

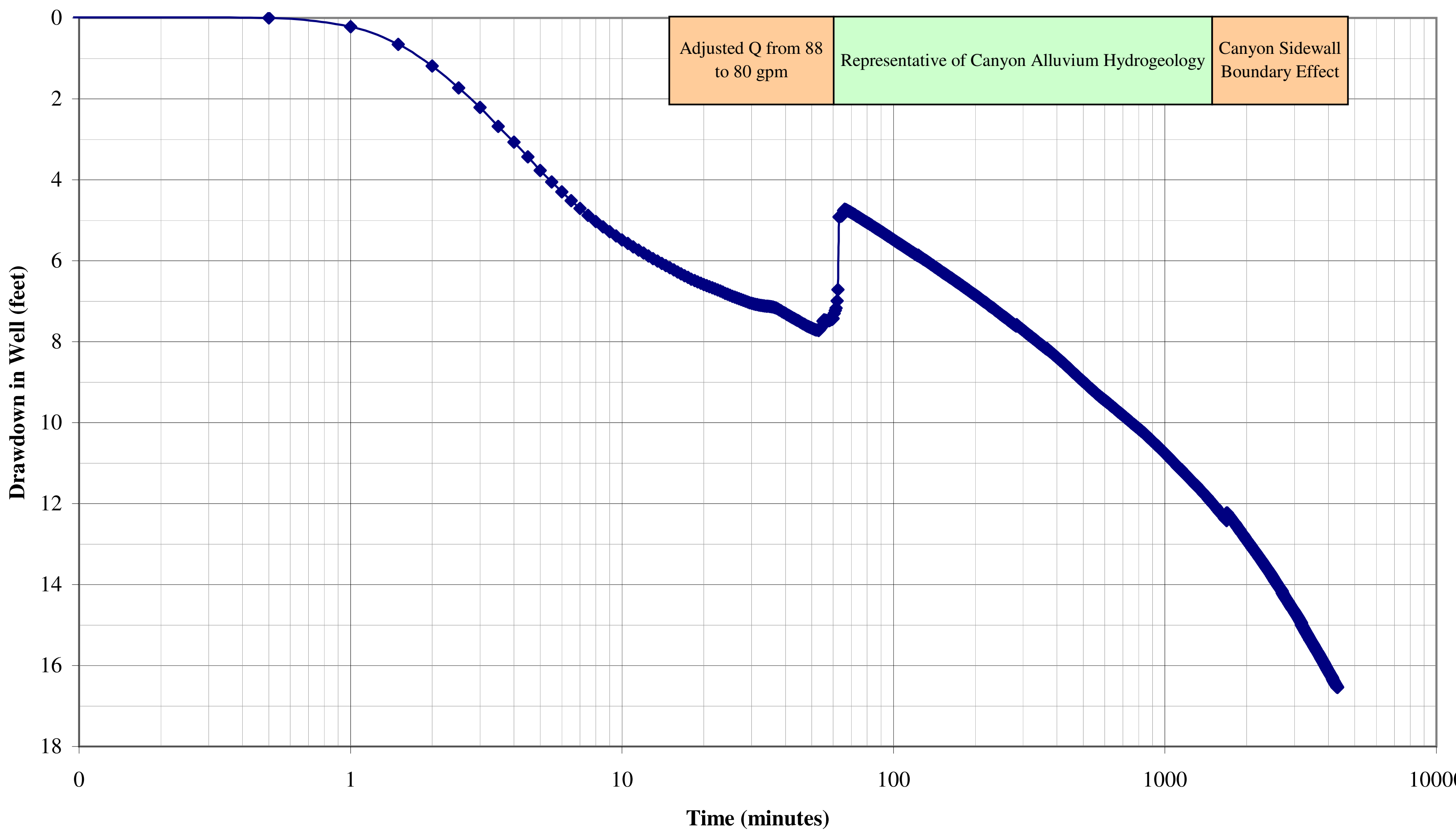


Figure 6
South Well
(Observation Well)
Recovery Time-Drawdown Plot

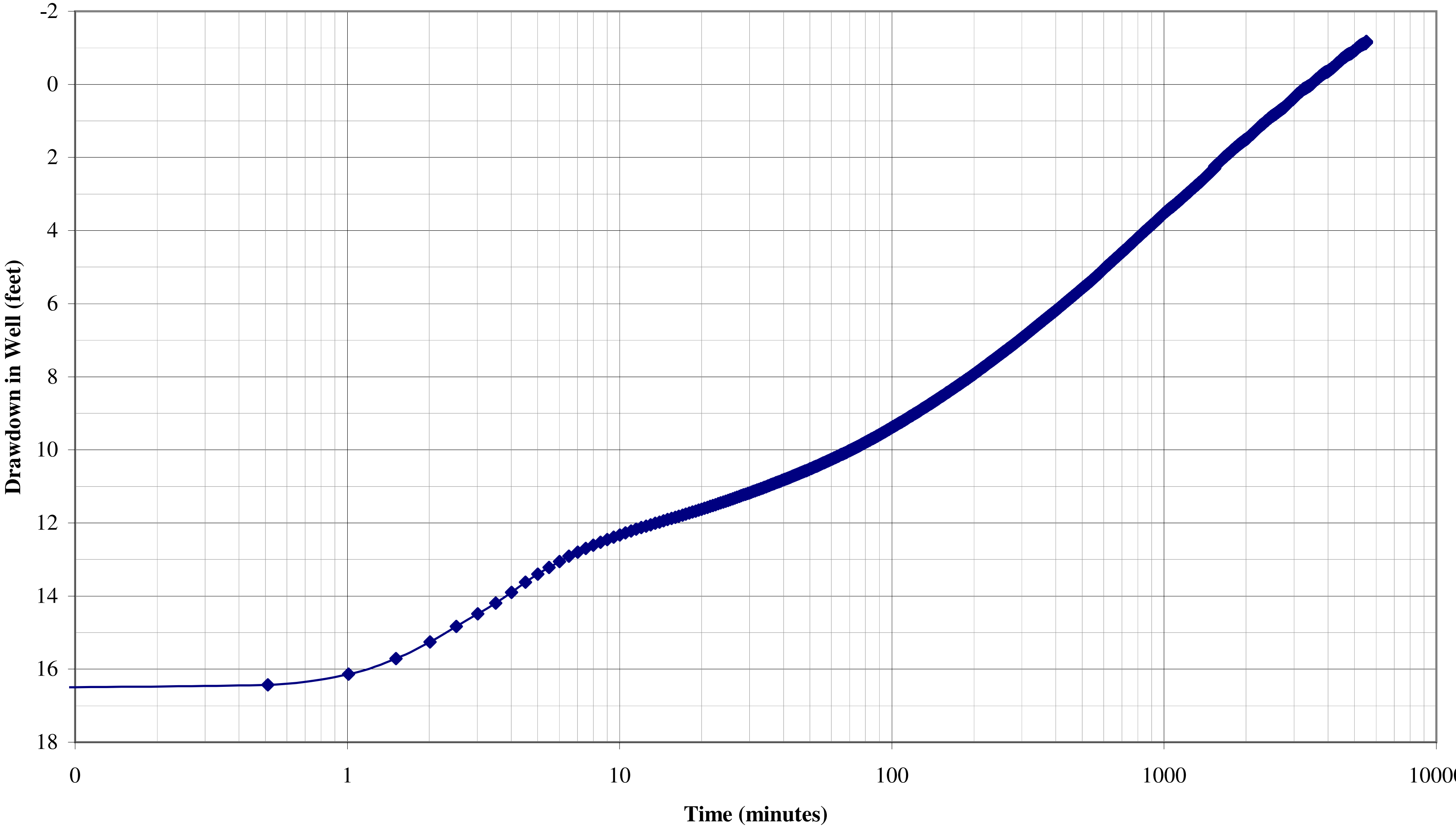


Figure 7
Thing Valley Well
(Observation Well)
Time-Drawdown Plot

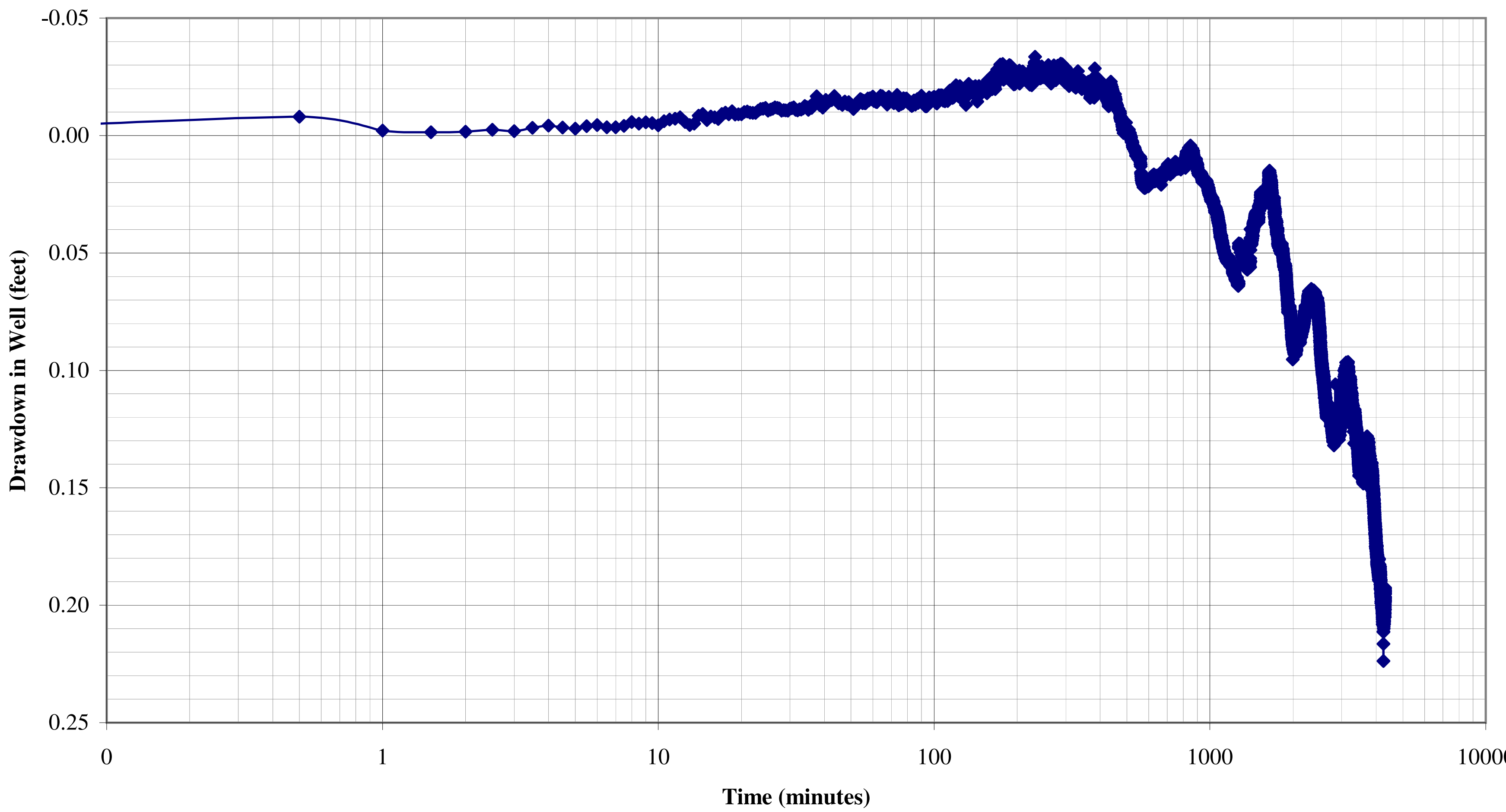
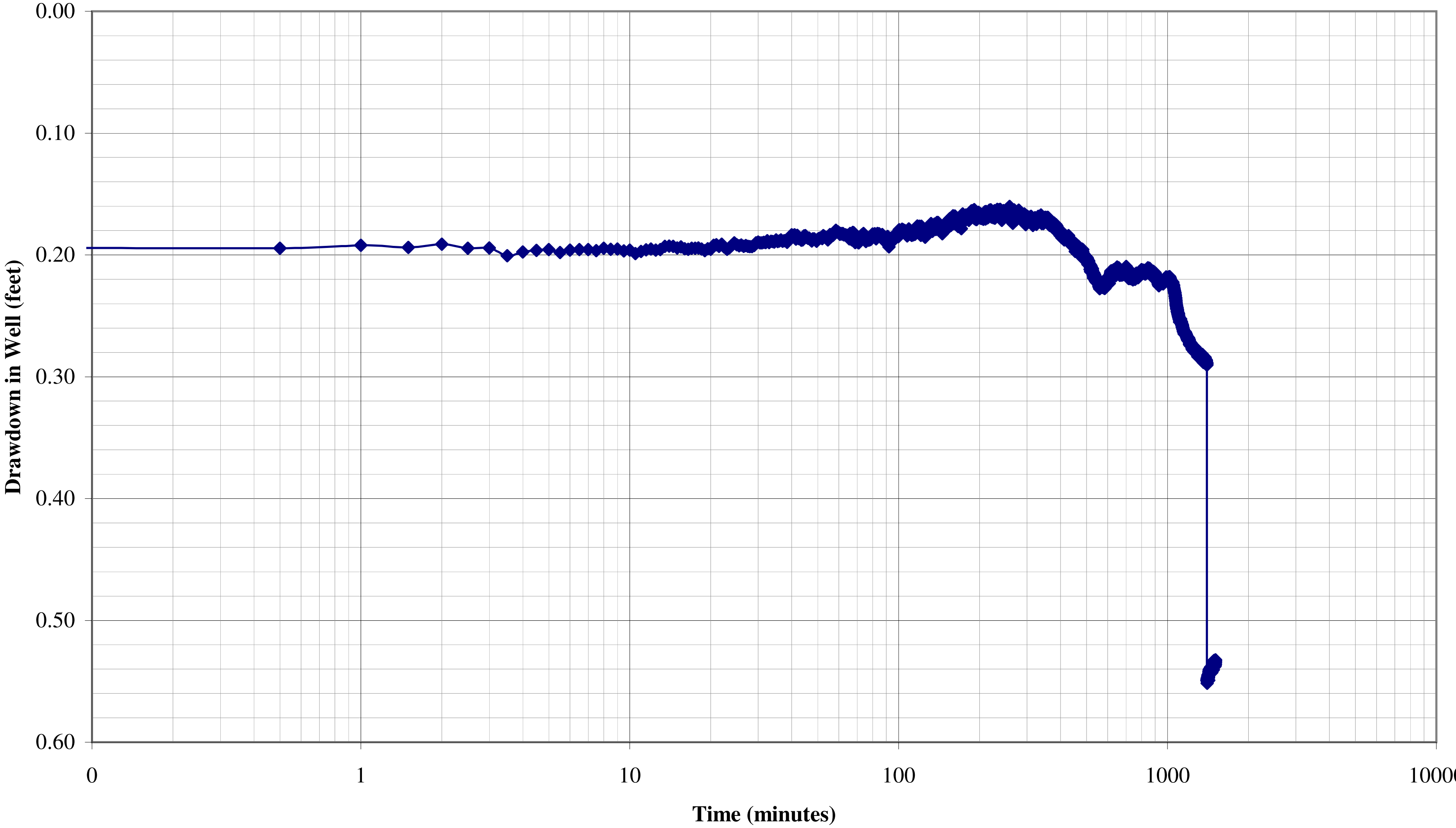
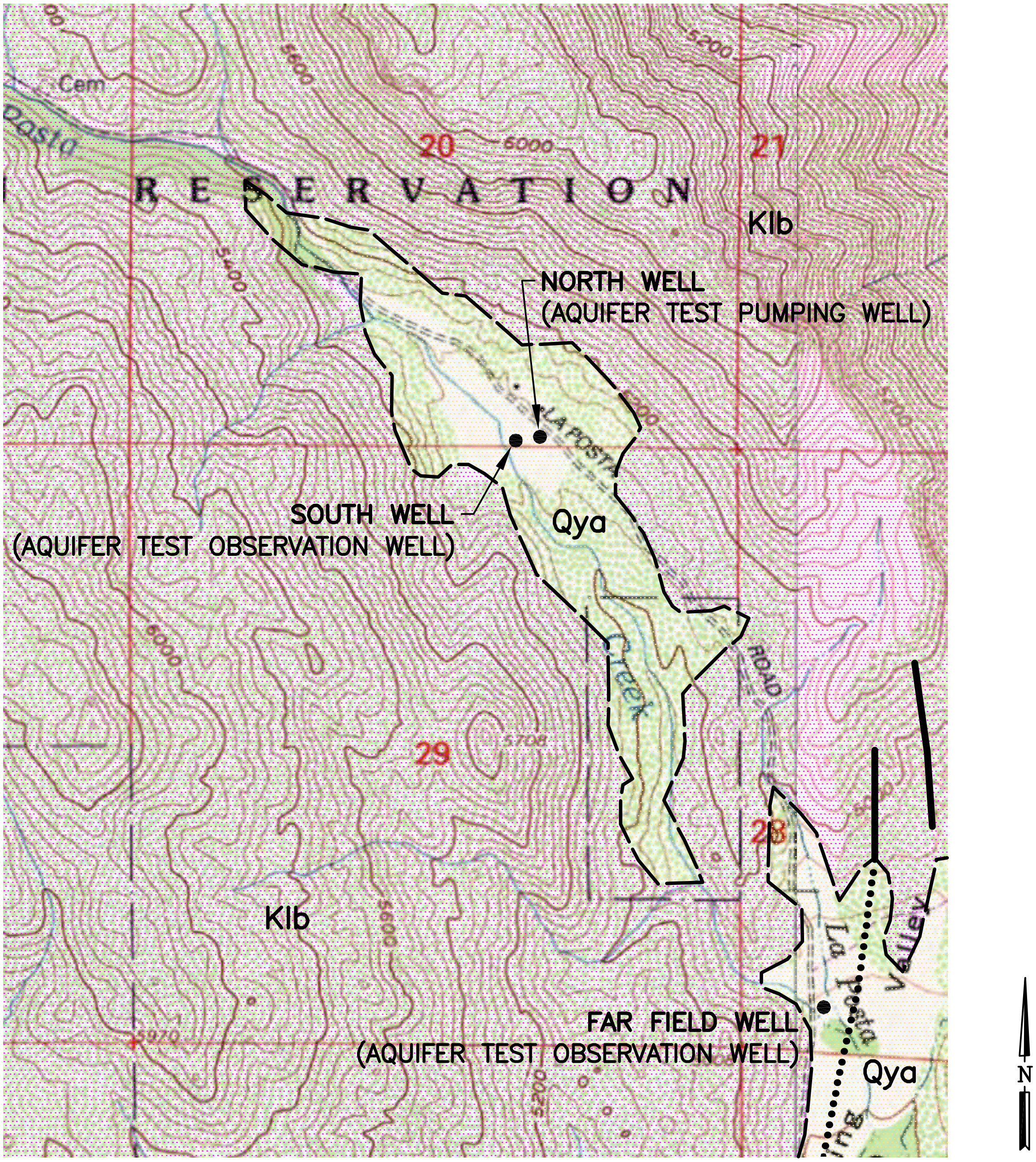


Figure 8
Thing Valley Well
Recovery
Time-Drawdown Plot





EXPLANATION:

Qya	YOUNG ALLUVIUM (HOLOCENE)
Klb	TONALITE OF LAS BANCAS (EARLY CRETACEOUS)
— — — —	APPROXIMATE GEOLOGIC CONTACT
——•••••	FAULT, DOTTED WHERE CONCEALED

GRAPHIC SCALE

750 0 375 750 1500

(in feet)

1 inch = 1500 ft.

REFERENCE: PRELIMINARY GEOLOGIC MAP OF EL CAJON 30' x 60' QUADRANGLE, SOUTHERN CALIFORNIA, V. R. TODD, 2004

FIGURE 9

GEOLOGIC MAP
THING VALLEY AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

Geo-Logic Associates
Geologists, Hydrogeologists, and Engineers

DRAWN BY:	DATE:	JOB NO.
VL	NOVEMBER 2010	2010-005

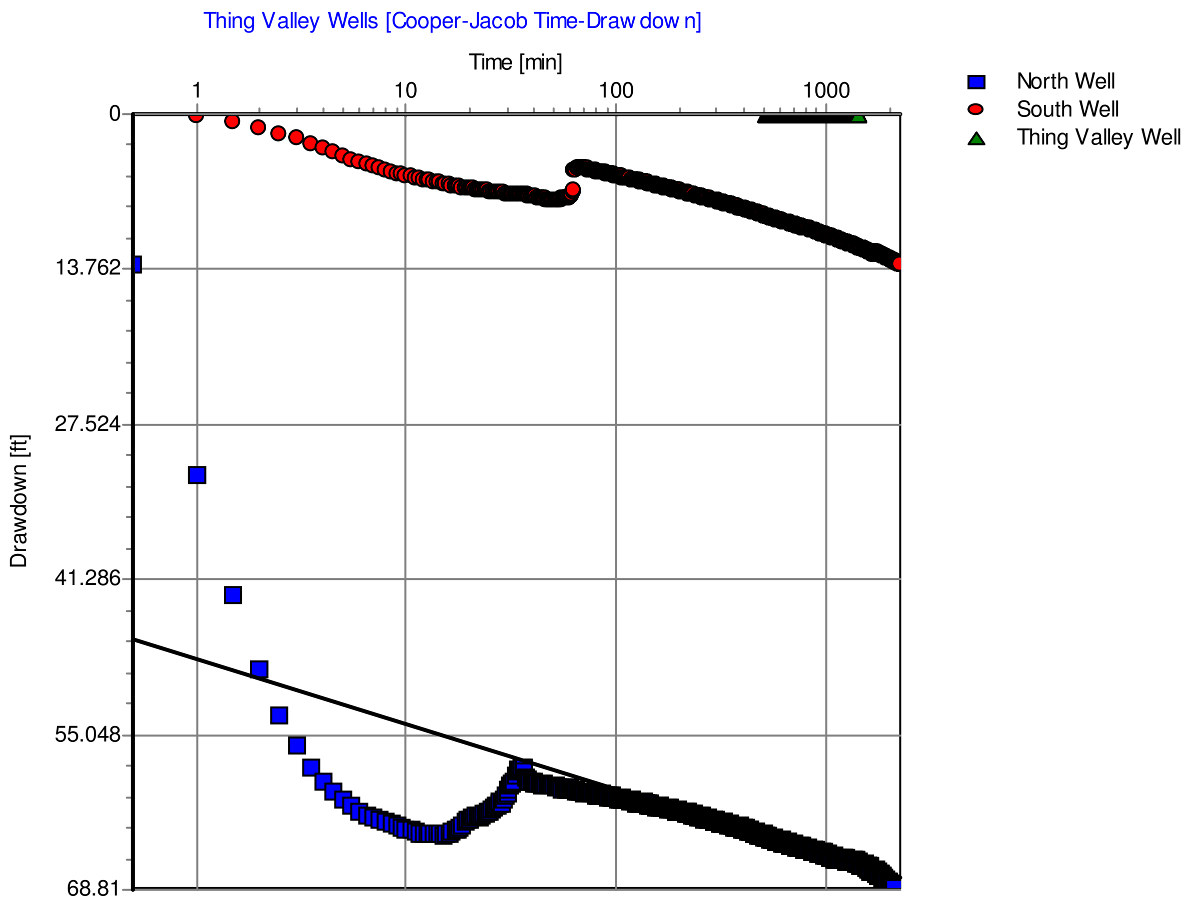
Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Thing Valley

Number: 2010-0005

Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	4.88E+2 [ft²/d]	Conductivity:	1.39E+0 [ft/d]
	Storativity:	3.33E-9		

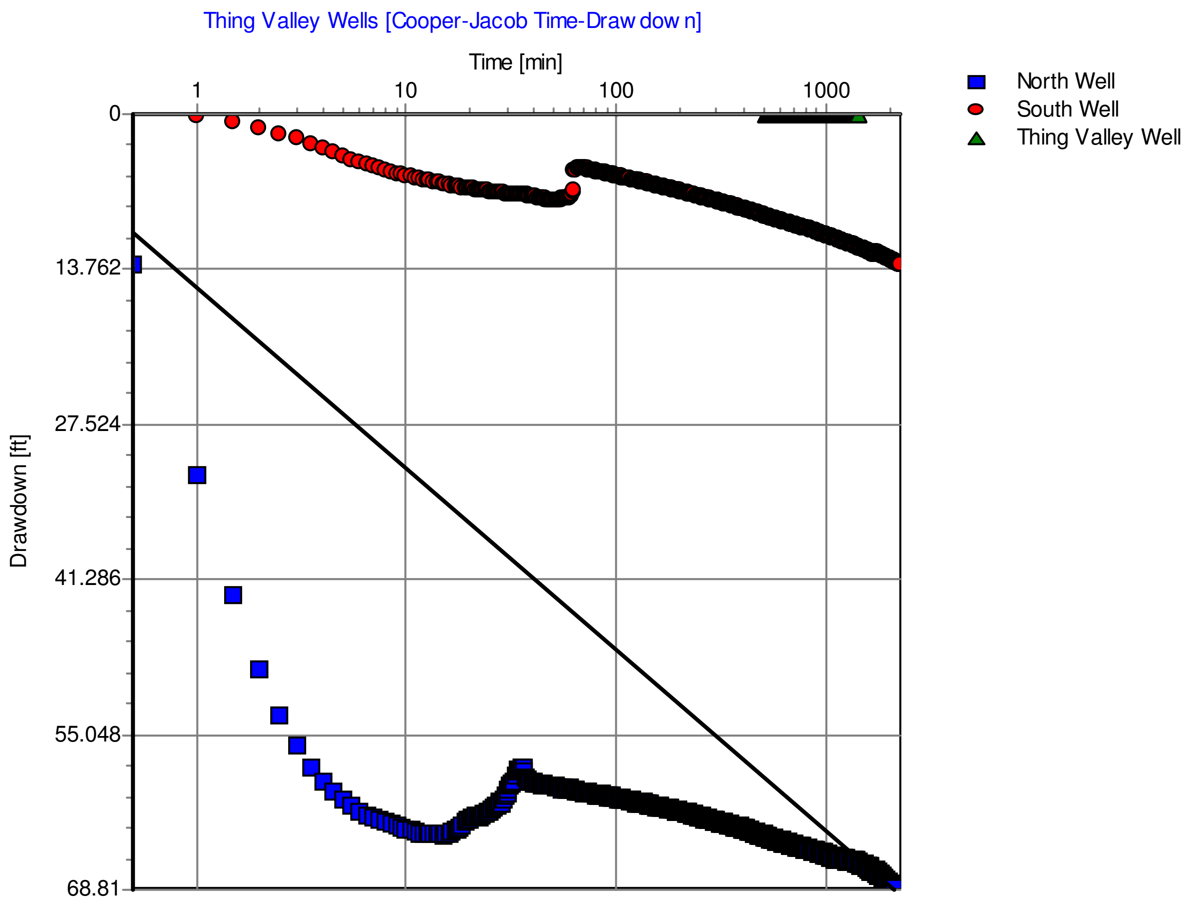
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: North Well Match to mid-late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc.	**Pumping Test Analysis Report**
460 Philip Street - Suite 101	Project: Thing Valley
Waterloo, Ontario, Canada	Number: 2010-0005
Phone: +1 519 746 1798	Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	1.76E+2 [ft²/d]	Conductivity:	5.02E-1 [ft/d]
	Storativity:	3.05E-2		

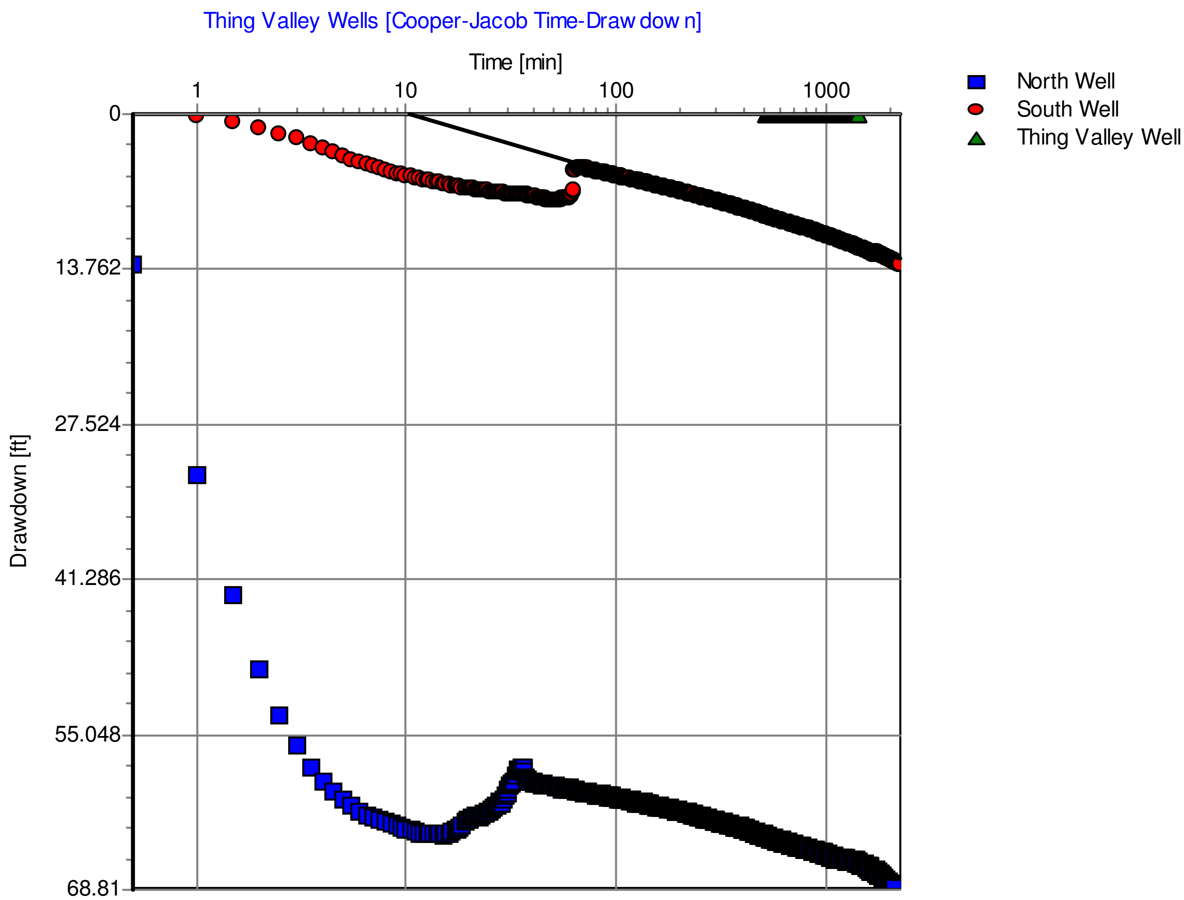
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: North Well match to late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc. 460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798	**Pumping Test Analysis Report** Project: Thing Valley Number: 2010-0005 Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	5.13E+2 [ft²/d]	Conductivity:	1.47E+0 [ft/d]
	Storativity:	8.29E+0		

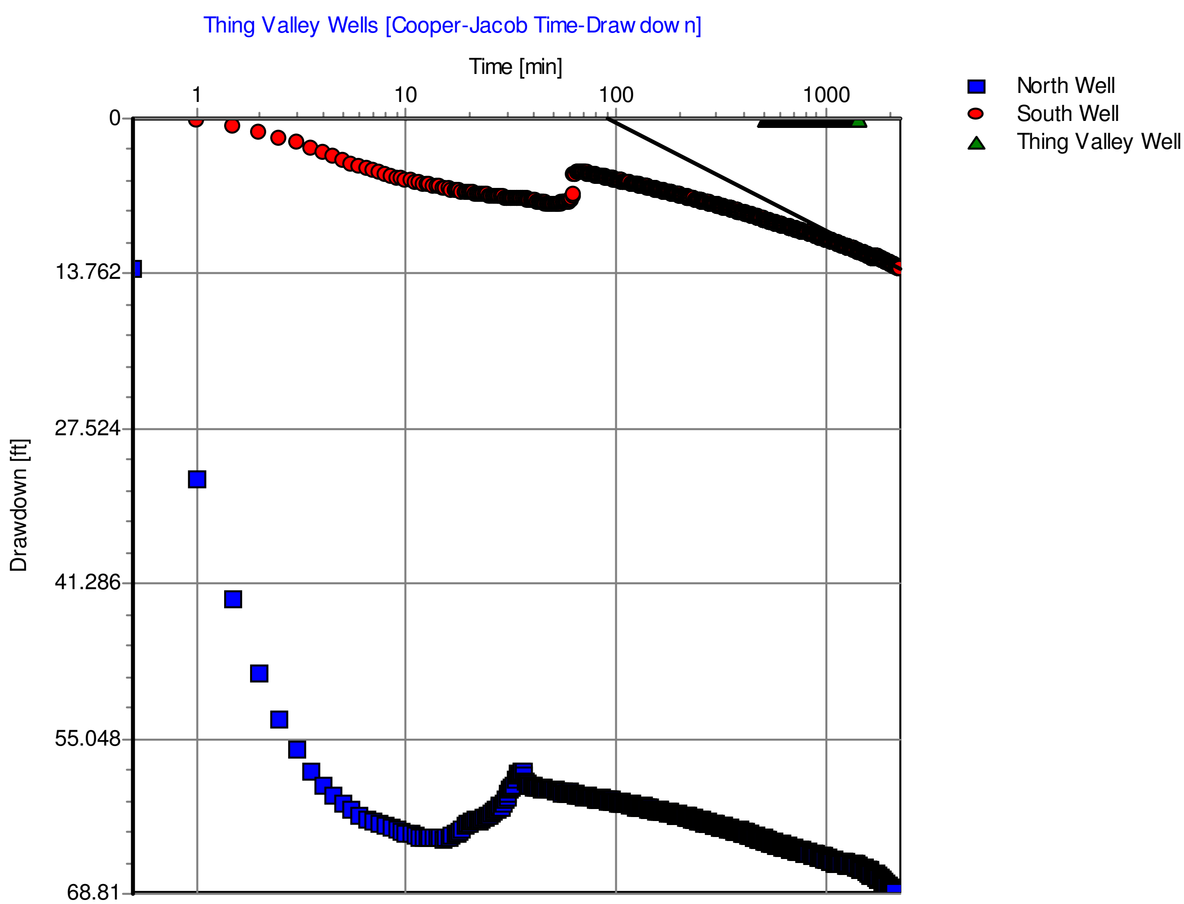
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: South Well match to late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc. 460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798	**Pumping Test Analysis Report** Project: Thing Valley Number: 2010-0005 Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	2.94E+2 [ft²/d]	Conductivity:	8.41E-1 [ft/d]
	Storativity:	4.19E+1		

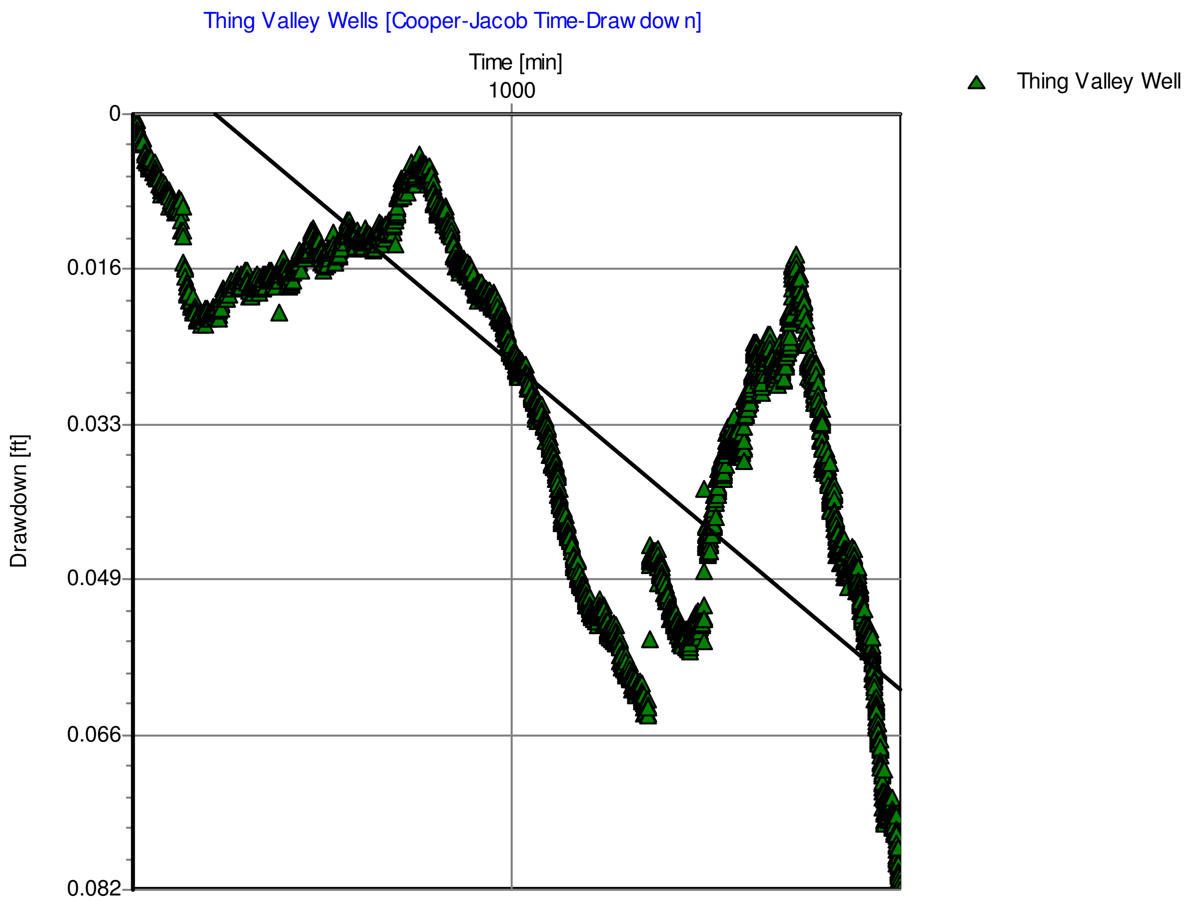
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: South Well match to very late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc.	**Pumping Test Analysis Report**
460 Philip Street - Suite 101	Project: Thing Valley
Waterloo, Ontario, Canada	Number: 2010-0005
Phone: +1 519 746 1798	Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	2.41E+4 [ft²/d]	Conductivity:	6.88E+1 [ft/d]
	Storativity:	7.34E-4		

Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

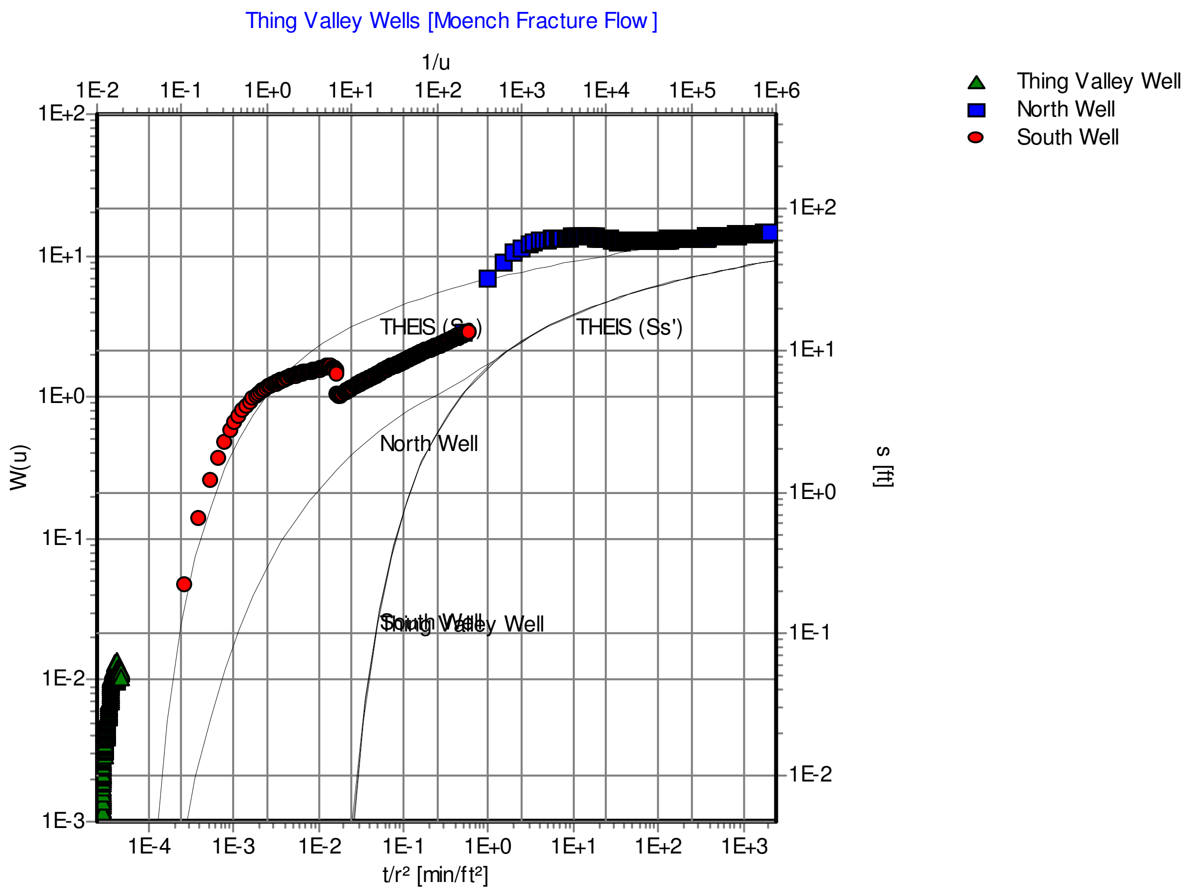
Comments: Thing Valley program best fit match.

Evaluated by: MWV

Evaluation Date: 11/4/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report
Project: Thing Valley
Number: 2010-0005
Client:



Pumping Test:	**Thing Valley Wells**			
Analysis Method:	**Moench Fracture Flow**			
Analysis Results:	Transmissivity:	2.61E+2 [ft²/d]	Conductivity:	7.47E-1 [ft/d]
	Storativity:	4.45E-4		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	b:	350 [ft]
	Screen length:	350 [ft]	Kv/Kh:	0.1
	Boring radius:	0.42 [ft]	C:	0.554
	Discharge Rate:	80.111574 [U.S. gal/mi	K(block)/K(Skin):	0.1
	Ss(blk)/Ss(fract):	200	K(block)/K(fracture):	0.1
Comments:	North Well match to late data.			

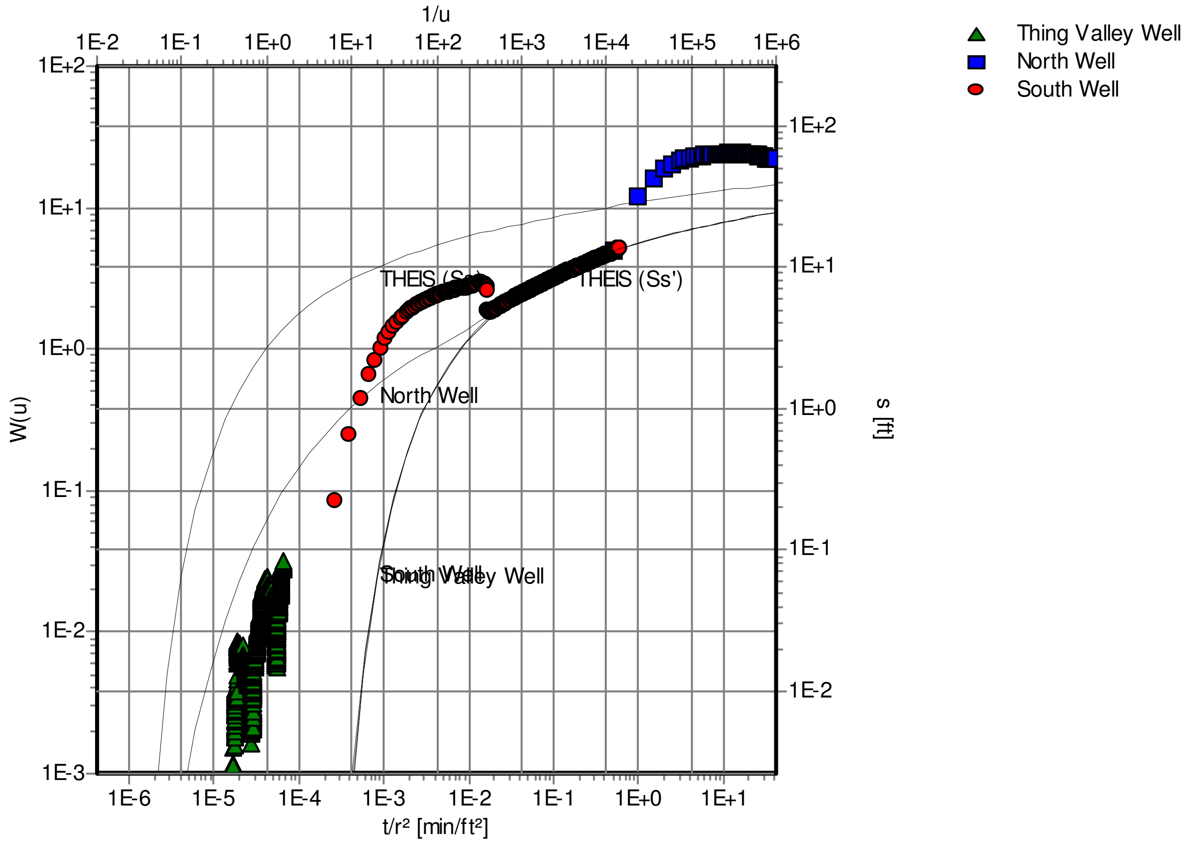
Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report
Project: Thing Valley
Number: 2010-0005
Client:

Thing Valley Wells [Moench Fracture Flow]



Pumping Test:	**Thing Valley Wells**			
Analysis Method:	**Moench Fracture Flow**			
Analysis Results:	Transmissivity:	4.67E+2 [ft²/d]	Conductivity:	1.33E+0 [ft/d]
	Storativity:	1.35E-5		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	b:	350 [ft]
	Screen length:	350 [ft]	Kv/Kh:	0.1
	Boring radius:	0.42 [ft]	C:	0.554
	Discharge Rate:	80.111574 [U.S. gal/mi	K(block)/K(Skin):	0.1
	Ss(blk)/Ss(fract):	200	K(block)/K(fracture):	0.1
Comments:	South Well match to late data.			

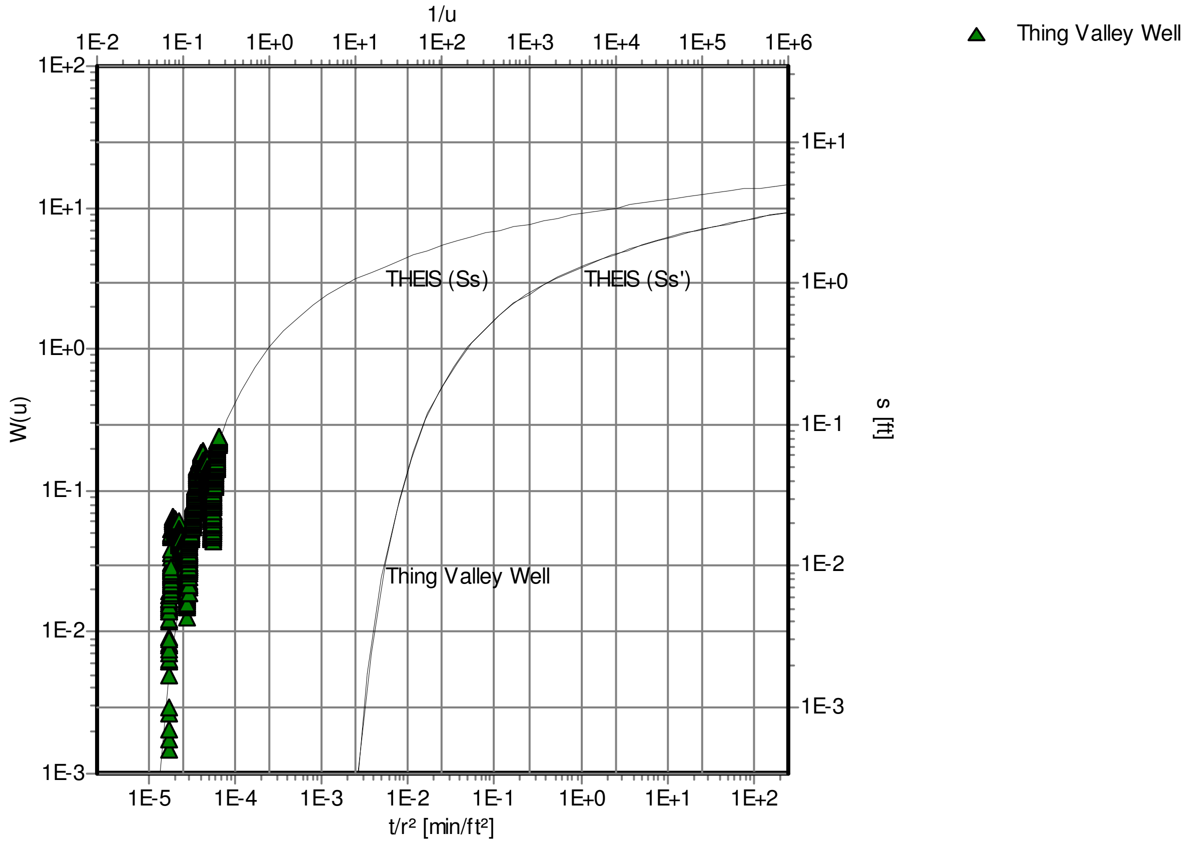
Evaluated by: MWV

Evaluation Date: 11/1/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report
Project: Thing Valley
Number: 2010-0005
Client:

Thing Valley Wells [Moench Fracture Flow]



Pumping Test: **Thing Valley Wells**

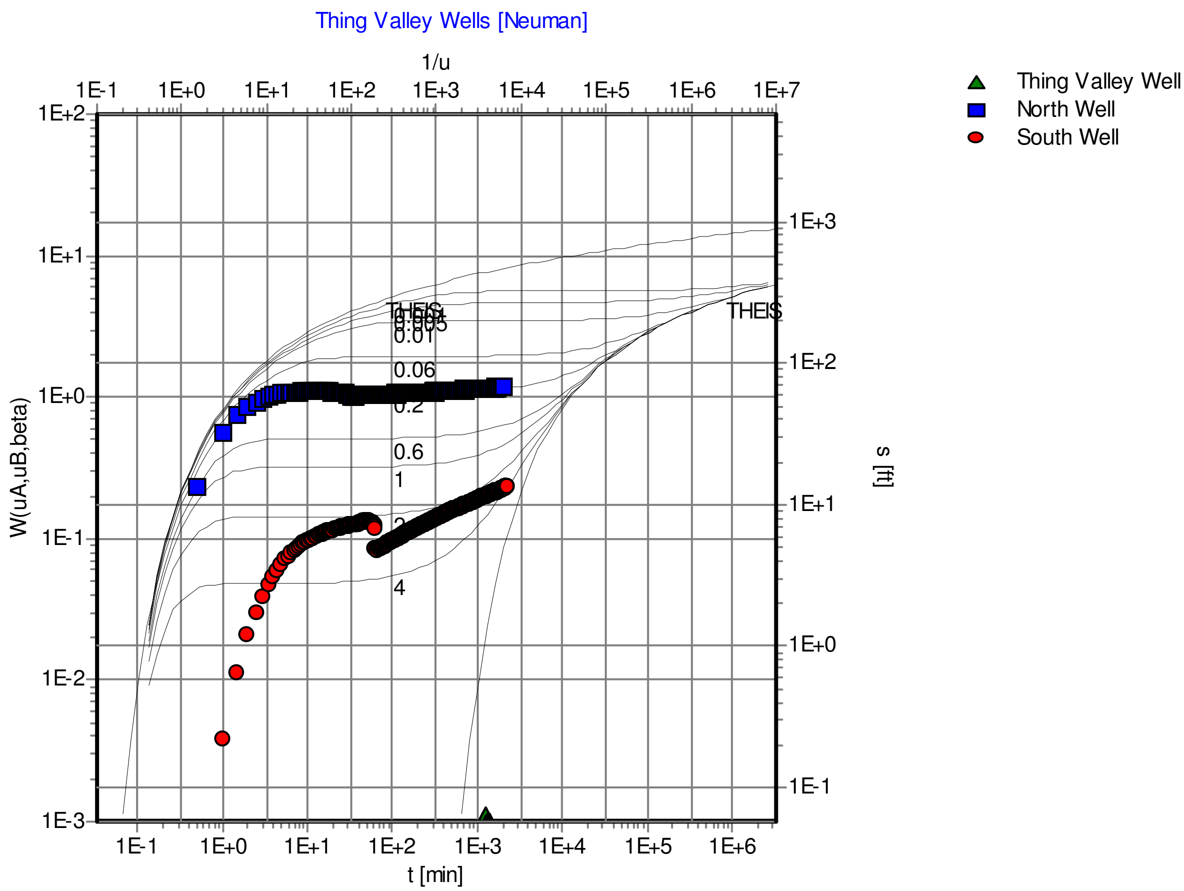
Analysis Method: **Moench Fracture Flow**

Analysis Results:	Transmissivity:	3.61E+3 [ft²/d]	Conductivity:	1.03E+1 [ft/d]
	Storativity:	6.28E-4		
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	b:	350 [ft]
	Screen length:	350 [ft]	Kv/Kh:	0.1
	Boring radius:	0.42 [ft]	C:	0.554
	Discharge Rate:	80.111574 [U.S. gal/mi	K(block)/K(Skin):	0.1
	Ss(blk)/Ss(fract):	200	K(block)/K(fracture):	0.1

Comments: Moench match to Thing Valley Well data.

Evaluated by: MWV
Evaluation Date: 11/4/2010

Waterloo Hydrogeologic, Inc. 460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798	**Pumping Test Analysis Report** Project: Thing Valley Number: 2010-0005 Client:



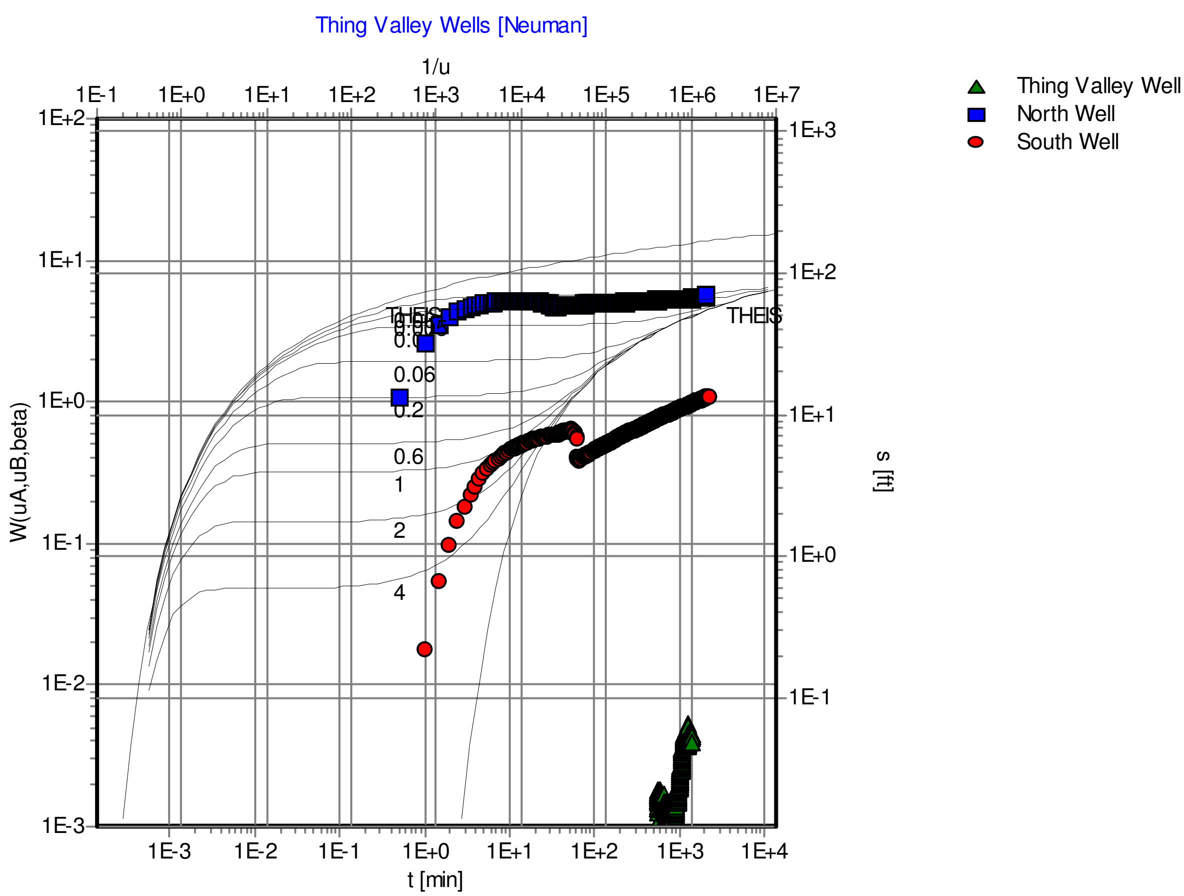
Pumping Test:	**Thing Valley Wells**			
Analysis Method:	**Neuman**			
Analysis Results:	Transmissivity:	2.13E+1 [ft²/d]	Conductivity:	6.09E-2 [ft/d]
	Storativity:	1.96E-2	Specific Yield:	1.96E+2
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Beta:	0.005
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		
	LOG(Sy/S):	4		
Comments:	North Well match to all data.			

Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report	
Project:	Thing Valley
Number:	2010-0005
Client:	

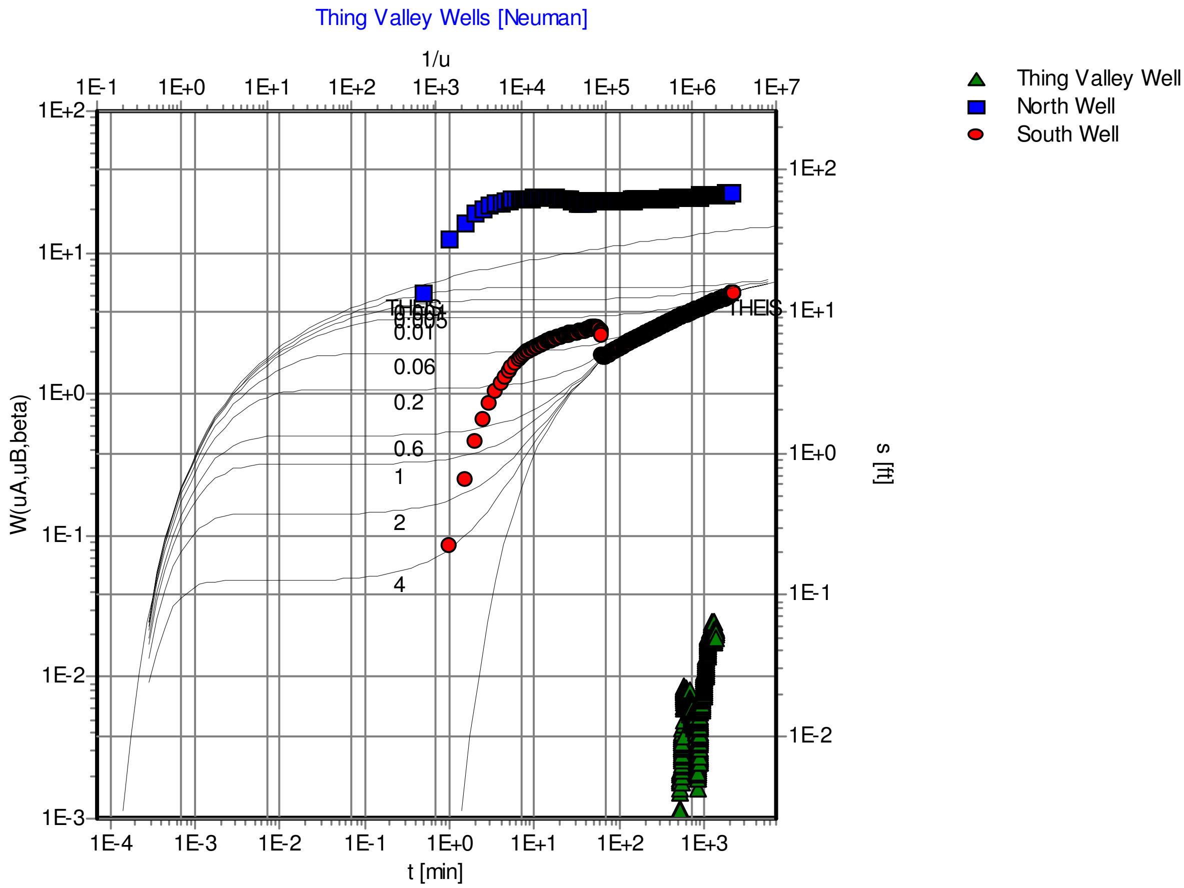


Pumping Test:	**Thing Valley Wells**			
Analysis Method:	**Neuman**			
Analysis Results:	Transmissivity:	9.98E+1 [ft²/d]	Conductivity:	2.85E-1 [ft/d]
	Storativity:	3.82E-4	Specific Yield:	3.82E+0
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Beta:	0.005
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		
	LOG(Sy/S):	4		
Comments:	North Well match to late data.			

Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc. 460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798	**Pumping Test Analysis Report** Project: Thing Valley Number: 2010-0005 Client:



<u>Pumping Test:</u> **Thing Valley Wells**

<u>Analysis Method:</u> **Neuman**

<u>Analysis Results:</u>

Transmissivity:	4.69E+2 [ft²/d]	Conductivity:	1.34E+0 [ft/d]
Storativity:	9.12E-4	Specific Yield:	9.12E+0

<u>Test parameters:</u>

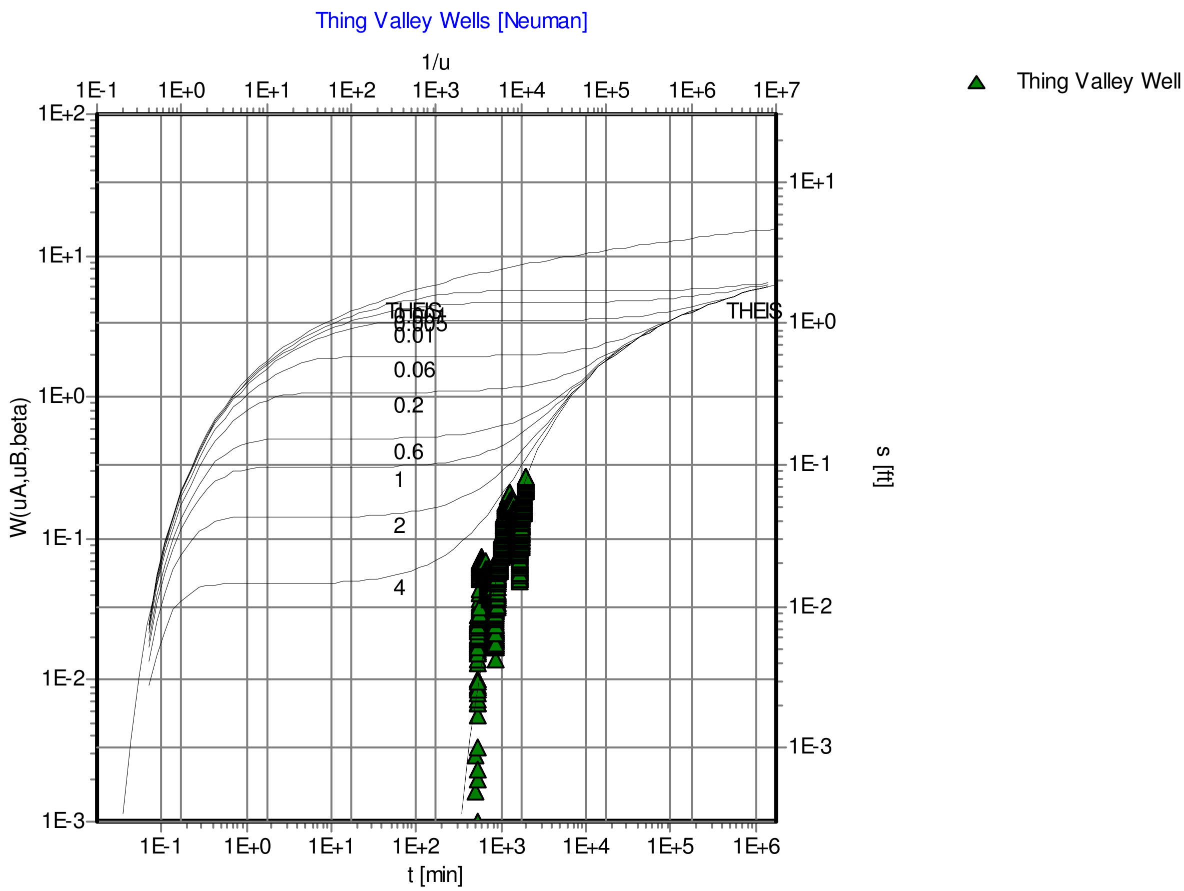
Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
Casing radius:	0.25 [ft]	Beta:	0.005
Screen length:	350 [ft]		
Boring radius:	0.42 [ft]		
Discharge Rate:	80.111574 [U.S. gal/min]		
LOG(Sy/S):	4		

<u>Comments:</u> South Well match to late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc.	Pumping Test Analysis Report
460 Philip Street - Suite 101	Project: Thing Valley
Waterloo, Ontario, Canada	Number: 2010-0005
Phone: +1 519 746 1798	Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Neuman**

Analysis Results:	Transmissivity:	4.06E+3 [ft²/d]	Conductivity:	1.16E+1 [ft/d]

Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Beta:	0.005
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		
	LOG(Sy/S):	4		

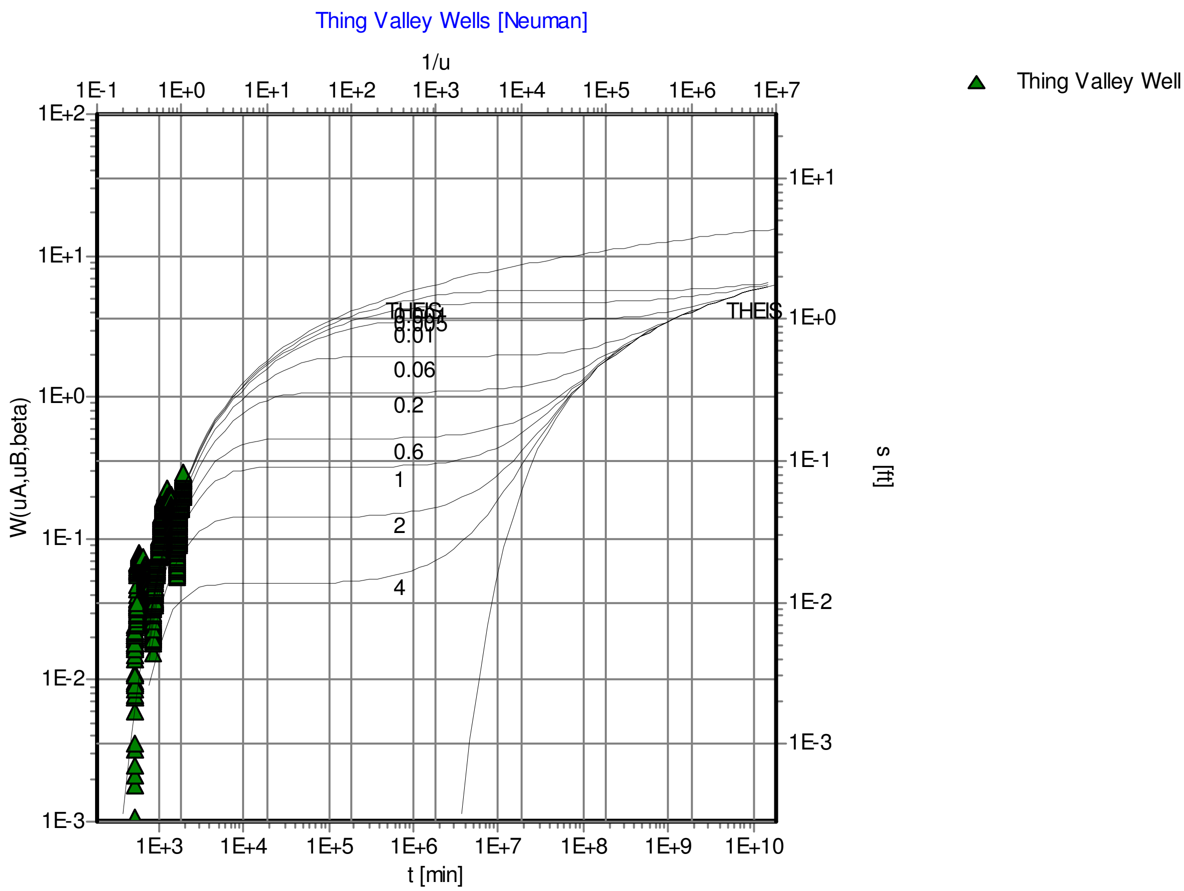
Comments: Thing Valley data

Evaluated by: MWV

Evaluation Date: 11/4/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report
Project: Thing Valley
Number: 2010-0005
Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Neuman**

Analysis Results:	Transmissivity:	4.35E+3 [ft²/d]	Conductivity:	1.24E+1 [ft/d]

Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Beta:	0.005
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		
	LOG(Sy/S):	4		

Comments: Thing Valley data

Evaluated by: MWV

Evaluation Date: 11/4/2010

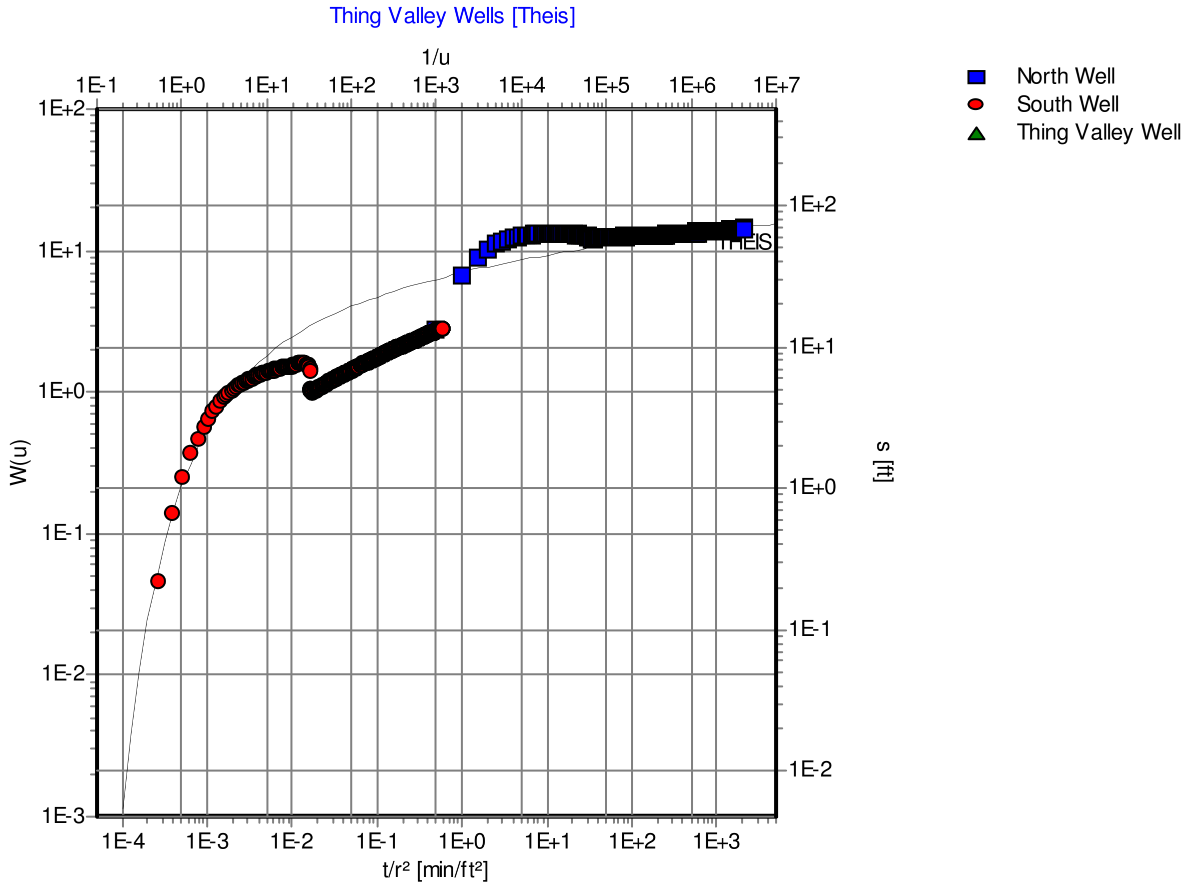
Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Thing Valley

Number: 2010-0005

Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Theis**

Analysis Results:	Transmissivity:	2.56E+2 [ft²/d]	Conductivity:	7.33E-1 [ft/d]
	Storativity:	3.57E-4		

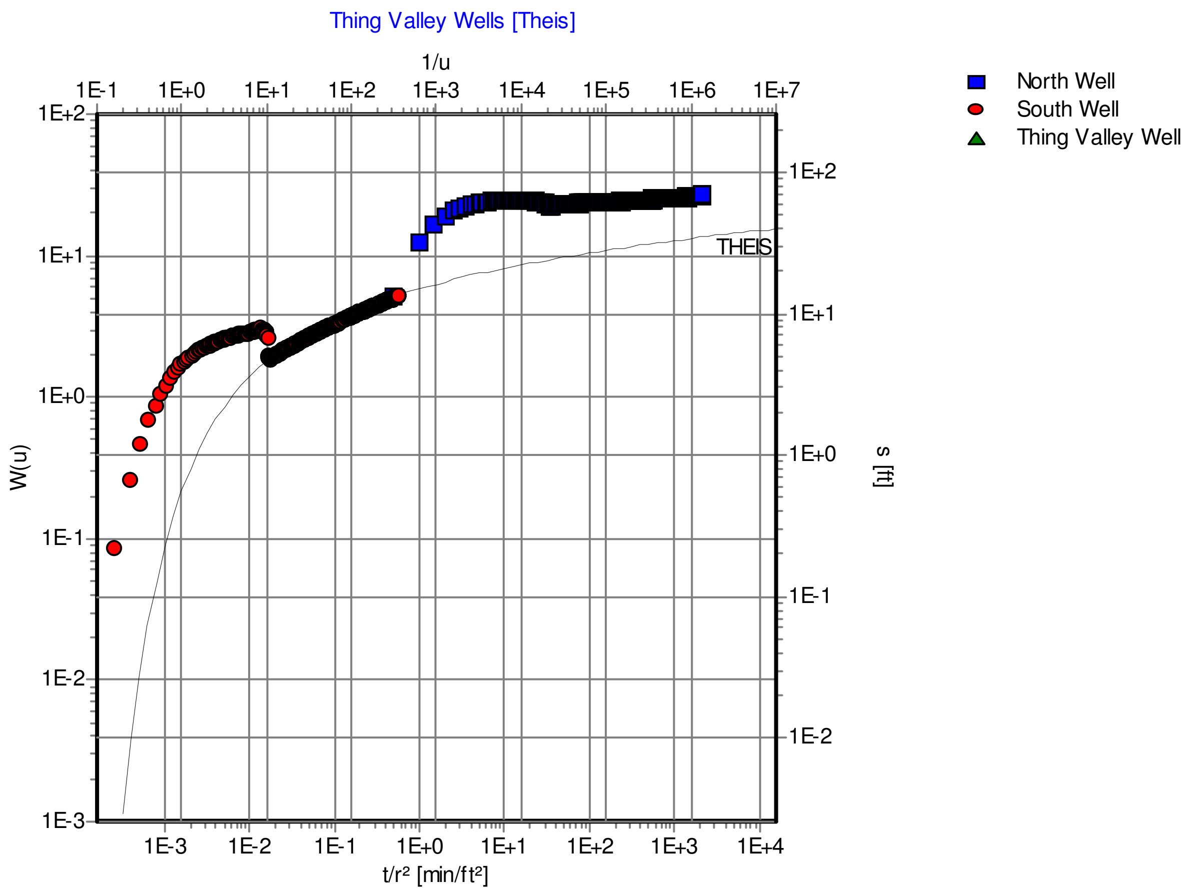
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: North Well match to late data.
South Well match to early data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc.	Pumping Test Analysis Report
460 Philip Street - Suite 101	Project: Thing Valley
Waterloo, Ontario, Canada	Number: 2010-0005
Phone: +1 519 746 1798	Client:



Pumping Test: **Thing Valley Wells**

Analysis Method: **Theis**

Analysis Results:	Transmissivity:	4.77E+2 [ft²/d]	Conductivity:	1.36E+0 [ft/d]
	Storativity:	2.10E-3		

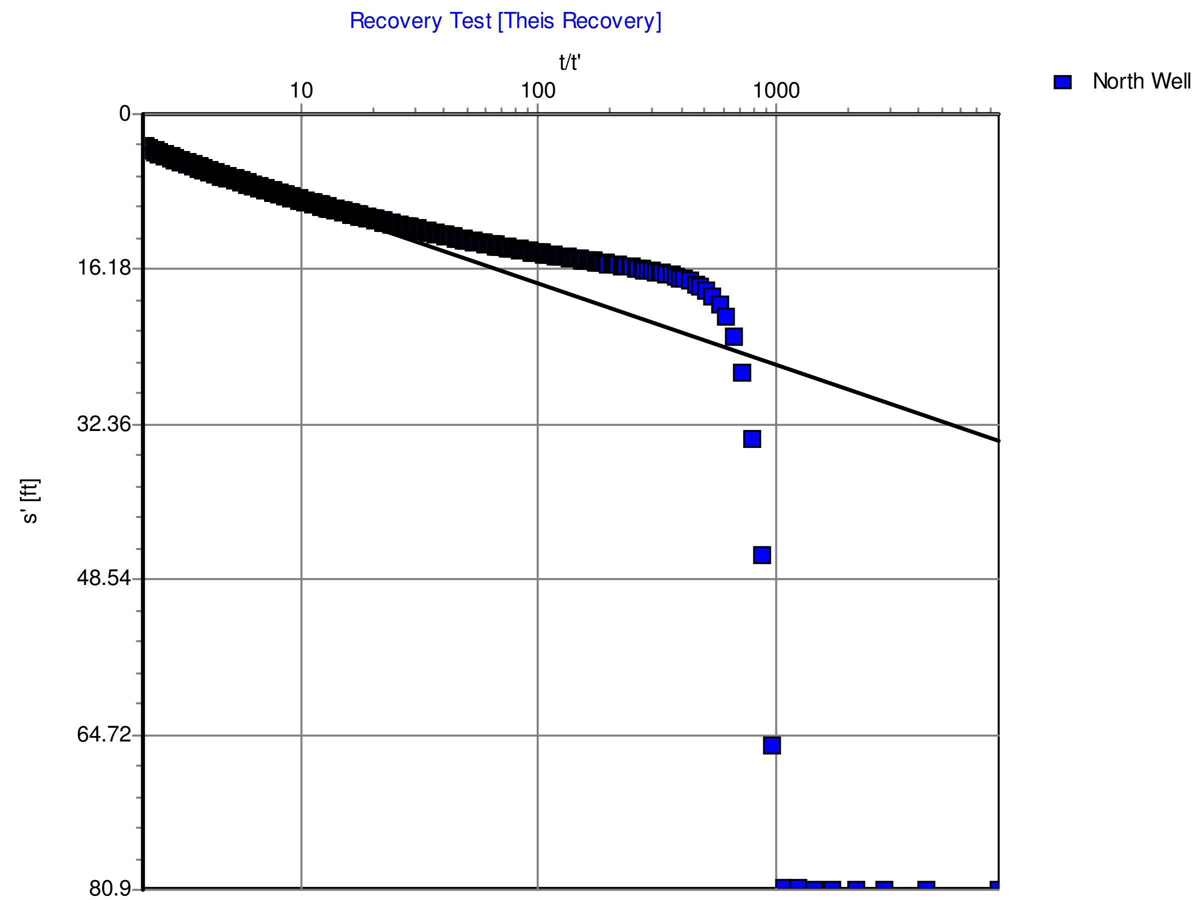
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	80.111574 [U.S. gal/min]		

Comments: Match to South Well late data.

Evaluated by: MWV

Evaluation Date: 10/29/2010

Waterloo Hydrogeologic, Inc.	Pumping Test Analysis Report
460 Philip Street - Suite 101	Project: Thing Valley
Waterloo, Ontario, Canada	Number: 2010-0005
Phone: +1 519 746 1798	Client:



Pumping Test:	**Recovery Test**
Analysis Method:	**Theis Recovery**

Analysis Results:	Transmissivity:	3.37E+2 [ft²/d]	Conductivity:	9.63E-1 [ft/d]

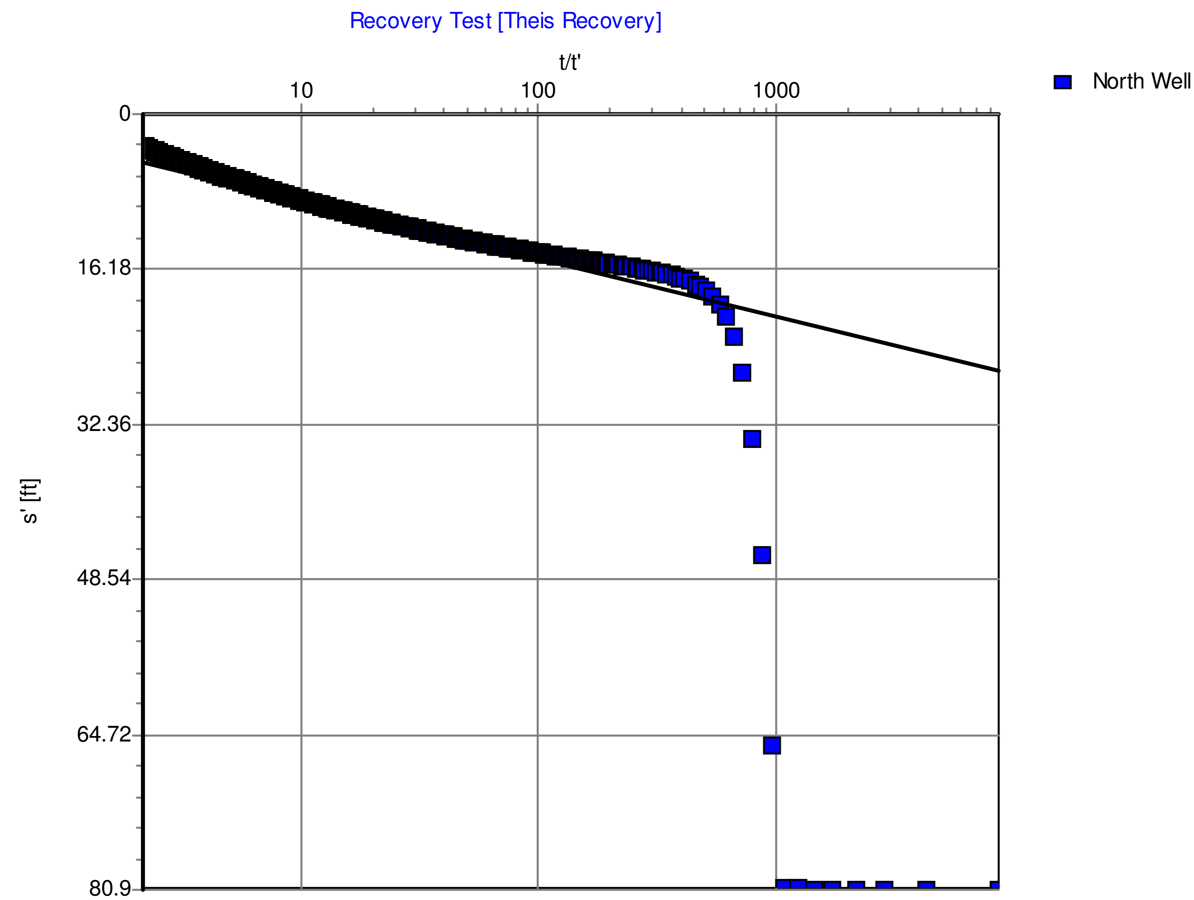
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	81 [U.S. gal/min]		
	Pumping Time	4320 [min]		

Comments: North Well recovery match to late data.

Evaluated by: MWV

Evaluation Date: 11/2/2010

Waterloo Hydrogeologic, Inc. 460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798		**Pumping Test Analysis Report** Project: Thing Valley Number: 2010-0005 Client:



Pumping Test: **Recovery Test**

Analysis Method: **Theis Recovery**

Analysis Results:	Transmissivity:	4.73E+2 [ft²/d]	Conductivity:	1.35E+0 [ft/d]

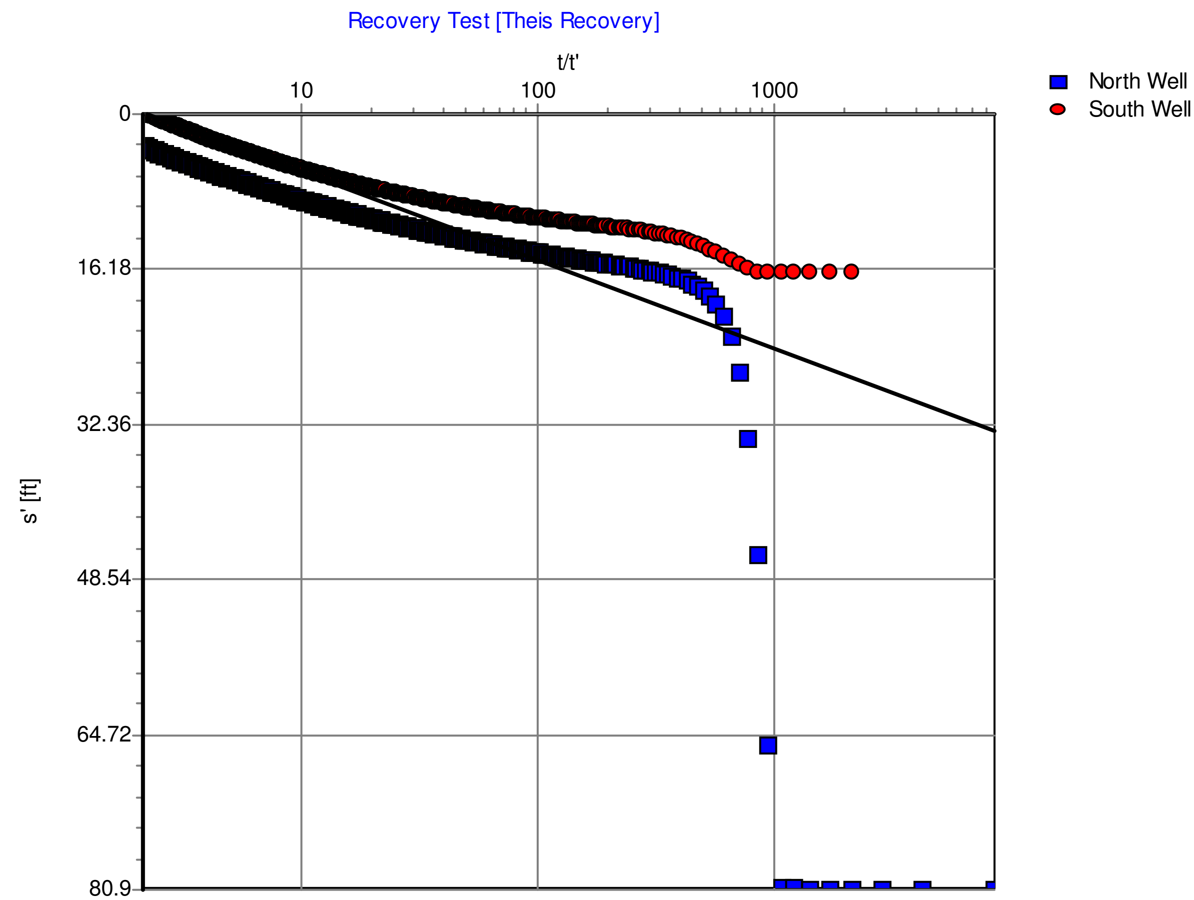
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	81 [U.S. gal/min]		
	Pumping Time	4320 [min]		

Comments:

Evaluated by:

Evaluation Date: 11/2/2010

Waterloo Hydrogeologic, Inc. 460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798	**Pumping Test Analysis Report** Project: Thing Valley Number: 2010-0005 Client:



Pumping Test: **Recovery Test**

Analysis Method: **Theis Recovery**

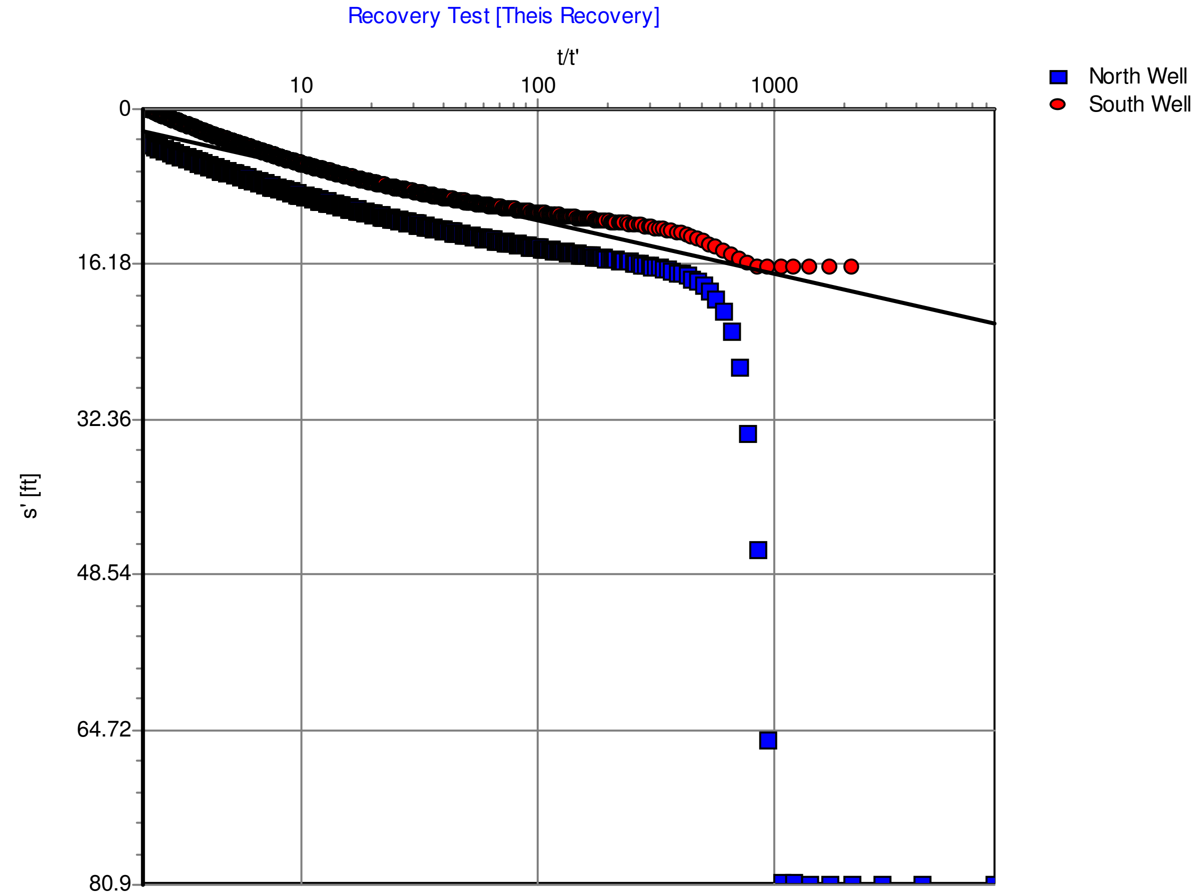
Analysis Results:	Transmissivity:	3.11E+2 [ft²/d]	Conductivity:	8.88E-1 [ft/d]
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	81 [U.S. gal/min]		
	Pumping Time	4320 [min]		

Comments: South Well Recovery match to late data.

Evaluated by: MWV

Evaluation Date: 11/2/2010

Waterloo Hydrogeologic, Inc.	**Pumping Test Analysis Report**
460 Philip Street - Suite 101	Project: Thing Valley
Waterloo, Ontario, Canada	Number: 2010-0005
Phone: +1 519 746 1798	Client:



Pumping Test: **Recovery Test**

Analysis Method: **Theis Recovery**

Analysis Results:	Transmissivity:	5.08E+2 [ft²/d]	Conductivity:	1.45E+0 [ft/d]
Test parameters:	Pumping Well:	Pumping Well	Aquifer Thickness:	350 [ft]
	Casing radius:	0.25 [ft]	Confined Aquifer	
	Screen length:	350 [ft]		
	Boring radius:	0.42 [ft]		
	Discharge Rate:	81 [U.S. gal/min]		
	Pumping Time	4320 [min]		

Comments: South Well Recovery match to middle data.

Evaluated by: MWV

Evaluation Date: 11/2/2010

1

ABANDONED/DESTROYED

TOO close to
SEPtic tank

2

Pump in well
<u>NO</u> power

pumped this w/
generator worked
fine

Just East of
water Storage
tank

WELL #2

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
1255 Imperial Ave
San Diego, CA 92101
619-338-2222

INVOICE

ERMIT TYPE & NUMBER: LWEL 16225 **INVOICE DATE:** 16 SEP 2004
'ERMIT OWNER: **CONTACT:**
IANOS DRILLING & PUMP
6052 LAWSON VALLEY RD.

AMUL CA 91935

APPLICANT:
FADEM ROBERT S&MARY O TRUST B1

\PN: ~~611-070-02-00~~ 611-060-03 611-070-01
;ITE ADDRESS: ~~2750~~ MCCAIN VALLEY RD
.OCATION DESCRIPTION: ~~2750~~ MCCAIN VALLEY RD ~~JACUMBA 92036~~ BOULEVARD 91905 --

'ROJECT DESCRIPTION/SCOPE
lumber of Wells on Permit Application: 1
)escription of Work: well drilling
'ype of Use for Each Well: domestic

'EE/DEPOSIT DETAILS

FEE CODE	DESCRIPTION	TIME ACCT.	ACCT. CODE	AMOUNT
6LE01--EHO	WATER WELL PERMIT	429E01	9773-773	390.00
			TOTAL AMOUNT DUE	$390.00

1-11? R 7? Sec 9

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

DEH USE ONLY
PERMIT # W 16225
WELL COMPUTER #
FEE:
WATER DIST:

Parcel #~~2~~ 120 acres

1. Property Owner: Hamann Companies Phone: 440-7424
   1000 Pioneer Way (Mailing Address) El Cajon (City) 92020 (Zip)
2. Well Location - Assessors Parcel Number ~~611-070-03~~ 611-060-03 611-070-01
   McCain Hwy (Site Address) ~~[illegible]~~ BOULEVARD (City) (Zip)
3. Well Contractor - Well Driller Jim Mann Company Name: Jim Mann Drilling
   1025 Lane ... (Mailing Address) Jamul (City) 91935 (Zip)

   Phone#: 445-1926 C-57#: 340732 ☒ Cash Deposit ☐ Bond Posted
4. Use: ☐ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other
5. Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: Air Rotary
7. Depth of Well: Proposed: 300 Existing: 0
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☐ Yes ☐ No	☐ Yes ☐ No	From: To:
Depth: 150'	Depth: ft.	From: To:	From: To:
Diameter 7 in.	Diameter in.	Type:	From: To:
Wall/Gauge: 1/4"	Wall/Gauge:	Wall/Gauge:	

9. Annular Seal: Depth: 50 ft. Sealing Material: Cement
   Borehole diameter: 11 in. Conductor diameter: in. Annular Thickness 2 in.
10. Date of Work: Start: ... Complete: ...

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Jim Mann Date: 9-16-04

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Larry O'Call... Date: 9/16/04

No public water to site

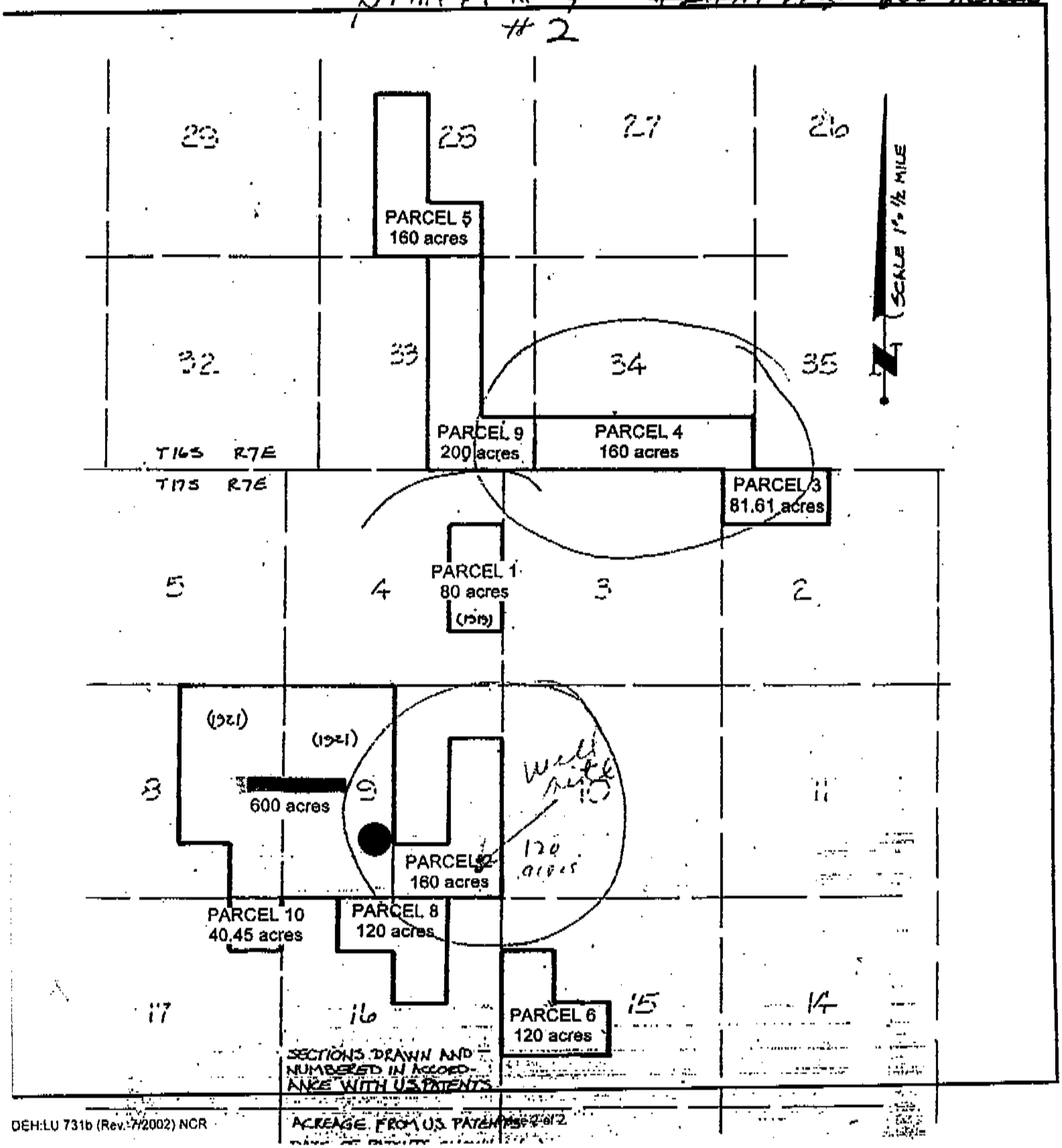
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWEL 16225
Assessor's Parcel Number: ~~611-070-03~~
611-060-03
611-070-01

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

Parcel #4 ~~[illegible]~~ 600 ACRES
#2



-2-

County Mail Station —A-21 11/290

FIRST CARBON COPY , pump 160

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES
1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101-2417

ASSESSORS PARCEL NUMBER: ______ ______ ______

WATER WELL DRILLERS REPORT
(INSERT under ORIGINAL PAGE w/carbon of State Form)

Notice of Intent No. ______
Local Permit No. or Date ______

State Well No. ______
Other Well No. ______

(1) OWNER: Name John Gibson #6
Address ______
City ______ Zip ______

(2) LOCATION OF WELL (See instructions):
County ______ Owner's Well Number ______
Well address if different from above ______
Township ______ Range ______ Section ______
Distance from cities, roads, railroads, fences, etc. ______

DEPARTMENT USE ONLY
Completed Well Construction:
Date ______
Date Inspected ______
Comments ______
Water Sample Taken? ______
Sanitarian's Approval: ______
6/4

(3) TYPE OF WORK:
New Well ☐ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in item (12)

(4) PROPOSED USE:
Domestic ☒
Irrigation ☒
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) Equipment:
Rotary ☒ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) Gravel Pack: MEANS
Yes ☐ No ☒ Size ______
Diameter of above ______
Packed from ______ to ______ ft.

(7) Casing Installed:
Steel ☒ Plastic ☐ Concrete ☐

(8) Perforations:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot Size
0	24'	7"	156			

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth ______ ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ______ ft.
Method of sealing BENTONITE-CEMENT

(10) WATER LEVELS:
Depth of first water, if known 70' ft.
Standing level after well completion 45' ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? DRILLER
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test — ft. At end of test — ft.
Discharge 10 gal/min after 3 hours Water temperature Cool
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 600 ft. Depth of completed well 185? ft.
from ft. to ft. Formation (Describe by color, character, size or material)

0-2 - LOOSE SOIL
2-15 - D.G. GRAY
15-70 - BLACK' WHITE ROCK
70-71 - SOFTER (2 GPM)
71-90 - BLACK' WHITE ROCK
90-92 - SOFTER, ORANGE (2 GPM)
92-168 - BLACK' WHITE ROCK, SOME SOFT AREAS
168-178 - VERY SOFT (6 GPM)

Work Started 19 Completed 19

WELL DRILLERS STATEMENT: I hereby declare under penalty of perjury that the information provided in this report is true. This water well was installed in compliance with San Diego County Code and State of California, Department of Water Resources, Bulletin No. 74.

SIGNED [signature]
(Well Driller)

NAME ______
(Person, firm, or Corporation) (Type or Print)

ADDRESS ______

CITY ______ ZIP ______

LICENSE NO. ______ DATE THIS REPORT ______

 CONFIDENTIAL — NOT FOR PUBLIC USE — WATER CODE SEC. 13752

DUPLICATE
Driller's Copy

Page 1 of 1

Owner's Well No. 2

Date Work Began 10-1-04, Ended 10-4-04

Local Permit Agency San Diego E.H.S.

Permit No. LWEL16225 Permit Date 9-16-04

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 0909404

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD rotary FLUID air

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0 – 2	loose soil
2 – 15	dg, gray
15 – 70	black & white rock
70 – 71	softer
71 – 90	black & white rock
90 – 92	softer, orange
92 – 168	black & white rock
	some softer areas
168 – 178	very soft

TOTAL DEPTH OF BORING 600 (Feet)

TOTAL DEPTH OF COMPLETED WELL 195 (Feet)

WELL OWNER

Name Hamann Companies

Mailing Address 1000 Pioneer Way

El Cajon, Ca 92020

CITY STATE ZIP

WELL LOCATION

Address McCain Valley

City Jacumba

County San Diego

APN Book 611 Page 070 Parcel 02

Township 17 S Range 7E Section 9

Lat ___ DEG. MIN. SEC. N Long ___ DEG. MIN. SEC. W

LOCATION SKETCH

NORTH

WEST

See attached

EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

USES (✓)

WATER SUPPLY
X Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 70 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 45 (Ft.) & DATE MEASURED 10-4-04

ESTIMATED YIELD * 10 (GPM) & TEST TYPE airlift

TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN — (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	TYPE (✓) BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 – 24	11	x				steel	6 5/8	.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 – 24	x	x		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
✓ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME JIM MANOS DRILLING & PUMP
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

16052 LAWSON VLY RD, JAMUL, CA 91935
ADDRESS CITY STATE ZIP

Signed Jim Manos 3-1-06 360722
C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSE NUMBER

#3

NO PUMP
NO POWER

WELL IS CAPPED

LOW GPM

COUNTY OF SAN DIEGO

DEPARTMENT OF ENVIRONMENTAL HEALTH
1255 Imperial Ave
San Diego, CA 92101
619-338-2222

#3

INVOICE

PERMIT TYPE & NUMBER: **LWEL 16223**

INVOICE DATE: 16 SEP 2004

PERMIT OWNER:
MANOS DRILLING & PUMP
16052 LAWSON VALLEY RD.

JAMUL CA 91935

CONTACT:

APN: ~~529-150-01-00~~ 611-060-03 611-070-01

APPLICANT:
FADEM ROBERT S&MARY O TRUST B1

SITE ADDRESS: ~~6057~~ MCCAIN VALLEY RD BOULEVARD 91905

LOCATION DESCRIPTION: ~~3057~~ MCCAIN VALLEY RD. ~~EL CAJON 92020.~~

PROJECT DESCRIPTION/SCOPE

Number of Wells on Permit Application: 1
Description of Work: well drilling
Type of Use for Each Well: domestic

FEE/DEPOSIT DETAILS

FEE CODE	DESCRIPTION	TIME ACCT.	ACCT. CODE	AMOUNT
6LE01--EHO	WATER WELL PERMIT	429E01	9773-773	390.00
			09-16-04 11128 9773 773 429E01 CHECK	
			TOTAL AMOUNT DUE	$390.00

T-16 S
R 7E
Sec. 34

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

Parcel #4 600 acres

DEH USE ONLY
PERMIT # WEL16223
WELL COMPUTER #:
FEE:
WATER DIST:

1. Property Owner: Hamann Companies Phone: 440-7424
1000 Pioneer Way El Cajon 92020
Mailing Address City Zip

2. Well Location - Assessors Parcel Number ~~S 39-150-31~~ 611-060-03 611-070-01
McCain Valley ~~Jacumba~~ BOULEVARD 91905
Site Address City Zip

3. Well Contractor - Well Driller Van Manns Company Name: Van Manns Drilling
11052 Lawson Rd Jamul 91935
Mailing Address City Zip

Phone#: 445-1926 C-57#: 566722 ☒ Cash Deposit ☐ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other

5. Type of Work: ☒ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: Air Rotary

7. Depth of Well: Proposed: 300 Existing:

8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☐ Yes ☐ No	☐ Yes ☐ No	
Depth: 20	Depth: ft.	From: To:	From: To:
Diameter 7 in.	Diameter in.	Type:	From: To:
Wall/Gauge: .188	Wall/Gauge:	Wall/Gauge:	From: To:

9. Annular Seal: Depth: 20 ft. Sealing Material: Bentonite Cement
Borehole diameter: 11 in. Conductor diameter: in. Annular Thickness 2 in.

10. Date of Work: Start: 9-27-04 Complete: 9-30-04

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: [signature] Date: 9-14-04

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Danny O'Call Date: 9/16/04

No public water to site

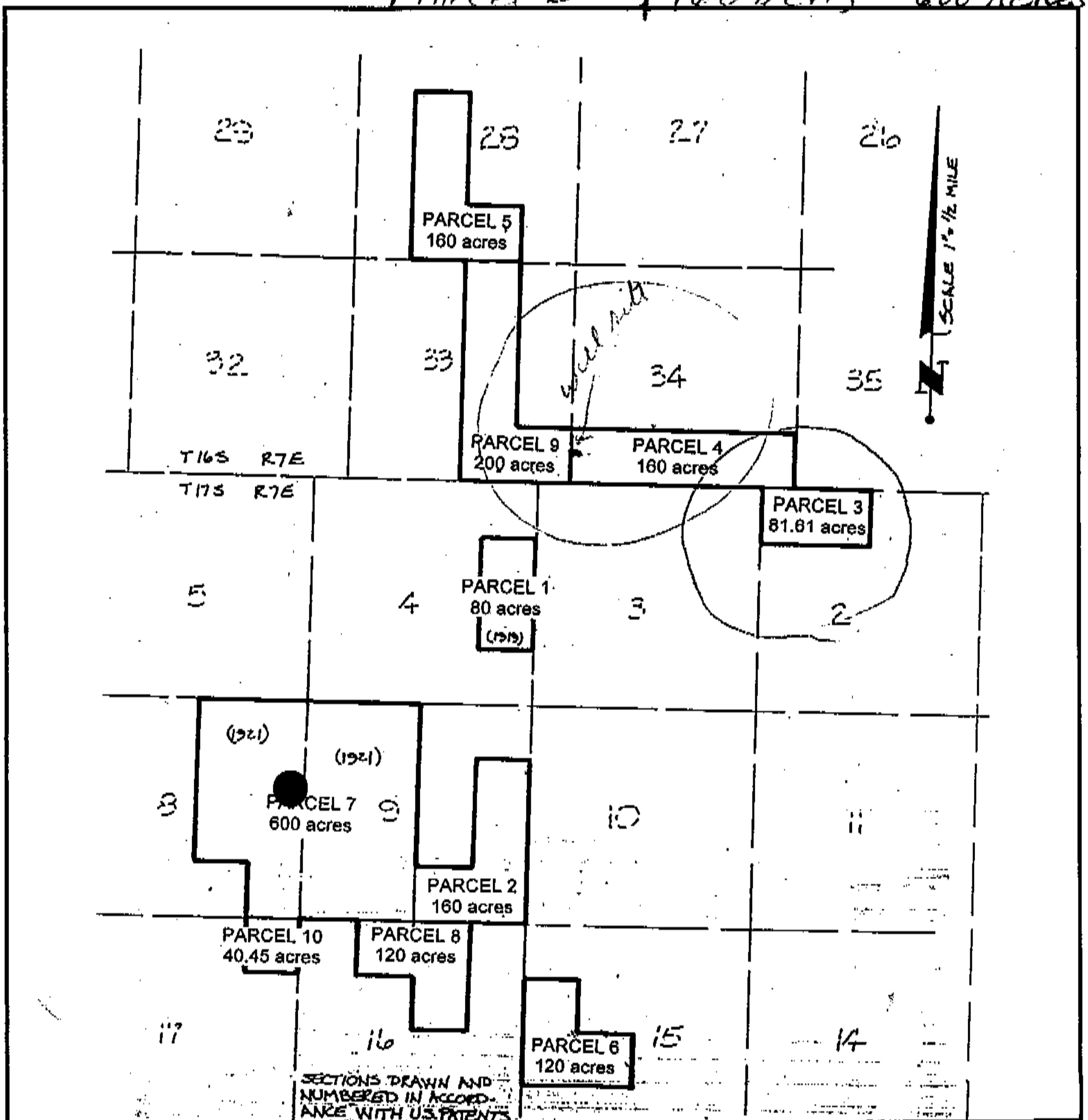
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWEL 16223
Assessor's Parcel Number: ~~529-150-~~
611-060-03
611-070-01

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

Parcel # ~~160 acres~~ 600 Acres



ACREAGE FROM U.S. PATENTS
DATE OF PATENTS SHOWN ( )

3

County Mail Station — A-21

ASSESSORS PARCEL NUMBER:

FIRST CARBON COPY

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES
1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101-2417

0

WATER WELL DRILLERS REPORT
(INSERT under ORIGINAL PAGE w/carbon of State Form)

Notice of Intent No. ______
Local Permit No. or Date ______

State Well No. ______
Other Well No. ______

(1) OWNER: Name John Gibson #5
Address MCLAIN VALLEY
City ______ Zip ______

(2) LOCATION OF WELL (See instructions):
County ______ Owner's Well Number ______
Well address if different from above ______
Township ______ Range ______ Section ______
Distance from cities, roads, railroads, fences, etc. ______

(12) WELL LOG: Total depth 900 ft. Depth of completed well 900 ft.
from ft. to ft. Formation (Describe by color, character, size or material)

0-2 - SANDY TOPSOIL
2-102 - BLACK, WHITE, ORANGE, WEATHERED AREAS, LOOSE ROCKS, SAND (DRIP)
102-110 - BLACK, WHITE ROCK
110-112 - SOFTER (1 GPM) SAND
112-348 - BLACK, WHITE ROCK
348-349 - SOFTER (1½ GPM)
349-900 - BLACK, WHITE ROCK SOME SOFTER AREAS

DEPARTMENT USE ONLY
Completed Well Construction:
Date ______
Date Inspected ______
Comments ______
Water Sample Taken? ______
Sanitarian's Approval:

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item (12)

(4) PROPOSED USE:
Domestic ☒
Irrigation ☒
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

5¾

(5) Equipment:
Rotary ☒ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) Gravel Pack: Needs
Yes ☐ No ☒ Size ______
Diameter of above ______
Packed from ______ to ______ ft.

(7) Casing Installed:
Steel ☒ Plastic ☐ Concrete ☐

(8) Perforations:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot Size
0	209	6 5/8	.188			

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth ______ ft.
Were strata sealed against pollution? Yes ☐ No ☐ Interval ______ ft.
Method of sealing BENTONITE - CEMENT

(10) WATER LEVELS:
Depth of first water, if known 50' ft.
Standing level after well completion 35' ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? DRILLER
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test — ft. At end of test — ft.
Discharge 2 gal/min after 2 hours Water temperature COOL
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

Work Started 19 Completed 19

WELL DRILLERS STATEMENT: I hereby declare under penalty of perjury that the information provided in this report is true. This water well was installed in compliance with San Diego County Code and State of California, Department of Water Resources, Bulletin No. 74.

SIGNED [signature]
(Well Driller)

NAME ______
(Person, firm, or Corporation) (Type or Print)

ADDRESS ______

CITY ______ ZIP ______

LICENSE NO. ______ DATE THIS REPORT ______

DHS:EHP-732 (83) CONFIDENTIAL — NOT FOR PUBLIC USE — WATER CODE SEC. 13752

DUPLICATE
Driller's Copy

Page 1 of 1

Owner's Well No. 3

Date Work Began 9-27-04, Ended 9-30-04

Local Permit Agency San Diego E.H.S.

Permit No. LWEL16223 Permit Date 9-16-04

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 0909443

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

CONFIDENTIAL — NOT FOR PUBLIC USE — WATER CODE SEC. 13752

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD rotary FLUID air

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0 – 2	sandy topsoil
2 – 102	black, white, orange, very soft areas, loose rocks & sand
102 – 110	black & white rock
110 – 112	softer
112 – 348	black & white rock
348 – 349	soft
349 – 900	black & white rock, some softer areas

TOTAL DEPTH OF BORING 900 (Feet)

TOTAL DEPTH OF COMPLETED WELL 900 (Feet)

WELL OWNER

Name Hamann Companies

Mailing Address 1000 Pioneer Way

El Cajon, Ca 92020

CITY STATE ZIP

WELL LOCATION

Address 3057 McCain Valley Rd

City Jacumba

County San Diego

APN Book 529 Page 150 Parcel 01

Township 16 Range 7E Section 34

Lat ___ DEG. MIN. SEC. N Long ___ DEG. MIN. SEC. W

LOCATION SKETCH

NORTH

WEST EAST

See Attached

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

USES (✓)

WATER SUPPLY
X Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 50 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 35 (Ft.) & DATE MEASURED 9-30-04

ESTIMATED YIELD * 2 (GPM) & TEST TYPE airlift

TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN - (Ft.)

* May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 – 209	11	x				steel	6 5/8	.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 – 209	x	x		

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
✓ Soil/Water Chemical Analyses
✓ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME JIM MANOS DRILLING & PUMP
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

16052 LAWSON VLY RD, JAMUL, CA 91935
ADDRESS CITY STATE ZIP

Signed ___ C-57 LICENSED WATER WELL CONTRACTOR 3-6-06 DATE SIGNED 360722 C-57 LICENSE NUMBER

DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

#4

Power at well

NO pump

Across road from Bathrooms in West Canyon

water was Discolored & hence quit using

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
1255 Imperial Ave
San Diego, CA 92101
619-338-2222

#4

INVOICE

ERMIT TYPE & NUMBER: LWEL 16226 INVOICE DATE: 16 SEP 2004

ERMIT OWNER: CONTACT:
ADEM ROBERT S&MARY O TRUST B1
553 OCEAN ST

92008

611-060-03
PN: ~~611-110-01-00~~ 611-070-01

APPLICANT:
FADEM ROBERT S&MARY O TRUST B1

ITE ADDRESS: ~~2533~~ MCCAIN VALLEY RD
OCATION DESCRIPTION: ~~2533~~ MCCAIN VALLEY RD,

ROJECT DESCRIPTION/SCOPE
umber of Wells on Permit Application:1
escription of Work:new
ype of Use for Each Well:private

EE/DEPOSIT DETAILS

FEE CODE	DESCRIPTION	TIME ACCT.	ACCT. CODE	AMOUNT
6LE01--EHO	WATER WELL PERMIT	429E01	9773-773	390.00
			09-16-04 11:30 9773 773 429E01 CHECK	$390.00
			TOTAL AMOUNT DUE	$390.00

2 75
c.15

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

Parcel 1 ~~87~~ 600 ~~Degrees~~

DEH USE ONLY
PERMIT # W LWCL162
WELL COMPUTER #
FEE: ____
WATER DIST: ____

1. Property Owner: Hamann Companies Phone: 440-7424
1000 Pioneer Way | El Cajon | 92020
Mailing Address | City | Zip

2. Well Location - Assessors Parcel Number ~~611-110-07~~ 611-060-03 611-070-01
McCain Valley | BOULEVARD | 91905
Site Address | City | Zip

3. Well Contractor - Well Driller Jim Mayes Company Name: Jim Mayes Drilling
[illegible] | Jamul | 91935
Mailing Address | City | Zip

Phone#: 445-1926 C-57#: [illegible] ☐ Cash Deposit ☐ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other ____
5. Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: Air Rotary
7. Depth of Well: Proposed: 300 Existing: ____
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☐ Yes ☐ No	☐ Yes ☐ No	From: ____ To: ____
Depth: 20	Depth: ____ ft.	From: ____ To: ____	From: ____ To: ____
Diameter 7 in.	Diameter ____ in.	Type: ____	From: ____ To: ____
Wall/Gauge: [illegible]	Wall/Gauge: ____	Wall/Gauge: ____	

9. Annular Seal: Depth: ____ ft. Sealing Material: [illegible]
Borehole diameter: ____ in. Conductor diameter: ____ in. Annular Thickness ____ in.

10. Date of Work: Start: [illegible] Complete: 9-27-04

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Jim Mayes Date: [illegible]

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Danny O'Cull Date: 9/16/04

DEH-LU-731a (Rev. 4/02) NCR

[illegible]

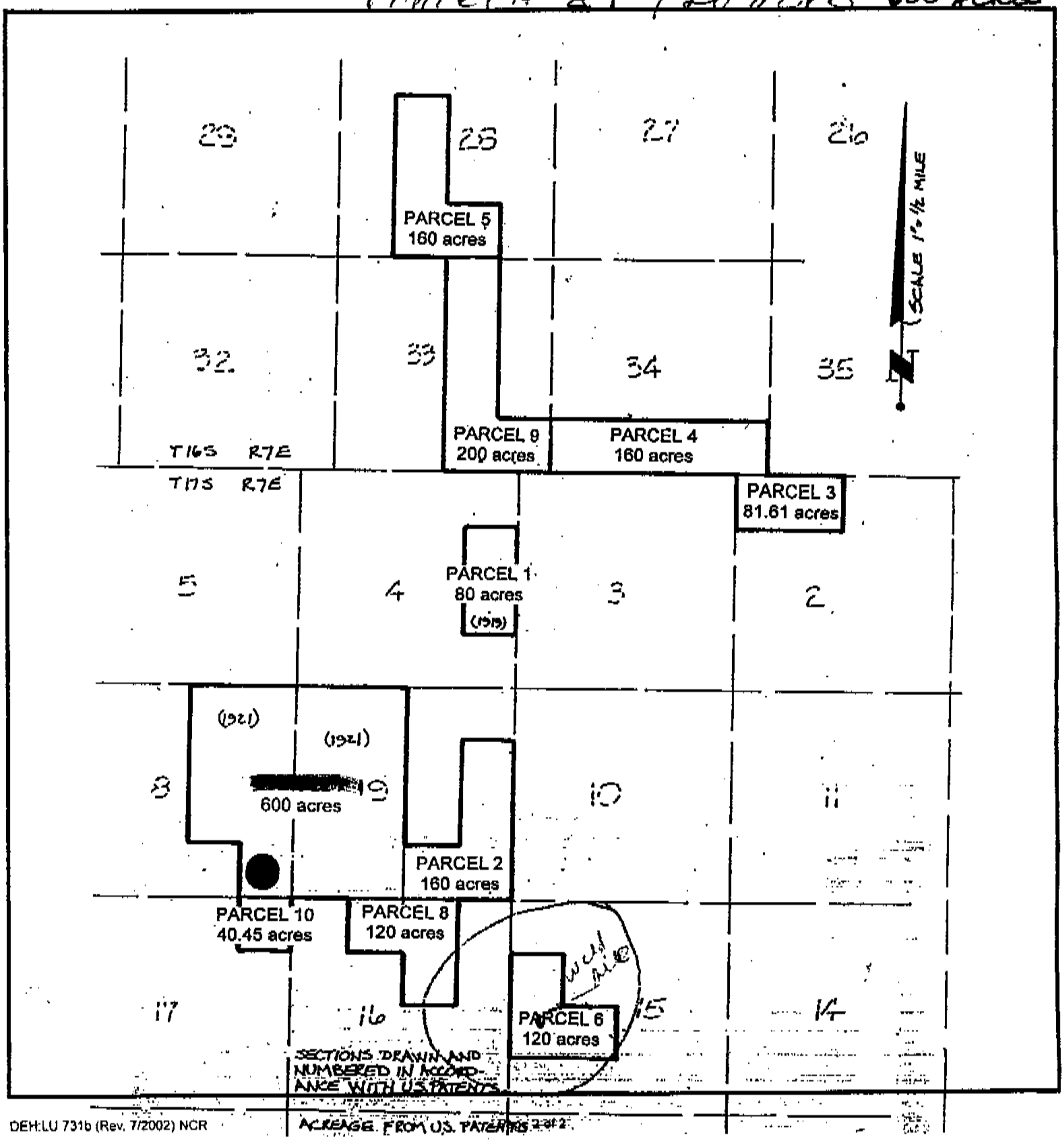
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWCL 16226
Assessor's Parcel Number: ~~611-110-07~~
611-060-03
611-070-01

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

Parcel # 8 ~~[illegible]~~ 600 ACRES



County Mail Station — A-21

FIRST CARBON COPY

ASSESSORS PARCEL NUMBER:

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES
1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101-2417

WATER WELL DRILLERS REPORT

(INSERT under ORIGINAL PAGE w/carbon of State Form)

Notice of Intent No. ______
Local Permit No. or Date ______

State Well No. ______
Other Well No. ______

(1) OWNER: Name JOHN WELL NO 2
Address ROXY ACRES
City ______ Zip ______

(2) LOCATION OF WELL (See Instructions):
County ______ Owner's Well Number ______
Well address if different from above ______
Township ______ Range ______ Section ______
Distance from cities, roads, railroads, fences, etc. ______

DEPARTMENT USE ONLY
Completed Well Construction:
Date ______
Date Inspected ______
Comments ______
Water Sample Taken? ______
Sanitarian's Approval: ______

Jetter #8

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item (12)

(4) PROPOSED USE:
Domestic ☒
Irrigation ☒
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) Equipment:
Rotary ☒ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) Gravel Pack:
Yes ☒ No ☐ Size 3/8ths
Diameter of above 4"
Packed from 0 to 185 ft.

(7) Casing Installed:
Steel ☒ Plastic ☐ Concrete ☐

(8) Perforations:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot Size
0	91	6 5/8	.188	0	185	3/32nds

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 91' ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ______ ft.
Method of sealing BENTONITE - CEMENT

(10) WATER LEVELS:
Depth of first water, if known 130' ft.
Standing level after well completion 35 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? Driller
Type of test Pump ☐ Bailer ☐ Air lift ☐
Depth to water at start of test — ft. At end of test — ft.
Discharge 15 gal/min after 1 hours Water temperature Cool
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 260 ft. Depth of completed well 185 ft.
from ft. to ft. Formation (Describe by color, character, size or material)

0-91 - SANDY, D.G.
91-130 - SOFT, ORANGE, WHITE & BROWN
130-132 - GRAY SOFT (5 GPM)
132-185 - SOFT ORANGE, WHITE, BLACK
185-190 - LOOSE ROCKS (20 GPM)
190-260 - SOFT & HARD

Work Started 19 Completed 19

WELL DRILLERS STATEMENT: I hereby declare under penalty of perjury that the information provided in this report is true. This water well was installed in compliance with San Diego County Code and State of California, Department of Water Resources, Bulletin No. 74.

SIGNED [signature]
(Well Driller)

NAME ______
(Person, firm, or Corporation) (Type or Print)

ADDRESS ______

CITY ______ ZIP ______

LICENSE NO. ______ DATE THIS REPORT ______

DHS:EHP-732 (83) CONFIDENTIAL — NOT FOR PUBLIC USE — WATER CODE SEC. 13752

DUPLICATE
Driller's Copy

Page 1 of 1

Owner's Well No. # 4

Date Work Began 9-25-04, Ended 9-27-04

Local Permit Agency San Diego E.H.S.

Permit No. LWEL16226 Permit Date 9-16-04

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 0909442

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) x VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD rotary FLUID air

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION (Describe material, grain size, color, etc.)
0	91	sandy, dg
91	130	soft, orange, white & brown
130	133	very soft
133	185	soft, orange, white & black
185	190	loose rocks
190	260	soft & hard

TOTAL DEPTH OF BORING 260 (Feet)

TOTAL DEPTH OF COMPLETED WELL 185 (Feet)

WELL OWNER

Name Hamann Companies

Mailing Address 1000 Pioneer Way

El Cajon, Ca 92020

CITY STATE ZIP

WELL LOCATION

Address McCain Valley Rd

City Jacumba

County San Diego

APN Book 611 Page 110 Parcel 01

Township 17 Range 7E Section 15

Lat ___ N Long ___ W
DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST

See Map

EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

x NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

USES (✓)

WATER SUPPLY
x Domestic ___ Public
___ Irrigation ___ Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 130 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 35 (Ft.) & DATE MEASURED 9-27-04

ESTIMATED YIELD * 15 (GPM) & TEST TYPE airlift

TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN -- (Ft.)

* May not be representative of a well's long-term yield.

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	91	11	x				steel	6 5/8	.188	
0	185	6½		x			pvc	4	sch 40	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CEMENT (✓)	BENTONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	91	x	x		
0	185			x	5/16 pea gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME JIM MANOS DRILLING & PUMP
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

16052 LAWSON VLY RD, JAMUL, CA 91935
ADDRESS CITY STATE ZIP

Signed [signature] 3-6-06 360722
C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSE NUMBER

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

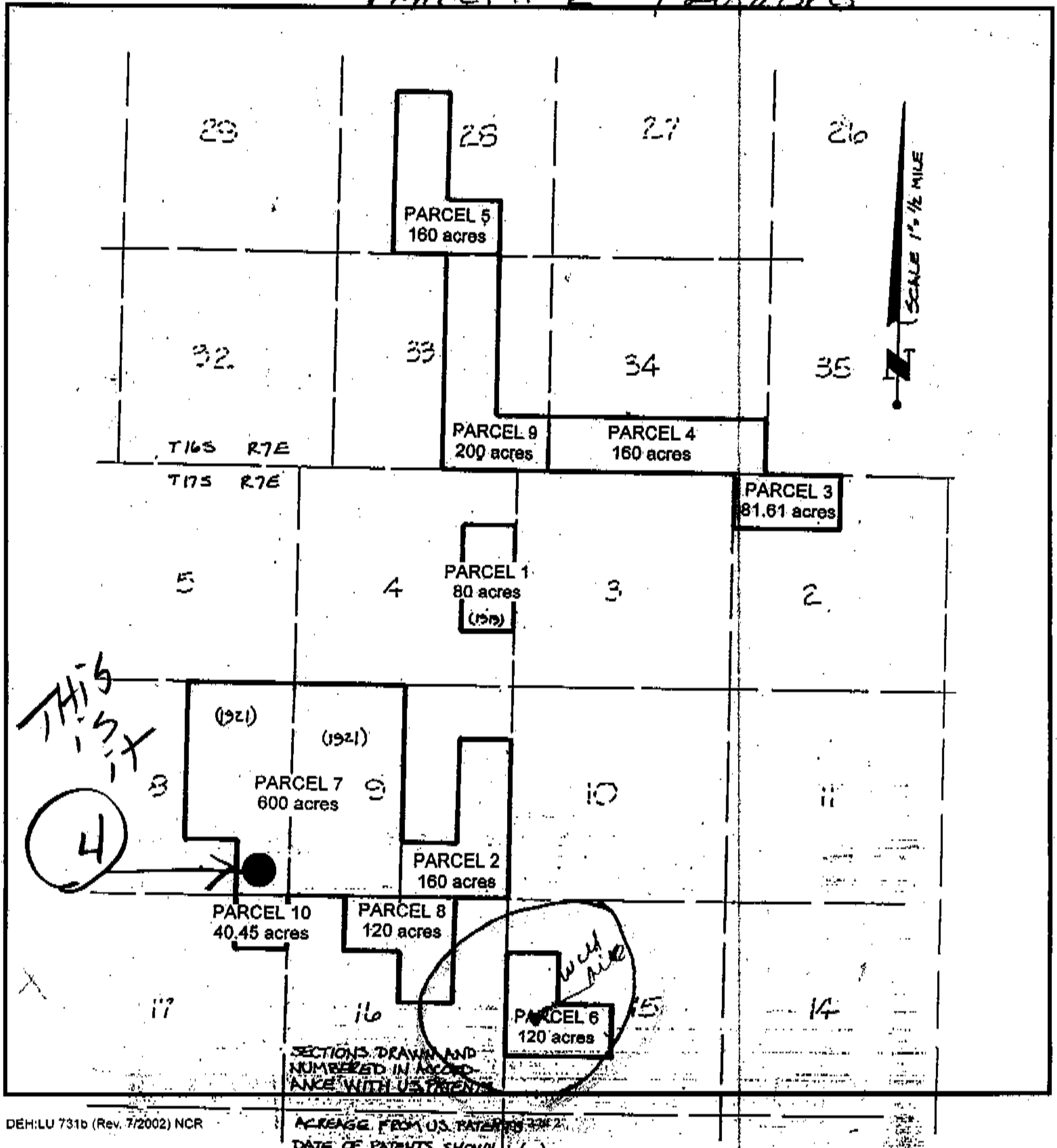
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWCL 16226
Assessor's Parcel Number: 611-110-01

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

Parcel # 6 120 acres



#5

Pump & power
to well

Have never
used this well

COUNTY OF SAN DIEGO

DEPARTMENT OF ENVIRONMENTAL HEALTH
1255 Imperial Ave
San Diego, CA 92101
619-338-2222

H5

INVOICE

PERMIT TYPE & NUMBER: LWEL 16224

INVOICE DATE: 16 SEP 2004

PERMIT OWNER:
MANOS DRILLING & PUMP
16052 LAWSON VALLEY RD.

JAMUL CA 91935

CONTACT:

APPLICANT:
HAMANN ROBERT D FAMILY TRUST 04

APN: 611-030-01-00

SITE ADDRESS: 3041 MCCAIN VALLEY RD

LOCATION DESCRIPTION: 3041 MCCAIN VALLEY RD. JACUMBA 91935

PROJECT DESCRIPTION/SCOPE

Number of Wells on Permit Application: 1
Description of Work: well drilling
Type of Use for Each Well: domestic

FEE/DEPOSIT DETAILS

FEE CODE	DESCRIPTION	TIME ACCT.	ACCT. CODE	AMOUNT
6LE01--EHO	WATER WELL PERMIT	429E01	9773-773	390.00
			09-16-04 11:32 9773 773 429E01 CHECK	[illegible] $39[illegible] $390.
			TOTAL AMOUNT DUE	$390.00

R-7?
Sec 4

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

Parcel #1 80 Acres

DEH USE ONLY
PERMIT # WEL 16224
WELL COMPUTER #
FEE:
WATER DIST:

1. Property Owner: Hamann Companies Phone: [illegible] 7424
1000 [illegible] El Cajon 92020
Mailing Address City Zip

2. Well Location - Assessors Parcel Number 611-030-01
McCain Vly [illegible]
Site Address City Zip

3. Well Contractor - Well Driller Jim Manos Company Name: [illegible] Drilling
Mailing Address City Zip

Phone#: 445-1926 C-57#: 361722 ☒ Cash Deposit ☐ Bond Posted

4. Use: ☐ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other
5. Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd
6. Type of Equipment: [illegible]
7. Depth of Well: Proposed: 300 Existing: —
8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☐ Yes ☐ No	☐ Yes ☐ No	From: To:
Depth: [illegible]	Depth: ft.	From: To:	From: To:
Diameter in.	Diameter in.	Type:	From: To:
Wall/Gauge: [illegible]	Wall/Gauge:	Wall/Gauge:	

9. Annular Seal: Depth: ft. Sealing Material: [illegible]
Borehole diameter: in. Conductor diameter: in. Annular Thickness in.

10. Date of Work: Start: [illegible] Complete: [illegible]

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: [signature] Date: 9-16-04

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: [signature] Date: 9/16/04

[illegible]

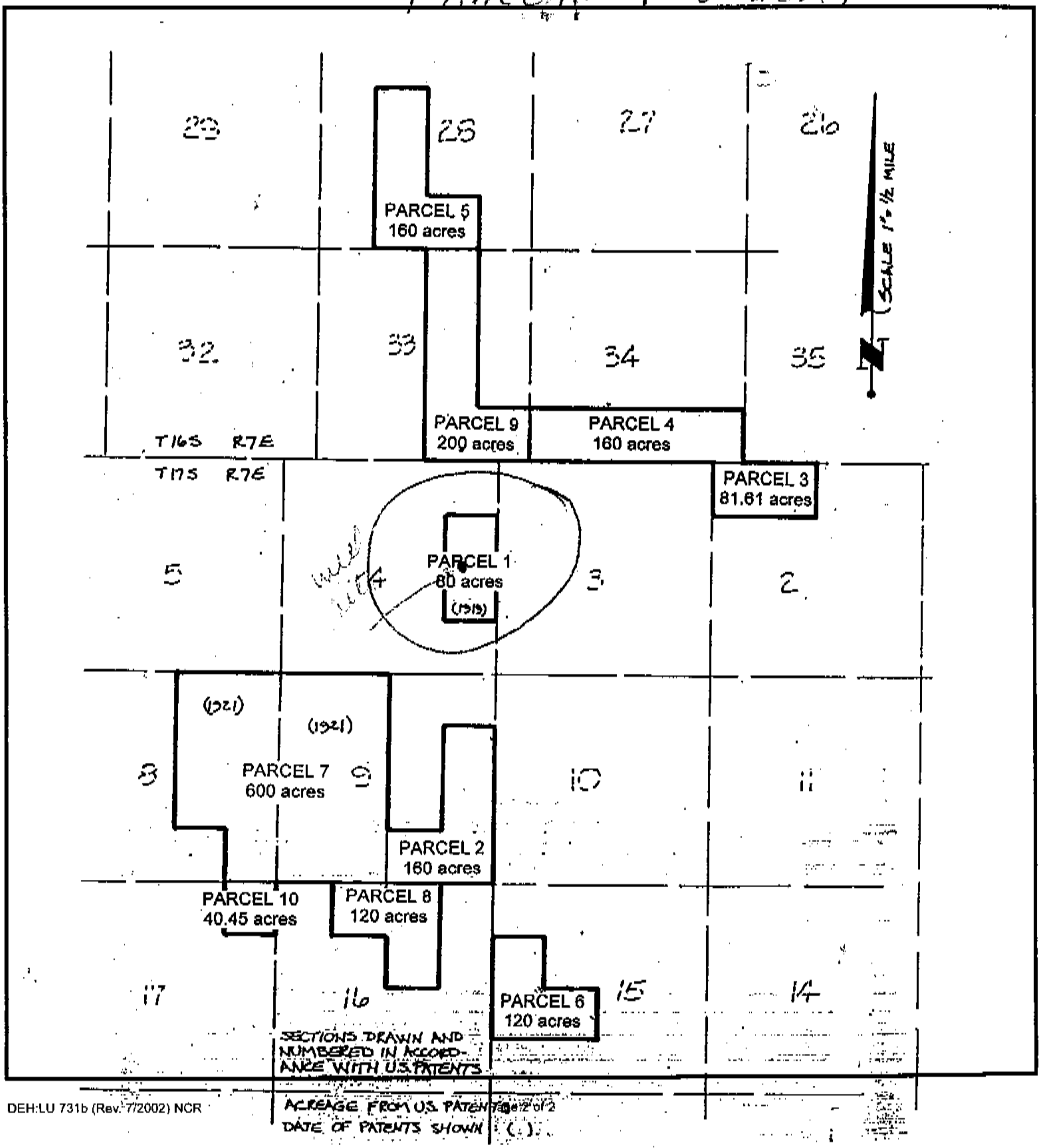
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWEL 16274
Assessor's Parcel Number: 611-030-08

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

Parcel # 1 80 acres



County Mail Station — A-21

FIRST CARBON COPY

O.K. well

#5

ASSESSORS PARCEL NUMBER:

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES
1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101-2417

WATER WELL DRILLERS REPORT
(INSERT under ORIGINAL PAGE w/carbon of State Form)

Notice of Intent No.
Local Permit No. or Date

State Well No.
Other Well No.

(1) OWNER: Name JOHN WELL #3
Address
City Zip

(2) LOCATION OF WELL (See instructions):
County Owner's Well Number
Well address if different from above
Township Range Section
Distance from cities, roads, railroads, fences, etc.

DEPARTMENT USE ONLY
Completed Well Construction:
Date
Date Inspected
Comments
Water Sample Taken?
Sanitarian's Approval:
6/A

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item (12)

(4) PROPOSED USE:
Domestic ☒
Irrigation ☒
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) Equipment:
Rotary ☒ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) Gravel Pack:
Yes ☐ No ☒ Size
Diameter of above
Packed from to ft.

(7) Casing Installed:
Steel ☒ Plastic ☐ Concrete ☐

(8) Perforations:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot Size
0	21	7"	.188			

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 20' ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ft.
Method of sealing BENTONITE - CEMENT

(10) WATER LEVELS:
Depth of first water, if known 50' ft.
Standing level after well completion 45' ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? DRILLER
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test — ft. At end of test — ft.
Discharge 7 gal/min after 1 hours Water temperature COOL
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

(12) WELL LOG: Total depth 800 ft. Depth of completed well 800 ft.
from ft. to ft. Formation (Describe by color, character, size or material)

0 - 15 TOPSOIL
15 - 50 - BLACK/WHITE ROCK
50 - 51 - (5 GPM)
51 - 110 - BLACK/WHITE ROCK
110 - 112 - SOFTER, ORANGE (1 GPM)
112 - 726 - BLACK/WHITE ROCK
726 - 727 - (5½ GPM)
727 - 800 - BLACK/WHITE ROCK

Work Started 19 Completed 19

WELL DRILLERS STATEMENT: I hereby declare under penalty of perjury that the information provided in this report is true. This water well was installed in compliance with San Diego County Code and State of California, Department of Water Resources, Bulletin No. 74.

SIGNED [signature]
(Well Driller)

NAME
(Person, firm, or Corporation) (Type or Print)

ADDRESS

CITY ZIP

LICENSE NO. DATE THIS REPORT

DHS:EHP-732 (8- CONFIDENTIAL — NOT FOR PUBLIC USE — WATER CODE SEC. 13752

DUPLICATE
Driller's Copy

Page 1 of 1

Owner's Well No. 5

Date Work Began 9-21-04, Ended 9-25-04

Local Permit Agency San Diego E.H.S.

Permit No. LWEL16224 Permit Date 9-16-04

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 0909441

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

CONFIDENTIAL

NOT FOR PUBLIC USE

WATER CODE SEC. 13752

GEOLOGIC LOG

ORIENTATION (✓) x VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD rotary FLUID air

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	1½	topsoil
1½	50	black & white rock
50	51	crack
51	110	black & white rock
110	112	softer, orange
112	726	black & white rock
726	727	crack
727	800	black & white rock

TOTAL DEPTH OF BORING 800 (Feet)

TOTAL DEPTH OF COMPLETED WELL 800 (Feet)

WELL OWNER

Name Hamann Companies

Mailing Address 1000 Pioneer Way

El Cajon, Ca 92020

CITY STATE ZIP

WELL LOCATION

Address 3041 McCain Valley Rd

City Jacumba

County San Diego

APN Book 611 Page 030 Parcel 01

Township 07 Range 7E Section 4

Lat ___ DEG. MIN. SEC. N Long ___ DEG. MIN. SEC. W

LOCATION SKETCH

NORTH

Se. attached

WEST EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

x NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

USES (✓)

WATER SUPPLY

x Domestic ___ Public

___ Irrigation ___ Industrial

MONITORING ___

TEST WELL ___

CATHODIC PROTECTION ___

HEAT EXCHANGE ___

DIRECT PUSH ___

INJECTION ___

VAPOR EXTRACTION ___

SPARGING ___

REMEDIATION ___

OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 50 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 45 (Ft.) & DATE MEASURED 9-25-04

ESTIMATED YIELD * 7 (GPM) & TEST TYPE airlift

TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN - (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	21	11	x				steel	6 5/8	.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	21	x	x		

ATTACHMENTS (✓)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

___ Other ___

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME JIM MANOS DRILLING & PUMP
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

16052 LAWSON VLY RD. JAMUL, CA 91935

ADDRESS CITY STATE ZIP

Signed Jim Manos 3-6-06 360722

C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 05-03 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

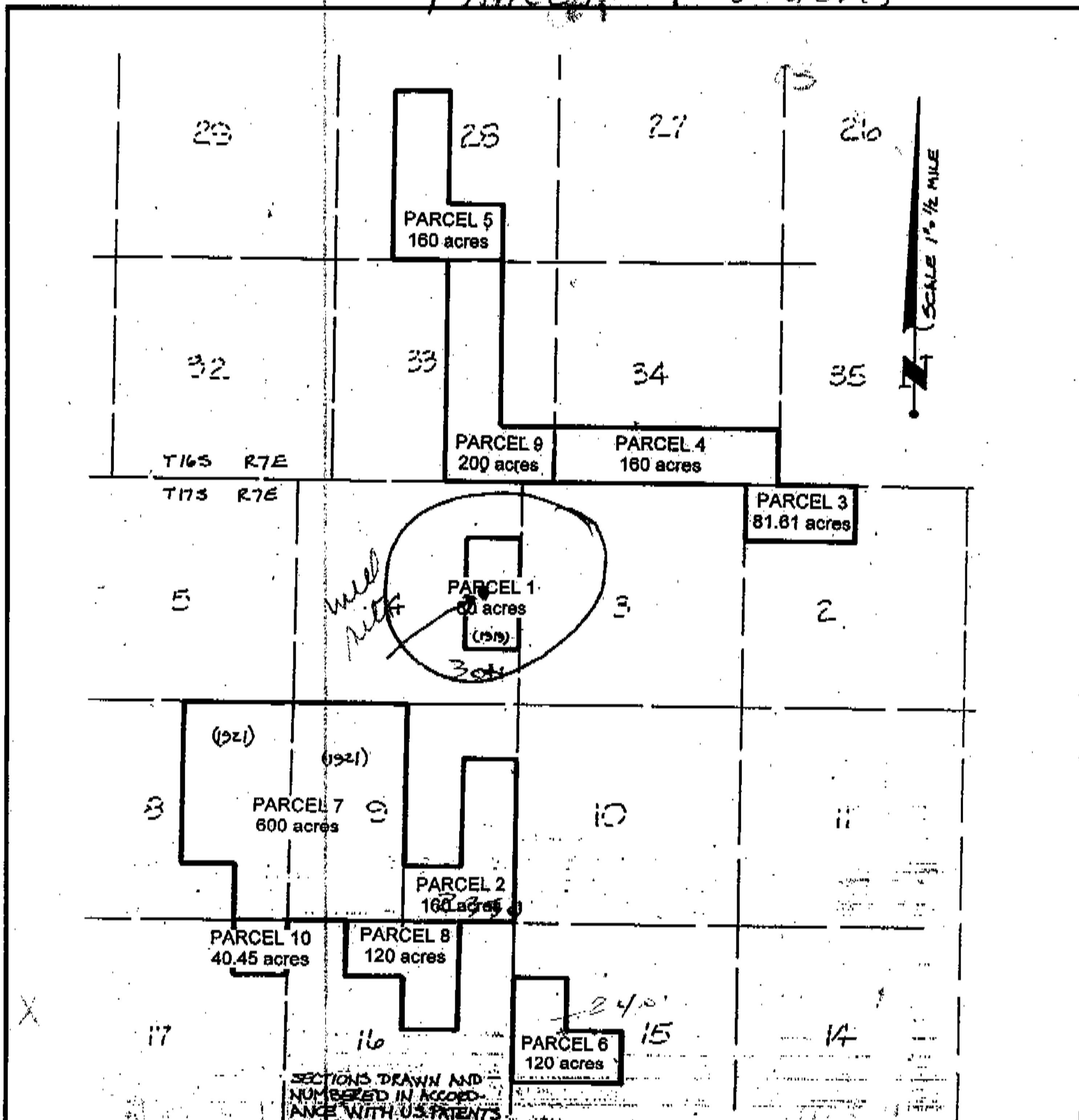
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWEL 16224
Assessor's Parcel Number: 611-030-03

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

Parcel # 1 80 acres



DEH:LU 731b (Rev. 7/2002) NCR

ACREAGE FROM U.S. PATENTS
DATE OF PATENTS SHOWN ( )

Fully operational

#6 NO Logs Available

origional well on Ranch

6A NEW
Public
Well

Fully operational

QUADRUPLICATE FEB 09 2010
For Local Requirements
County of San Diego
Dept. of Environmental Health
Land & Water Quality Div.

Page 1 of 1
Owner's Well No. 1

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 1089956

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

Date Work Began 11-4-09, Ended 11-10-09
Local Permit Agency San Diego C.H.S.
Permit No. LWT620420 Permit Date 11-13-09

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD ROTARY FLUID AIR

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0 - 10	sandy-rocks
10 - 30	sandy-slightly firm
30 - 32	soft
32 - 70	sandy
70 - 85	harder
85 - 87	cracks
87 - 230	black & white rock, softer areas
230 - 233	softer, orange
233 - 330	black/white & orange
330 - 332	softer, orange
332 - 385	black & white rock, softer areas
385 - 395	sand
395 - 420	black & white rock

Completed Well Construction
Date 2/9/10
Date inspected
Comments KIVA entered in this date.
Water Sample Taken? JN

TOTAL DEPTH OF BORING 420 (Feet)
TOTAL DEPTH OF COMPLETED WELL 385 (Feet)

NOT FOR PUBLIC USE
CONFIDENTIAL
SEE WATER CODE SECTION 13752

WELL OWNER

Name Harmony Grove Partners
Mailing Address 1000 Pioneer Way
El Cajon, Ca 92020
CITY STATE ZIP

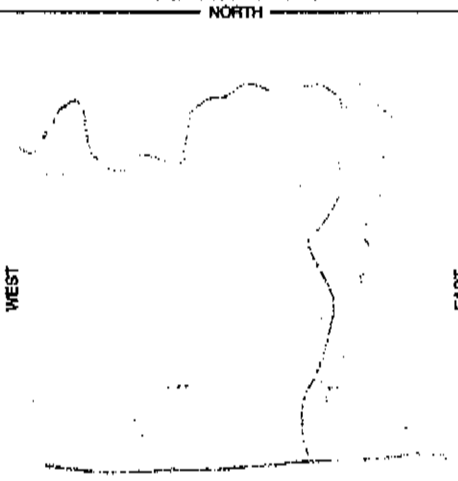
WELL LOCATION

Address Mc Cain Valley Road
City Jacumba, Ca
County San Diego
APN Book 611 Page 090 Parcel 04
Township 17 S Range 7 E Section 17
Lat ___ DEG. MIN. SEC. N Long ___ DEG. MIN. SEC. W

LOCATION SKETCH

NORTH

WEST



EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

USES (✓)

WATER SUPPLY
___ Domestic ___ Public
___ Irrigation X Industrial

MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 30 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 30 (Ft.) & DATE MEASURED 11-10-09
ESTIMATED YIELD * 60 (GPM) & TEST TYPE airlift
TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN - (Ft.)
** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 - 56	12	x				steel		.188	
0 - 75		x				steel	6 5/8	.188	
0 - 385	6½		x			pvc	4	CL200	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 - 56	x(cement was pumped)			
0 - 75		x		
0 - 385			x	3/16 pea gravel

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME JIM MANOS DRILLING & PUMP
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

16052 LAWSON VALLEY ROAD, JAMUL, CA 91935
ADDRESS CITY STATE ZIP

Signed ___ 1/4/10 360?
C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 05-03 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

#7 unstable hole
not much
water
well destroyed

Fain Drilling & Pump Co. Inc.

12029 Old Castle Rd.
Valley Center, CA 92082
Phone (760) 749-0701
Fax (760) 749-6380

Bad hole Destroyed

Invoice

Date	Invoice #
2/15/2005	8049

#7

Bill To
HAMANN COMPANIES 1000 PIONEER WAY EL CAJON, CA 92020

P.O. No.	Terms	Project
	Due on receipt	

Description	Qty	Rate	Amount
WELL DRILLING (TEST HOLE) APN 611 090 03			
PARCEL # 10 40.45 ACRES			
MOVE IN AND SET UP 1ST. TIME	1	500.00	500.00
DRILLING 6.5" DIA HOLE	400	12.00	4,800.00
BACKFILL TEST HOLE AND CEMENT TOP	1	400.00	400.00
MOVE BACK TO TEST HOLE AND SET UP 2ND TIME	1	500.00	500.00
DRILL OUT AND CLEAN OUT EXISTING 400 FT.	1	400.00	400.00
DRILLING FROM 400-850 FT. 6.5" DIA HOLE	450	14.00	6,300.00
BACKFILL AND DESTROY TEST HOLE	1	400.00	400.00
WELL PERMIT AND FILING FEES	1	490.00	490.00

Total	$13,790.00
Payments/Credits	$0.00
Balance Due	$13,790.00

TRIPLICATE
Owner's Copy
Page 1 of 1
Owner's Well No. Test Well Par 10
Date Work Began 2/4/05, Ended 2/14/05
Local Permit Agency DEH
Permit No. 16457 Permit Date 2/7/05

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0909548

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Air

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0	6	Slope wash - sand and silt brown color
6	62	Weathered, decomposed rock
62		1st water - seepage
62	112	quartz diorite
112	114	Fracture - seepage of water
114	274	Quartz diorite, soft weathered
274		Fracture - water
275	654	Quartz diorite, soft weathered
654		Fracture - seepage of water
654	720	Quartz diorite
720		Seepage of water
720	850	Quartz diorite
		Backfill and destroy bore hole

TOTAL DEPTH OF BORING 850 (Feet)
TOTAL DEPTH OF COMPLETED WELL 0 (Feet)

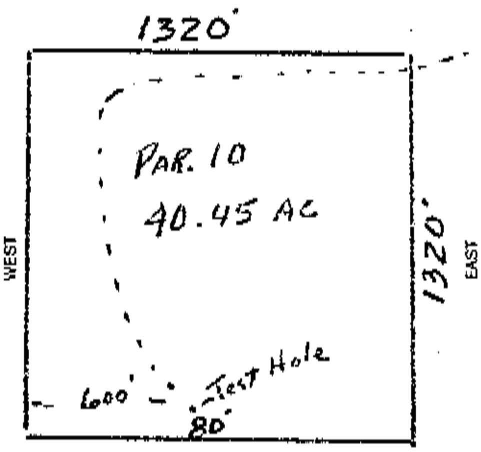
WELL OWNER

Name Hamann Companies
Mailing Address 1000 Pioneer Way
City El Cajon, State Ca Zip 92020

WELL LOCATION

Address Mc Cain Valley Rd.
City Boulevard
County San Diego
APN Book 611 Page 090 Parcel 03
Township 17 S Range 7 E Section 17
Lat 32° 17' 41.735" N (DEG. MIN. SEC.) Long 116° 16' .613" W (DEG. MIN. SEC.)

LOCATION SKETCH

NORTH


WEST EAST
SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

___ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

USES (✓)
WATER SUPPLY
___ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ✓
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 62 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 28 (Ft.) & DATE MEASURED 2/14/05
ESTIMATED YIELD * 10 (GPM) & TEST TYPE Airlift
TEST LENGTH 4 (Hrs.) TOTAL DRAWDOWN 500 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
NONE										

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	5			X	
5	25	X			
25	850			X	

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
✓ Other Site Map

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Fain Drilling & Pump Co Inc
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
12029 Old Castle Rd. Valley Center, Ca 92082
ADDRESS CITY STATE ZIP

Signed [signature] 2-14-05 328287
C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 05-03 IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

8

This WELL HAS
NO pump or power
NEEDS to be
relocated EAST
outside of
TRANSMISSION Line
power EASEMENT

Fain Drilling & Pump Co. Inc.
12029 Old Castle Rd.
Valley Center, CA 92082
Phone (760) 749-0701
Fax (760) 749-6380

#8

Invoice

Date	Invoice #
2/11/2005	8048

Bill To
THE HAMANN COMPANIES 1000 PIONEER WAY EL CAJON, CA 92020

P.O. No.	Terms	Project
	Due on receipt	

Description	Qty	Rate	Amount
DRILLING 970 FT DEEP WELL APN 611 110 01			
PARCEL 6 120 AC			
EQUIPMENT SET UP	1	500.00	500.00
DRILLING 6.5" DIA HOLE	400	12.00	4,800.00
DRILLING 400-800' 6.5" DIA HOLE	400	14.00	5,600.00
DRILLING 800 - 970' 6.5" DIA HOLE	170	16.00	2,720.00
REAMING 6" TO 10" DIA HOLE	226	12.00	2,712.00
FURNISH AND INSTALL 6" WELL CASING	228	13.00	2,964.00
INSTALL 50 FT. SURFACE SEAL	1	1,500.00	1,500.00
WELL PERMIT AND FILING FEES	1	490.00	490.00

Total	$21,286.00
Payments/Credits	$0.00
Balance Due	$21,286.00

TRIPLICATE
Owner's Copy
Page 1 of 1
Owner's Well No. Par. 6 -120
Date Work Began 2/1/05 , Ended 2/9/05
Local Permit Agency DEH
Permit No. 16456 Permit Date 2/1/05

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0909549

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Air

DEPTH FROM SURFACE Ft.	to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0	12	Slope wash - sandy decomposed granite - brown color
12	212	Weathered Granitic Rock
212	226	Broken Rock
226	310	Weathered granitic rock mostly white quartz
310		Water 8 gpm
310	961	Granitic rock large crystals of white quartz
961		Water 40+ gpm
961	970	Fractured granitic rock large quartz crystals

TOTAL DEPTH OF BORING 970 (Feet)
TOTAL DEPTH OF COMPLETED WELL 970 (Feet)

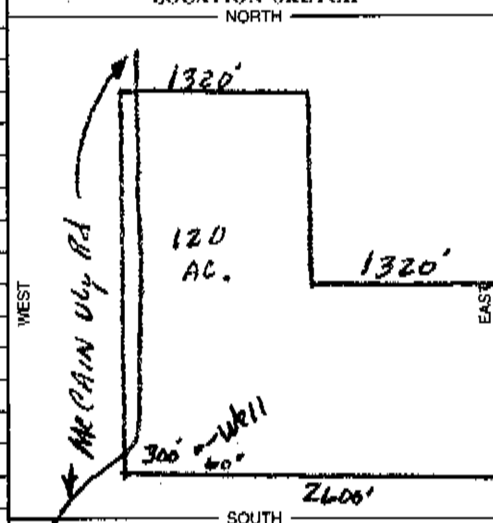
WELL OWNER

Name The Hamann Companies
Mailing Address 1000 Pioneer Way
El Cajon Ca 92020
CITY STATE ZIP

WELL LOCATION

Address Rough Acres Ranch McCain Valley Rd.
City Boulevard
County San Diego
APN Book 611 Page 110 Parcel 01
Township 17S Range 7E Section 15
Lat 36 16 772 N Long 115 69 465 W
DEG. MIN. SEC. DEG. MIN. SEC.

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. ***PLEASE BE ACCURATE & COMPLETE.***

ACTIVITY (✓)

✓ NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

USES (✓)
WATER SUPPLY
✓ Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 30 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 18 (Ft.) & DATE MEASURED
ESTIMATED YIELD * 50 (GPM) & TEST TYPE airlift
TEST LENGTH 3 (Hrs.) TOTAL DRAWDOWN 800 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft.	to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0	226	10	X				Steel	6	.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0	50	X			
50	226			X	

ATTACHMENTS (✓)

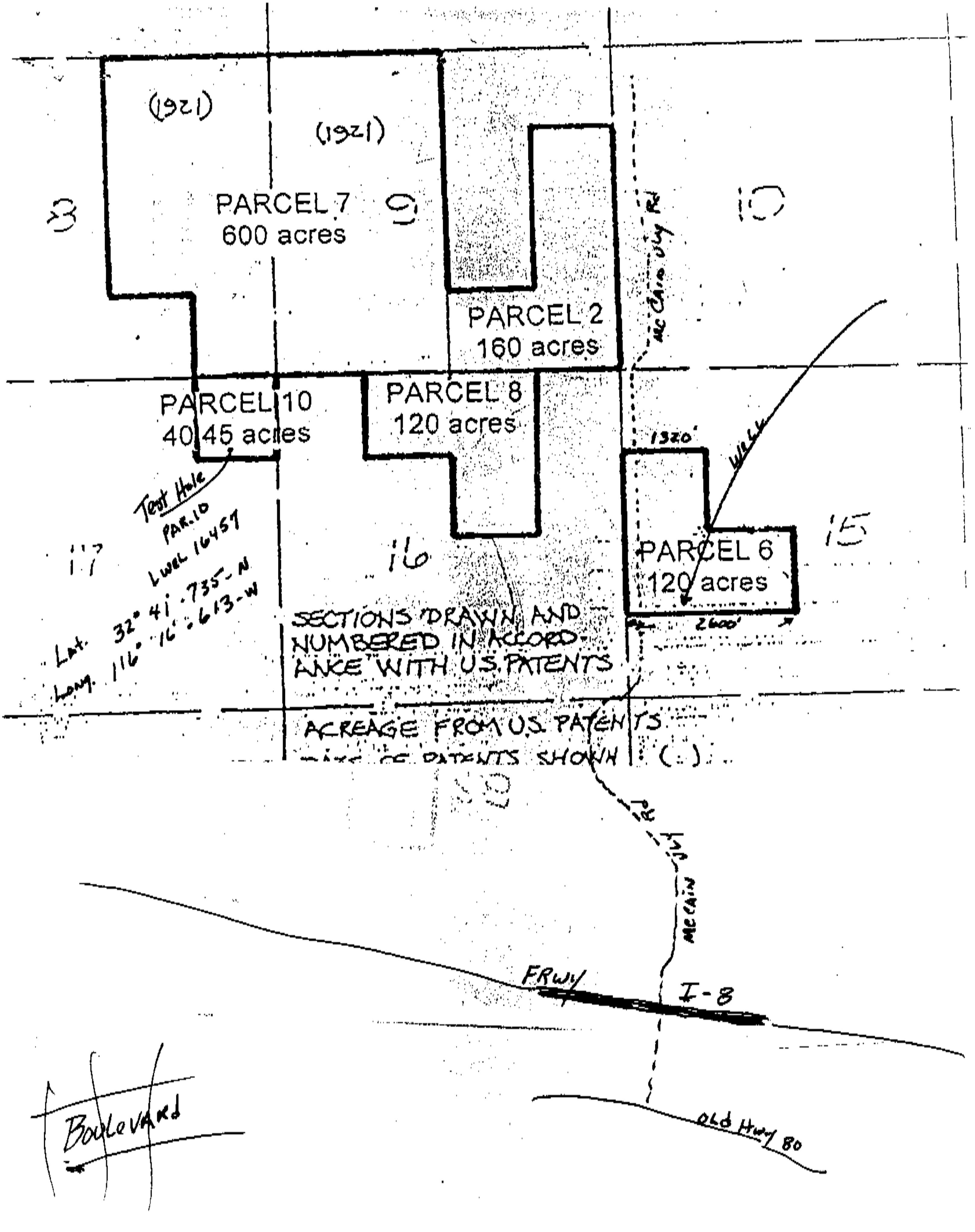
___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Fain Drilling & Pump Co. Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 12029 Old Castle Rd. Valley Center, Ca 92082
CITY STATE ZIP
Signed Joe R. Fain
C-57 LICENSED WATER WELL CONTRACTOR
2/11/05 DATE SIGNED
328287 C-57 LICENSE NUMBER

DWR 188 REV. 05-03
IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM



(1921)
(1921)
PARCEL 7
600 acres
8
9
10
PARCEL 2
160 acres
McCain Vly Rd
PARCEL 10
40.45 acres
PARCEL 8
120 acres
1320'
Well
Test Hole
PAR. 10
LWEL 16457
17
16
15
PARCEL 6
120 acres
2600'
Lat. 32° 41'.735 N
Long. 116° 16'.613 W
SECTIONS DRAWN AND
NUMBERED IN ACCORD-
ANCE WITH U.S. PATENTS
ACREAGE FROM U.S. PATENTS
McCain Vly Rd
FRWY
I-8
Boulevard
Old Hwy 80

9

Fully operational
old well
No info
probably 5-10 GPM
& shallow

APPENDIX B

OBSERVATIONS AND ANALYSIS OF AQUIFER CHARACERISTICS

ROUGH ACRES RANCH

MCCAIN VALLEY, EAST SAN DIEGO COUNTY, CALIFORNIA

Geo-Logic ASSOCIATES
Geologists, Hydrogeologists and Engineers

Date: December 1, 2010
Project No.: 2010-0005

To: John Hower, CEG
Sarah Battelle, CHG

From: Mark Vincent, CHG

Regarding: **Observations and Analyses of Aquifer Characteristics Rough Acres Ranch, San Diego County, California**

INTRODUCTION

This memo presents a summary of observations and analyses made following a stepped and a constant rate aquifer pumping and recovery test in wells located at Rough Acres Ranch located approximately in McCain Valley in eastern San Diego County, California. The tests were performed to determine whether sufficient volumes of water are available for the Tule Wind Farm construction projects. Analyses performed included calculation of transmissivity, hydraulic conductivity, and storativity for a pumping well and observation wells.

WELL AND AQUIFER CONDITIONS

A well labeled as Well #6a was used as the pumping well for this test. Another well labeled as Well #6 (also referred to as South Well) is located 36 feet away from the pumping well and was monitored and analyzed as an observation well. More distant observation wells were monitored including Well #9 (Horse Corral Well), Walker Residence Well, Well #4 (RV Well), Well #2, and Well #8 (Far Field Well) (Figure 1).

Records for drilling and construction of the wells used for these pumping tests are incomplete or nonexistent. A well identified on Department of Water Resources (DWR) records as being owned by Harmony Grove Partners (identified as Form No. 1089956) is believed to be the log for Well #6a. Logs for Well #4 (RV Well) and Well #8 (Far Field Well) were also obtained. No records are available for Well #6 (South Well), The Walker Residence Well, Well #9 (Horse Corral Well), or Well #2.

Although DWR records indicate the borehole for Well #6a was drilled to a total depth of 420 feet, the bottom of the well is recorded to be at a depth of 385 feet below ground surface. Records are incomplete but it was assumed that the well screen extends from a depth of 75 to 385 feet below ground surface. A cement sanitary seal is reported to extend from ground surface to a depth of 56 feet. Wells #6 and #6a used in this pumping test have existing electric submersible pumps installed in them. Based on the production rates achieved during the tests performed, the wells are likely to be outfitted with four-inch diameter electric submersible pumps. Based on the depth and pressure head on the transducers installed in the wells for the test, it was assumed that both of the boreholes are 385 feet deep and are 6.5-inches in diameter. It was further assumed that the wells were constructed with 4-inch diameter well casing and that they are perforated or screened from a depth of 75 feet below ground surface. Details of well construction could not be verified in the field because of the presence of pumps, discharge pipes, electrical wires, and surface sanitary seals. Available well logs are included at the back of this document.

The area immediately around Well #6 and #6a is underlain by alluvium comprised of poorly sorted sand, gravel, and silt derived from the crystalline basement rock exposed on the adjacent canyon sidewalls. The crystalline basement rocks are classified as tonalite and yield groundwater from fractures. The well log reportedly recorded for Well #6a indicates that there is about 70 to 85 feet of alluvium overlying the tonalite. Groundwater was measured at a depth of 27.81 feet below the top of sanitary seal on Well #6a.

TEST METHODS

Observations of groundwater elevation were recorded in a pumping well and six observation wells in McCain Valley. Data was collected using pressure transducers connected to data loggers. Barometric pressure changes were recorded during the test and corrections were made to the pressure head data collected during the tests.

A stepped aquifer pumping test was performed using Well #6a to determine the optimum pumping rate for a longer duration test. The pressure transducers were deployed and began recording data on August 20, 2010 to perform the stepped pumping test. The stepped pumping test was performed at pumping rates of 28 gallons per minute (gpm), 38 gpm, 55 gpm and 60 gpm. A semi-logarithmic plot of elapsed time versus drawdown for the stepped pumping test is shown on Figure 2.

The constant rate pumping and recovery test was performed from August 24 through 27, 2010. The pump was powered-down on August 27, 2010 and allowed to recover for 10 hours when the pressure transducers were removed from the wells. A recovery test was performed by turning off the pumps and recording the increasing head levels over time.

DATA ANALYSIS

Changes in groundwater level data recorded during this test were corrected for barometric pressure changes and used to generate a file containing tabulated time and changes in pressure head. The data was used to generate time-drawdown graphs for the pumping and observation wells and imported into computer software used to calculate the transmissivity and storativity of the fractured tonalite.

The stepped pump test analysis consists of plotting the drawdown versus time for each pumping rate on a time versus drawdown plot with time plotted on a logarithmic scale. Forward projections of each segment representing a different pumping rate can be used to predict the likely drawdown for the pumping well during for the selected duration of the test. A pumping rate of 50 gpm was selected as the target pumping rate because it would allow for ample drawdown without the well running dry during the test.

The method of Schafer (1978) was employed to determine how much of the data set for Well #6a was impacted by casing storage effects. The method is a simplification of the method first developed by Papadopulos and Cooper (1967) but does not require prior knowledge of the transmissivity or well efficiency. The point at which casing storage effects are overcome was calculated to occur approximately 23 to 25 minutes into the test based on the assumptions about well construction practices, pumping rates, and drawdown. Very early pumping data was ignored in the analyses described below due to casing storage effects.

Time versus drawdown plots were prepared for the pumping and observation wells for the pumping and recovery portions of the test. The plots are shown with the time axis plotted on a logarithmic scale and drawdown on a linear scale.

Figure 3 shows the time-drawdown plot for Well #6a during pumping. The first 23 to 25 minutes of the test show the casing storage effects. Well #6a drawdown plots as a straight line on the time-drawdown chart representing constant aquifer properties during that portion of the drawdown cone development. A sudden change in the drawdown curve starts at approximately 11 or 12 minutes; which may reflect leakage from the alluvium above the fractured bedrock.

A residual drawdown plot for Well #6a is shown on Figure 4. The plot shows the change in drawdown versus the ratio of the time since the pump test started divided by the time since the recovery portion of the test started (t/t`). The residual drawdown at a t/t` ratio of 1 is shown to be about 0.33 feet (a less than significant change in storage noted in the pumping well over the course of the pumping and recovery portions of the aquifer stress test).

A time-drawdown plot of Well #6 (the observation well also referred to as South Well) located 36 feet away from the pumping well shows a decrease in drawdown from approximately 30 minutes to approximately 400 minutes which may result from leakage from the alluvium above the fractured bedrock (Figure 5). The Well #6 plot shows even less drawdown versus time after 400 minutes possibly reflecting the fractured bedrock aquifer.

The Well #6 recovery portion of the test is plotted as the residual drawdown versus t/t` shows a flat line on the semi-logarithmic plot (Figure 6) indicative of uniform aquifer conditions from a t/t` ratio of about 8 to 110 into the recovery test period. The residual drawdown value measured for a t/t' ratio of 1 is about -0.22 feet. It is not regarded to be significant compared to the County standard maximum change of 0.5 feet.

The Well #9 (Horse Corral Well) was monitored and the time-drawdown plot reflects that the well pump cycled on and off five times during the test (Figure 7). No analyses were performed for this well because the changes in drawdown versus time due to the pump activating are far greater than any drawdown likely to be induced by the pumping test at Well #6a.

Well #2 (Pond Well) and Well #9 (Far Field Well) were monitored for changes in head during the pumping test. Figure 8 and 9 show the time-drawdown plots for Wells #2 and #9. Both plots show similar small, cyclic, barometric changes in head but are not likely to have resulted from the pumping test. No analyses were performed using the data from these wells.

Water level drawdown data were evaluated using the computer software program AquiferTest version 3.5 (Waterloo Hydrogeologic, 2002). The program performs curve matching of the time drawdown data to calculate transmissivity, hydraulic conductivity, and storativity using different methods. The methods employed included Cooper-Jacob (1946), Moench (1993), Neuman (1975), and Theis (1935).

DISCUSSION

As shown on Table 1, the calculated hydraulic conductivity values for all of the analytical methods employed ranged from a low of 7.50E-04 feet/day for data collected from Well #6 (South Well) using the Theis method for the data collected from the end of the recovery test to a high of 7.50E+00 feet/day using the Cooper Jacob method with late time data for Well #6 (South Well). An average conductivity of 1.85 feet/day was calculated from all methods from both Well #6 and #6a. The Storativity values range from a low of 4.48E-06 for Well #6 late time data calculated using the Moench Fracture Flow method and a high of 7.87E-01 for a match to the late time data recorded in Well #6 using the Moench method with the vertical hydraulic conductivity set at one-tenth the horizontal hydraulic conductivity.

All of the analytical results show a higher transmissivity and hydraulic conductivity value for matches to the observation Well #6. The pumping well and observation well used for these analyses are located in a portion of McCain Valley which is entirely covered in up to 75 to 80 feet of alluvium (Figure 10). Based on the measured depth to groundwater in Well #6 and #6a, approximately 47 to 52 of saturated alluvium overlies the fractured bedrock at the test site (Figure 11). The saturated alluvium is likely to act like a reservoir recharging the fractures in the bedrock. The aerial extent of the fractured bedrock aquifer and the amount of storage in the fractures is likely controlled in part by the presence of the alluvial aquifer. Because the fractures in the bedrock appear to be of aerially limited extent, the actual volume of groundwater available may be limited with larger volumes of groundwater available within the canyon areas where fracturing may be most prevalent and alluvium is saturated.

CLOSURE

This summary of observations and analyses has been prepared in general accordance with accepted professional geotechnical and hydrogeologic principles and practices. This report makes no other warranties, either expressed or implied as to the professional advice or information included in it. Our firm should be notified of any pertinent change in the project, or if conditions are found to differ from those described herein, because this may require a reevaluation of the conclusions. This report has not been prepared for use by parties or projects other than those named or described herein. It may not contain sufficient information for other parties or purposes.

Geo-**L**ogic **A**ssociates

Mark W. Vincent, PG 5767, CEG 1873, CHg 865
Senior Geologist

Attachments: Table 1 - Aquifer Stress Test Results
Figure 1 - Well Location Plan
Figure 2 - Step Test Time Drawdown Plot
Figure 3 - North Well Time Drawdown Plot Pumping
Figure 4 - North Well Time Drawdown Plot Recovery
Figure 5 - South Well Time Drawdown Plot Pumping
Figure 6 - South Well Time Drawdown Plot Recovery
Figure 7 - Thing Valley Well Time Drawdown Pumping
Figure 8 - Thing Valley Well Time Drawdown Recovery
Figure 9 - Geologic Map
Appendix A - Analytical Results from Aquifer Test Program
Appendix B - Department of Water Resources Well Completion Reports

REFERENCES

Cooper, H.H., Jr. and Jacob, C.E., 1946, A Generalized Graphical Method for Evaluating Formation Constants and Summarizing Well Field History, *Transactions, American Geophysical Union*, Vol. 27, No. 4.

Driscoll, D.G., 1986, <u>Groundwater and Wells</u>, Johnson Filtration Systems Inc., St. Paul, Minnesota.

Moench, S.P., 1993, Combining the Neuman and Boulton Models for Flow to a Well in an Unconfined Aquifer, *Ground Water*, Vol. 33, No. 3.

Neuman S.P., 1975, Analysis of Pumping Test Data from Anisotropic Unconfined Aquifers Considering Delayed Yield, *Water Resources Research*, Vol. 11, No. 2, pp. 329-342.

Papadopulos, I.S. and Cooper, H.H., Jr., 1967, Drawdown in a well of large diameter, *Water Resources Research*, vol. 3, pp 241-244.

Schafer, D.C., 1978, Casing Storage Can Affect Pumping Test Data, *Johnson Drillers' Journal*, Jan/Feb, Johnson Division, UOP Inc., St. Paul, Minnesota.

Theis, C.V., 1935, The Relation Between the Lowering of the Piezometric Surface and the Rate and Duration of Discharge of a Well Using Groundwater Storage, *American Geophysical Union Transactions*, Vol. 16, pp. 519-524.

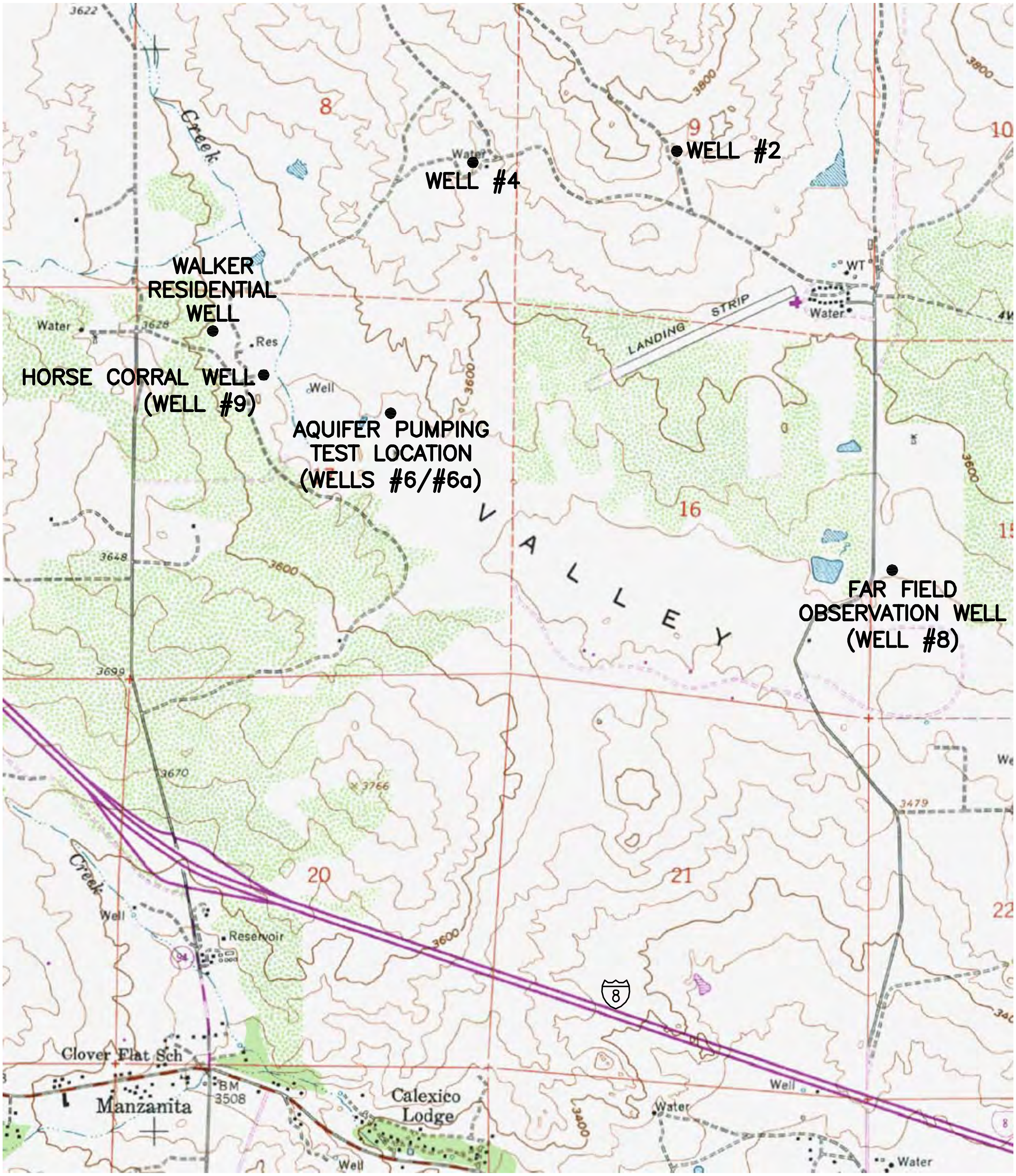
Waterloo Hydrogeologic (co-developed with Thomas Roerich), 2002, AquiferTest version 3.5, Advanced Pumping Test and Slug Test Analytical Software.

Table 1

Aquifer Stress Test Results

Rough Acres Ranch - McCain Valley

Well Designation	Condition	Distance From Pumping Well (feet)	Groundwater Depth from Ground Surface (feet)	Assumed Aquifer Thickness (feet)	Average Pumping Rate (gpm)	Analytical Method	Transmissivity (feet^2/day)	Conductivity (feet/day)	Storativity	Comments
Well #6a	Pumping	1	28	500	50	Cooper-Jacob	6.30E+02	1.26E+00	NA	Match to late data.
Well #6a	Pumping	1	28	500	50	Moench Fracture Flow	1.12E+02	2.25E-01	2.70E-04	Match to late data.
Well #6a	Pumping	1	28	500	50	Moench	1.21E+02	2.43E-01	1.72E-01	Match to late data.
Well #6a	Pumping	1	28	500	50	Neuman	5.69E+01	1.14E-01	1.62E-02	Spec Yld. = 1.62E+02
Well #6a	Pumping	1	28	500	50	Theis	2.69E+01	5.39E-02	1.64E-01	Match to early data.
Well #6a	Pumping	1	28	500	50	Theis	1.51E+02	3.03E-01	3.19E-05	Match to late data.
Well #6a	Pumping	1	28	500	50	Walton	1.11E+02	2.21E-01	7.08E-04	Match to late data.
Well #6a	Recovery	1	28	500	0	Theis Recovery	2.17E-02	4.35E-05	NA	Match to early data.
Well #6a	Recovery	1	28	500	0	Theis Recovery	7.27E+00	1.45E-02	NA	Match to late data.
South Well #6	Pumping	36	27.81	500	50	Cooper-Jacob	2.14E+03	4.28E+00	NA	Match to middle data.
South Well #6	Pumping	36	27.81	500	50	Cooper-Jacob	3.75E+03	7.50E+00	NA	Match to late data.
South Well #7	Pumping	36	27.81	500	50	Moench Fracture Flow	2.95E+03	5.91E+00	4.48E-06	Match to late data.
South Well #6	Pumping	36	27.81	500	50	Moench	1.30E+03	2.60E+00	7.87E-01	Kv=1/10 Kh
South Well #6	Pumping	36	27.81	500	50	Neuman	9.67E+02	1.93E+00	NA	Match to all data.
South Well #6	Pumping	36	27.81	500	50	Theis	3.18E+03	6.36E+00	3.29E-06	Match to late data.
South Well #6	Pumping	36	27.81	500	50	Walton	1.13E+03	2.26E+00	1.47E-03	Match to early data.
South Well #6	Recovery	36	27.81	500	0	Theis Recovery	3.75E-01	7.50E-04	NA	Match to early data.
South Well #6	Recovery	36	27.81	500	0	Theis Recovery	2.23E+00	4.47E-03	NA	Match to late data.
						Average Values	**9.24E+02**	**1.85E+00**	**1.14E-01**	



GRAPHIC SCALE

1000 0 500 1000 2000

(in feet)

1 inch = 2000 ft.

N

REFERENCE: 7.5 MINUTE SERIES (TOPOGRAPHIC) LIVE OAK SPRINGS (1975) CALIFORNIA QUADRANGLE

WELL LOCATION MAP
ROUGH ACRES RANCH AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

Geo-Logic ASSOCIATES

DRAWN BY: VL	DATE: NOVEMBER 2010	JOB NO. 2010-005

Figure 2
Step Drawdown Test
Well #6a - Pumping Well
Rough Acres Ranch, McCain Valley

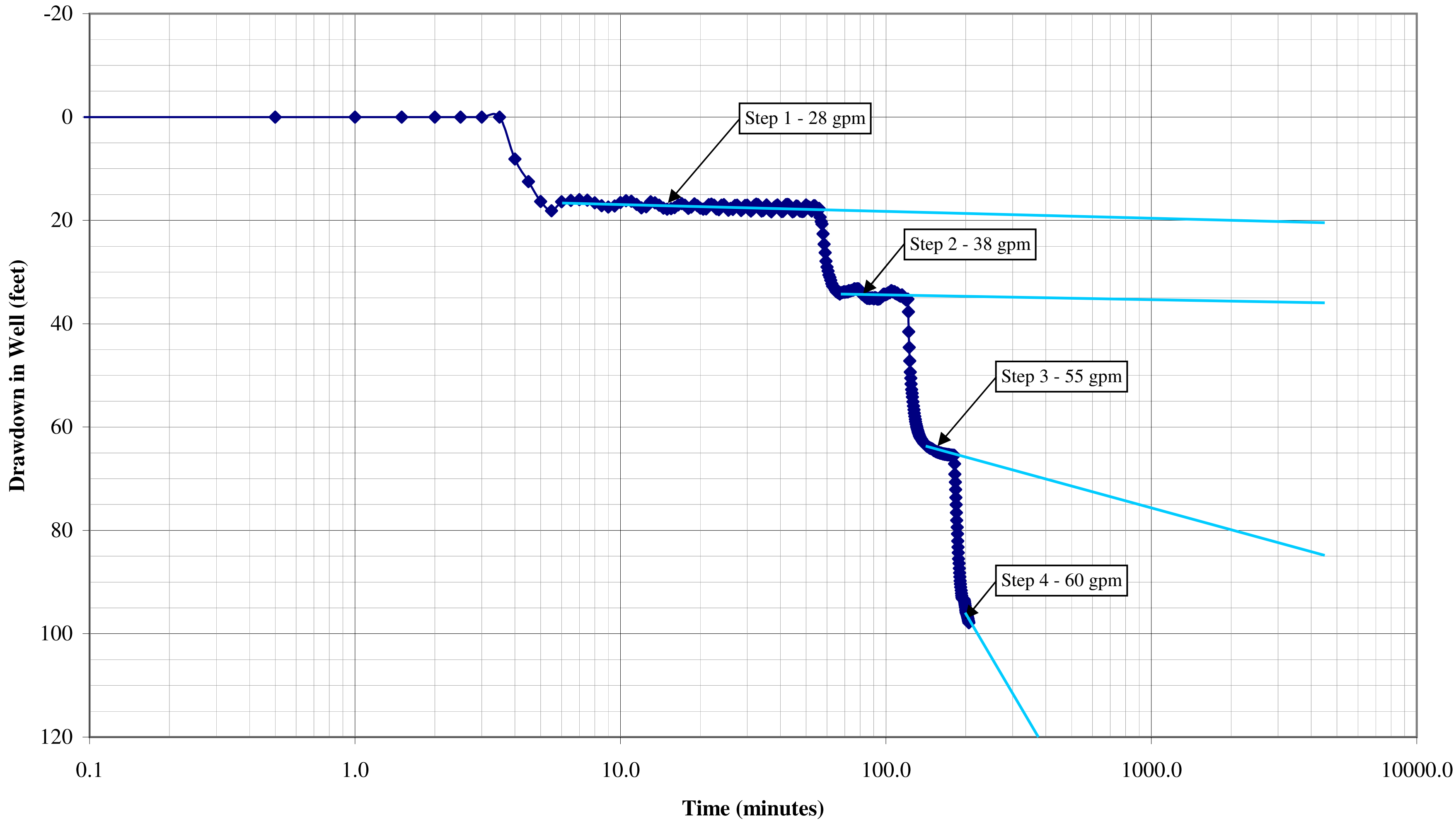


Figure 3
Drawdown in Pumping Well during 72-hour Pumping Test at 50 gpm
North Well at Rough Acres Ranch

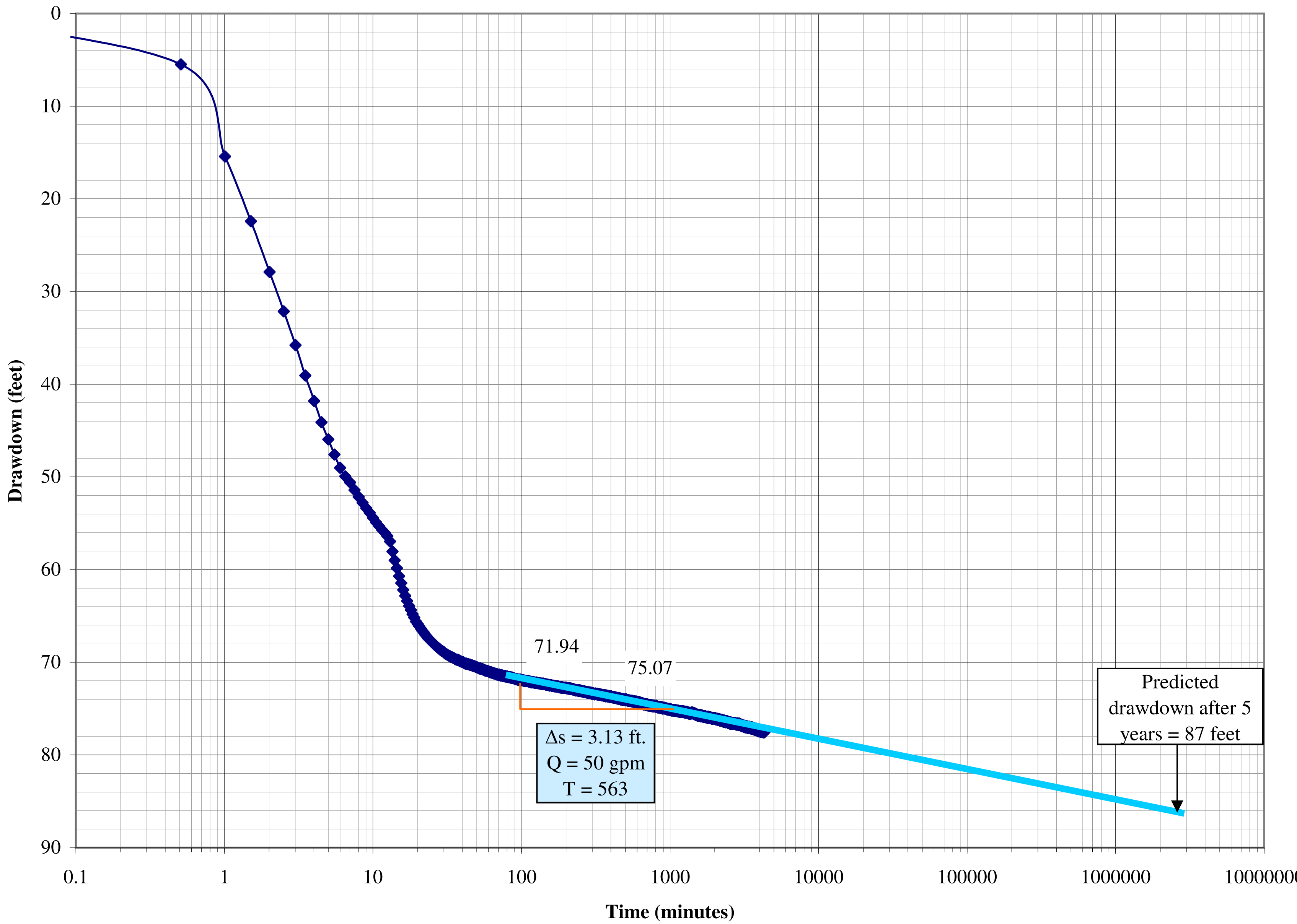


Figure 4
Residual Drawdown Plot
Pumping Well #6a

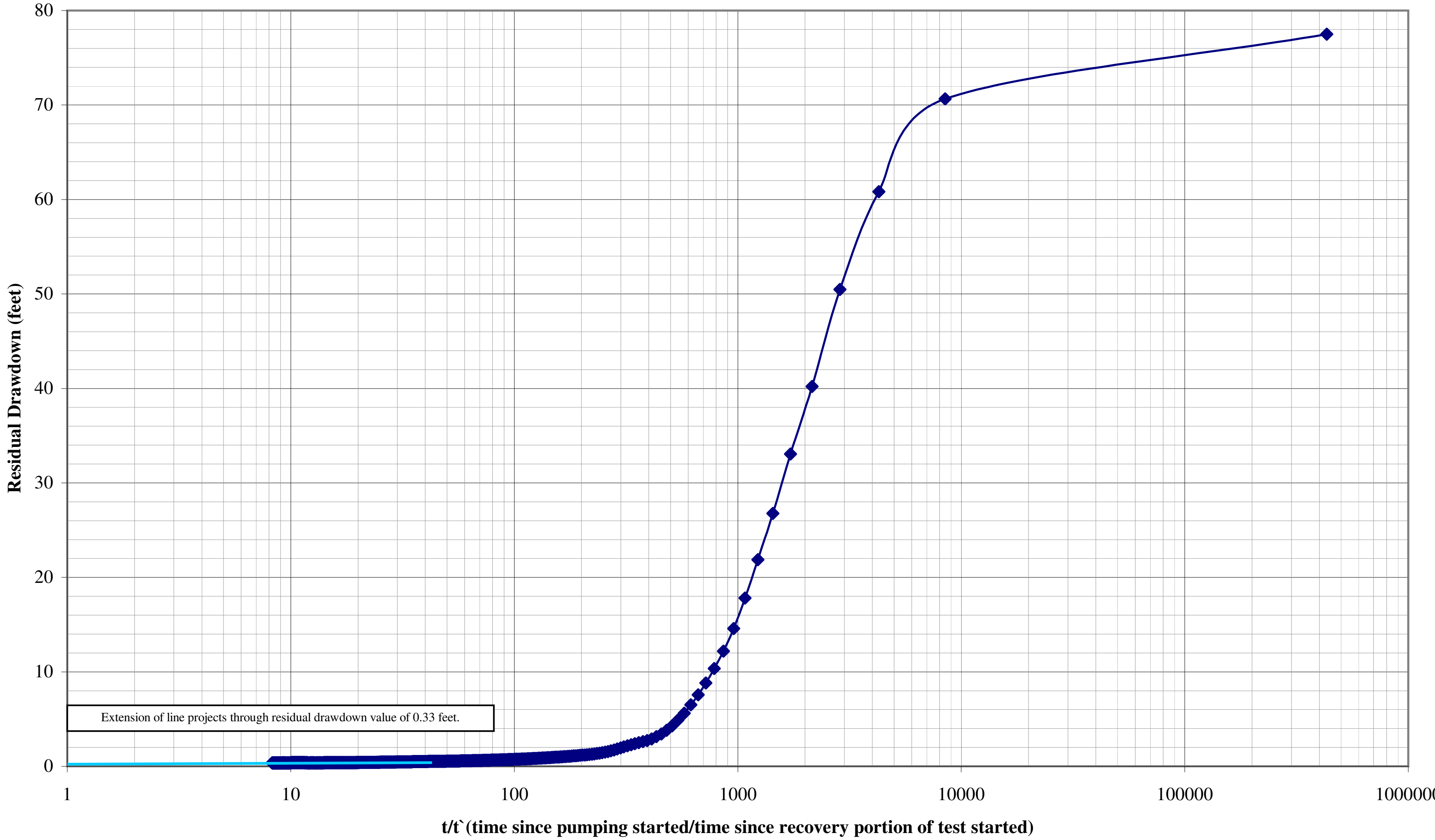


Figure 5
Well #6 - Observation Well
Time-Drawdown Plot
Rough Acres Ranch

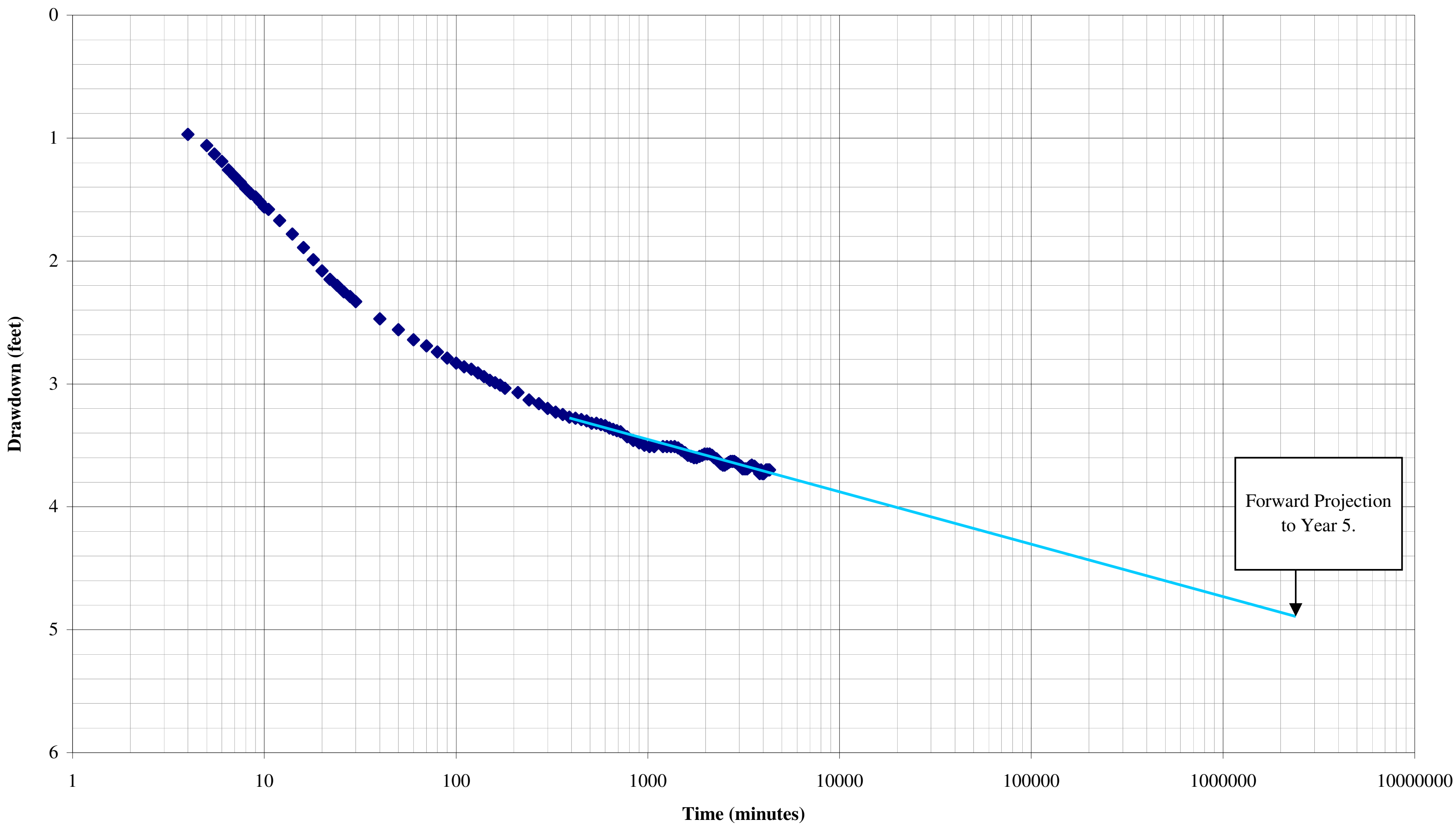


Figure 6
South Well - Observation Well
Residual Drawdown Plot
Rough Acres Ranch

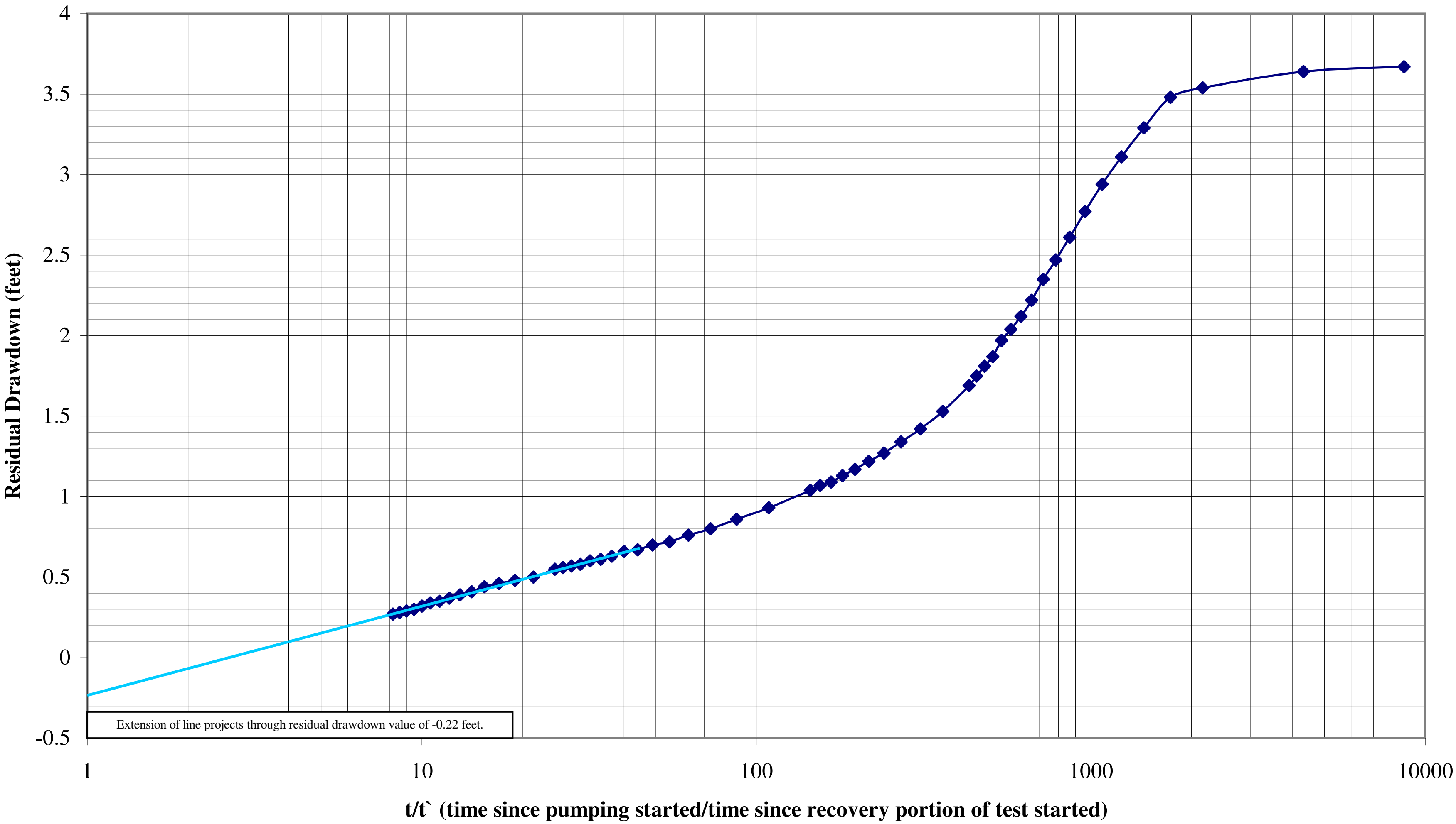


Figure 7
Horse Corral Well
(Observation Well)
Time-Drawdown Plot

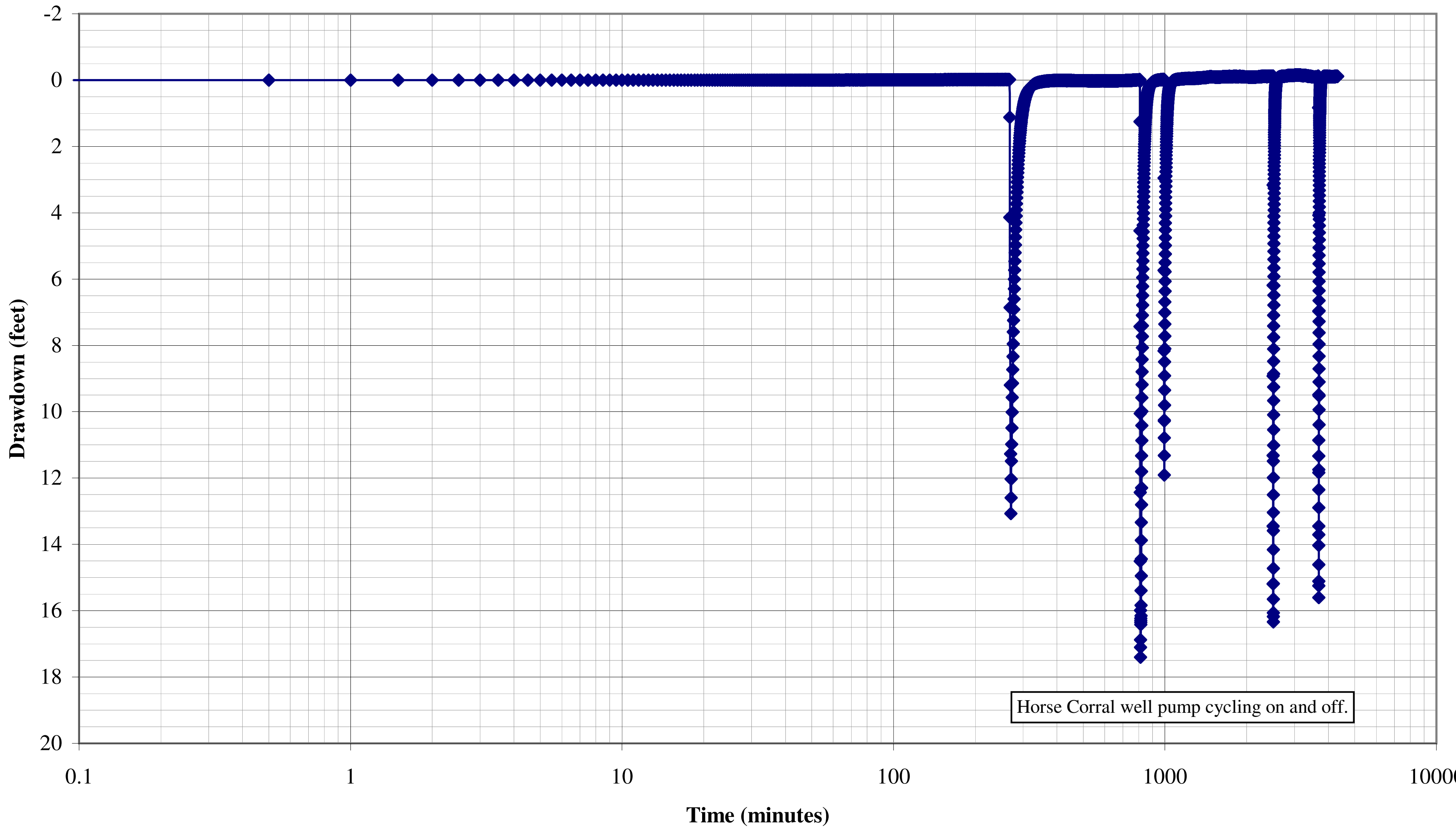


Figure 8
Well #2 - Observation Well
Distance-Drawdown Plot
Rough Acres Ranch

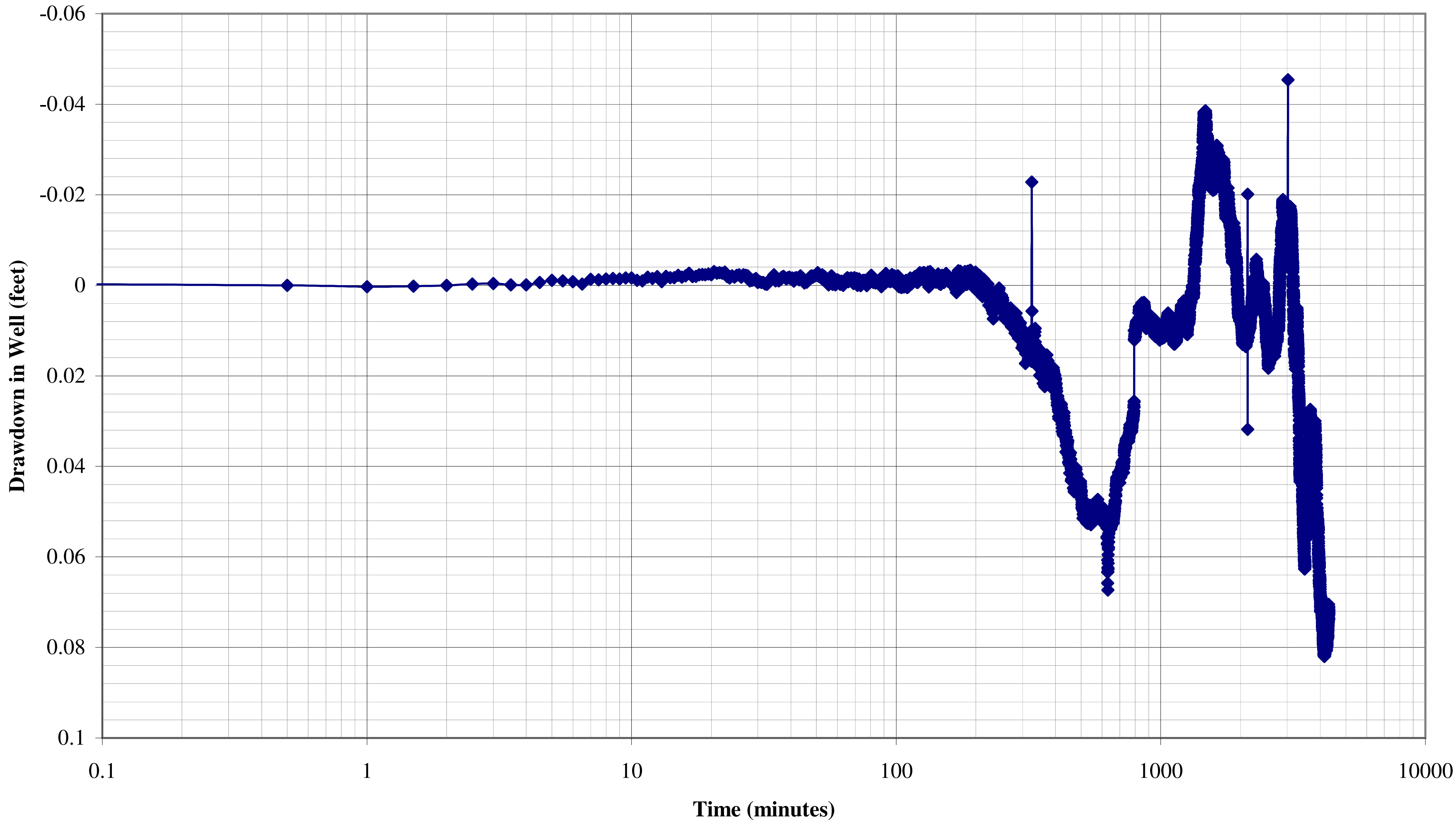
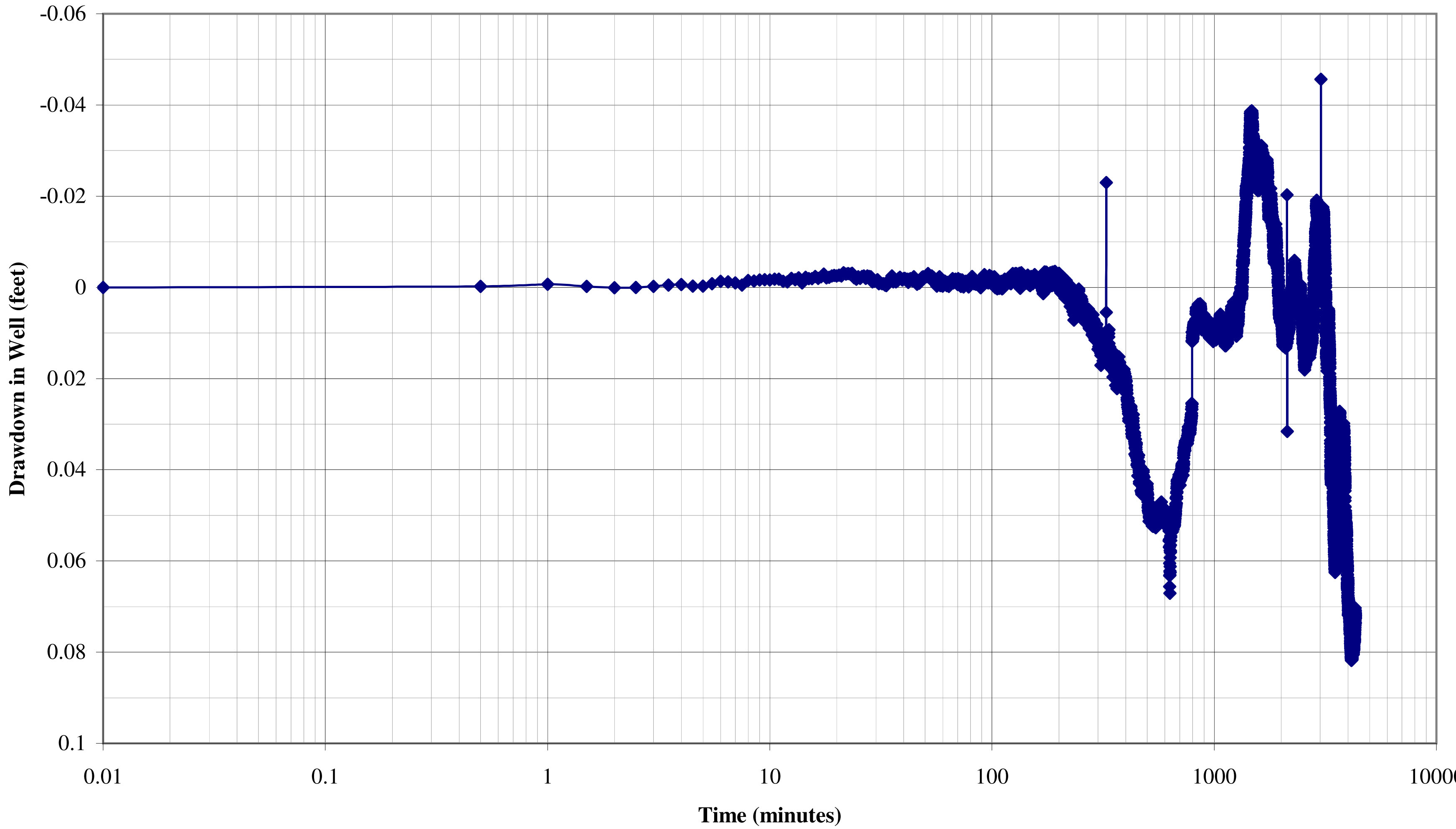
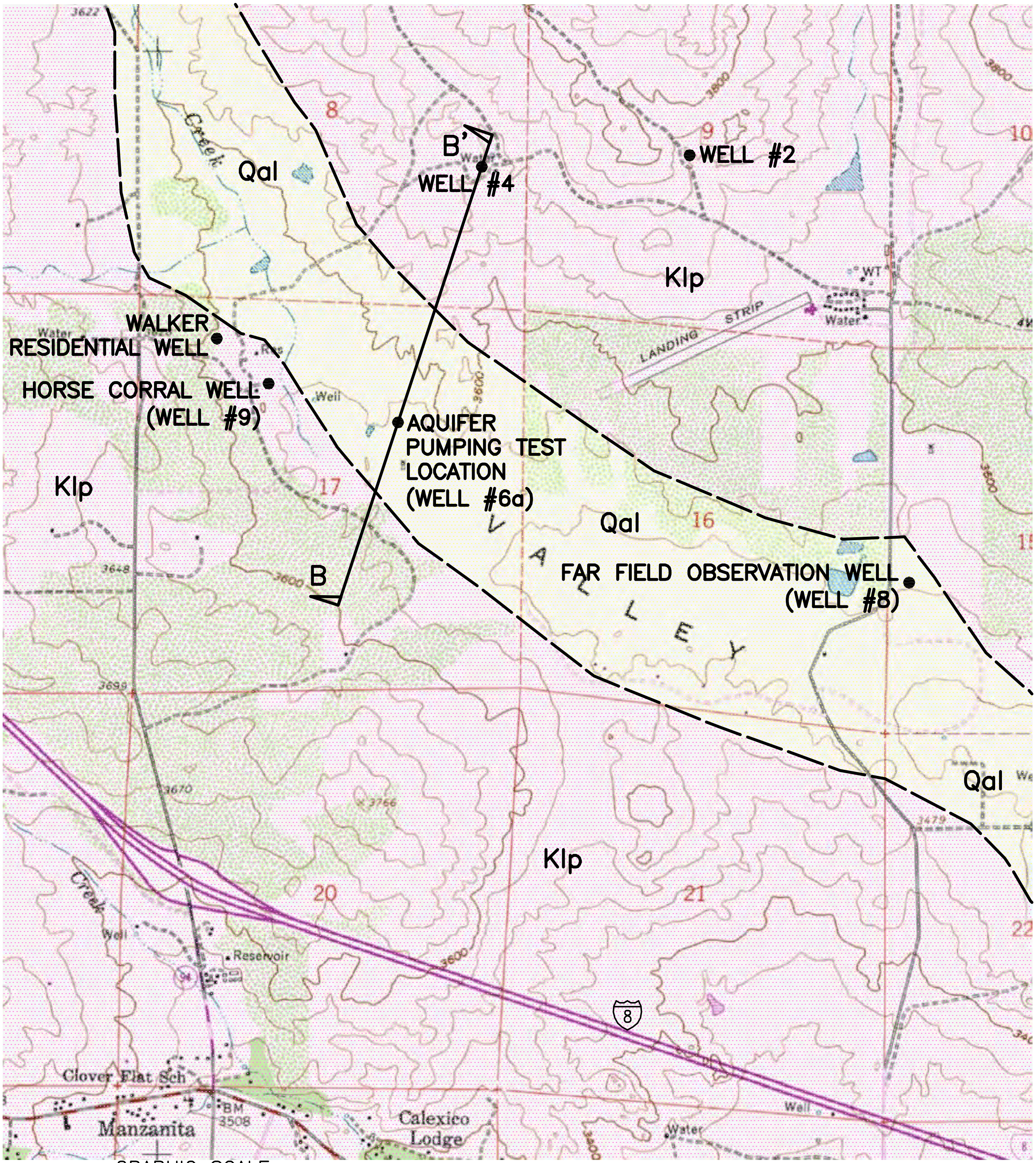


Figure 9
Well #8 Far Field - Observation Well
Time-Drawdown Plot
Rough Acres Ranch





GRAPHIC SCALE

1000 0 500 1000 2000

(in feet)

1 inch = 2000 ft.

N

REFERENCE: PRELIMINARY GEOLOGIC MAP OF EL CAJON 30' x 60' QUADRANGLE, SOUTHERN CALIFORNIA, V. R. TODD, 2004

EXPLANATION:

Qal	ALLUVIUM
Klp	TONALITE OF LA POSTA (EARLY AND LATE CRETACEOUS)
— — —	APPROXIMATE GEOLOGIC CONTACT
B B'	CROSS-SECTION LOCATION

GEOLOGIC MAP
ROUGH ACRES RANCH AQUIFER TEST SITE

TULE WIND PROJECT
SAN DIEGO COUNTY, CA

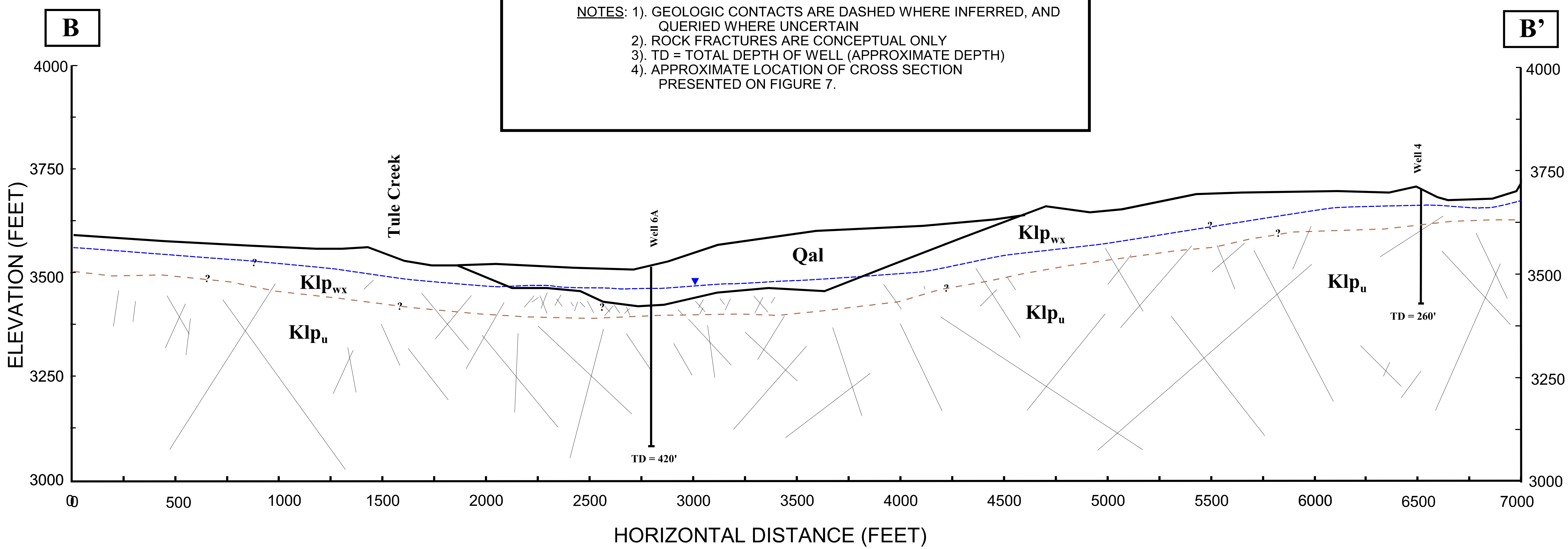
Geo-Logic
ASSOCIATES

DRAWN BY: VL	DATE: NOVEMBER 2010	JOB NO. 2010-005

LEGEND

Qal	RECENT ALLUVIUM
Klp$_{wx}$	LA POSTA TONALITE, WEATHERED
Klb$_{u}$	LA POSTA TONALITE, UNWEATHERED
	APPROXIMATE GROUNDWATER TABLE
	ROCK FRACTURES (SCHEMATIC ONLY)

NOTES: 1). GEOLOGIC CONTACTS ARE DASHED WHERE INFERRED, AND QUERIED WHERE UNCERTAIN
2). ROCK FRACTURES ARE CONCEPTUAL ONLY
3). TD = TOTAL DEPTH OF WELL (APPROXIMATE DEPTH)
4). APPROXIMATE LOCATION OF CROSS SECTION PRESENTED ON FIGURE 7.



NORTH 18° EAST

HORIZONTAL SCALE: 1 INCH = 500 FEET
VERTICAL SCALE: 1 INCH = 250 FEET
2x VERTICAL EXAGGERATION
(11 X 17 INCH FORMAT ONLY)

References: USGS, 1975, 7.5' Live Oak Springs, CA Quadrangle.

CONCEPTUAL HYDROGEOLOGIC CROSS SECTION

ROUGH ACRES STUDY AREA
SAN DIEGO COUNTY, CALIFORNIA

Geo-Logic ASSOCIATES

Draft	Date	Project No.
JGF	OCT 2010	2010-0005

Appendix A
Analytical Results from Aquifer Test Program

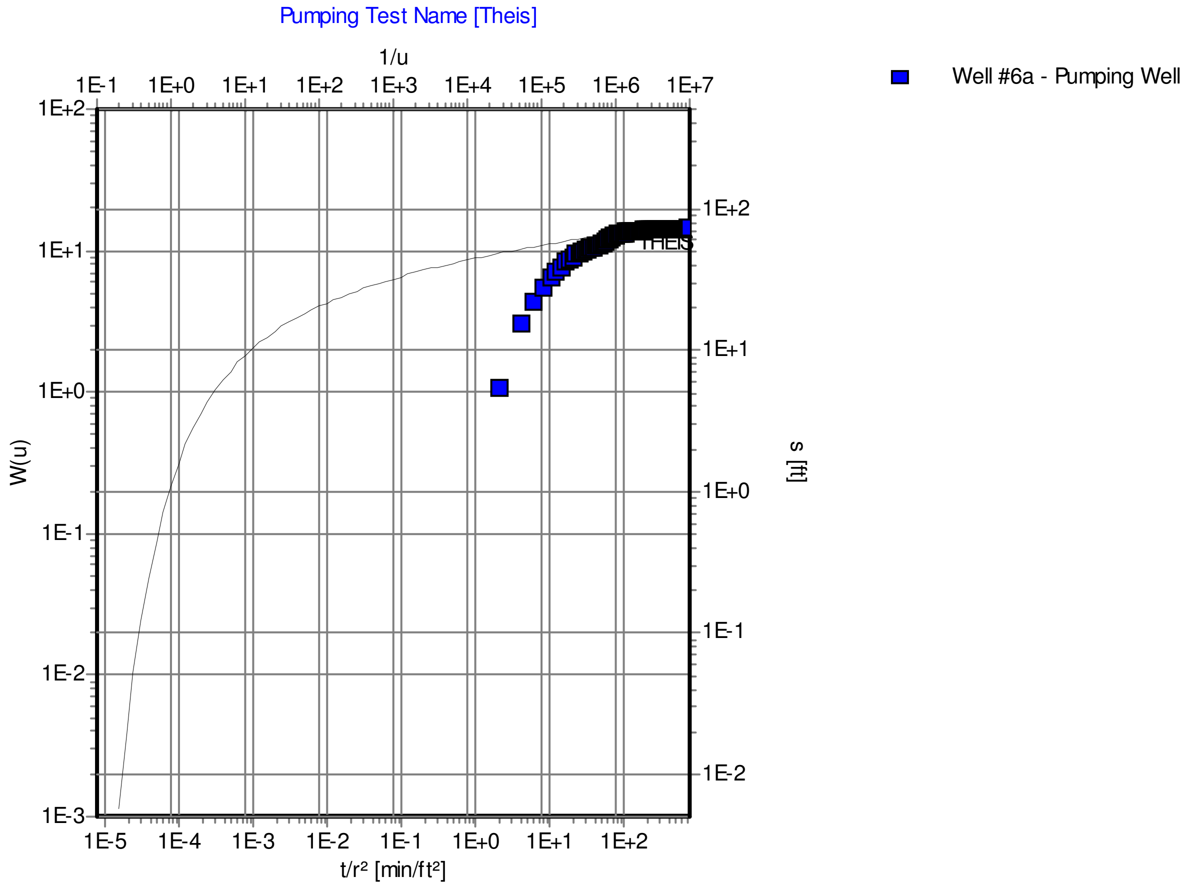
Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Rough Acres

Number:

Client:



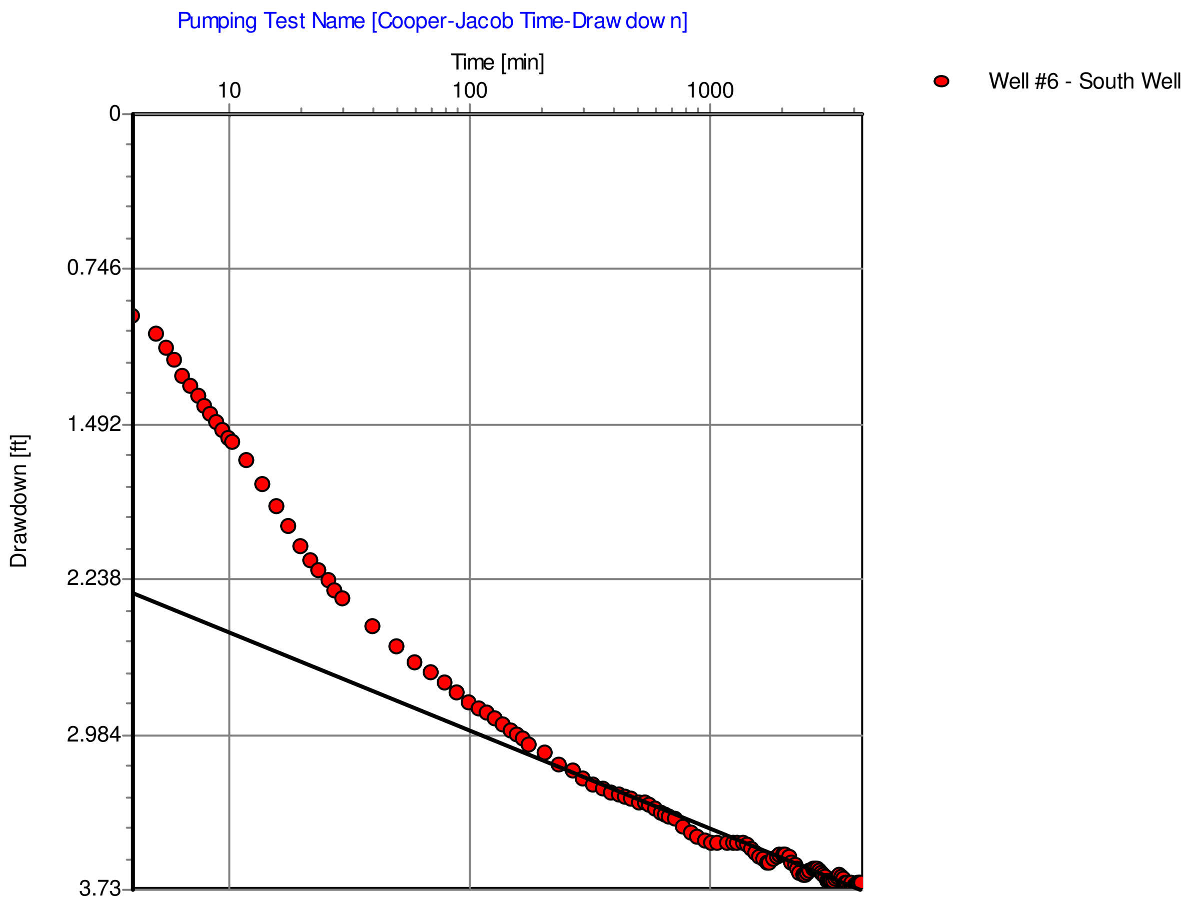
Pumping Test:	**Pumping Test Name**			
Analysis Method:	**Theis**			
Analysis Results:	Transmissivity:	1.51E+2 [ft²/d]	Conductivity:	3.03E-1 [ft/d]
	Storativity:	3.19E-5		
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Confined Aquifer	
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		
Comments:	Match to late time data. Pumping Well.			

Evaluated by: MWV

Evaluation Date: 11/18/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report	
Project:	Rough Acres
Number:	
Client:	



Pumping Test: **Pumping Test Name**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:				
	Transmissivity:	3.75E+3 [ft²/d]	Conductivity:	7.50E+0 [ft/d]
	Storativity:	2.28E-7		

Test parameters:				
	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Confined Aquifer	
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		

Comments: Match to latest time data. Observation Well.

Evaluated by: MWV

Evaluation Date: 11/18/2010

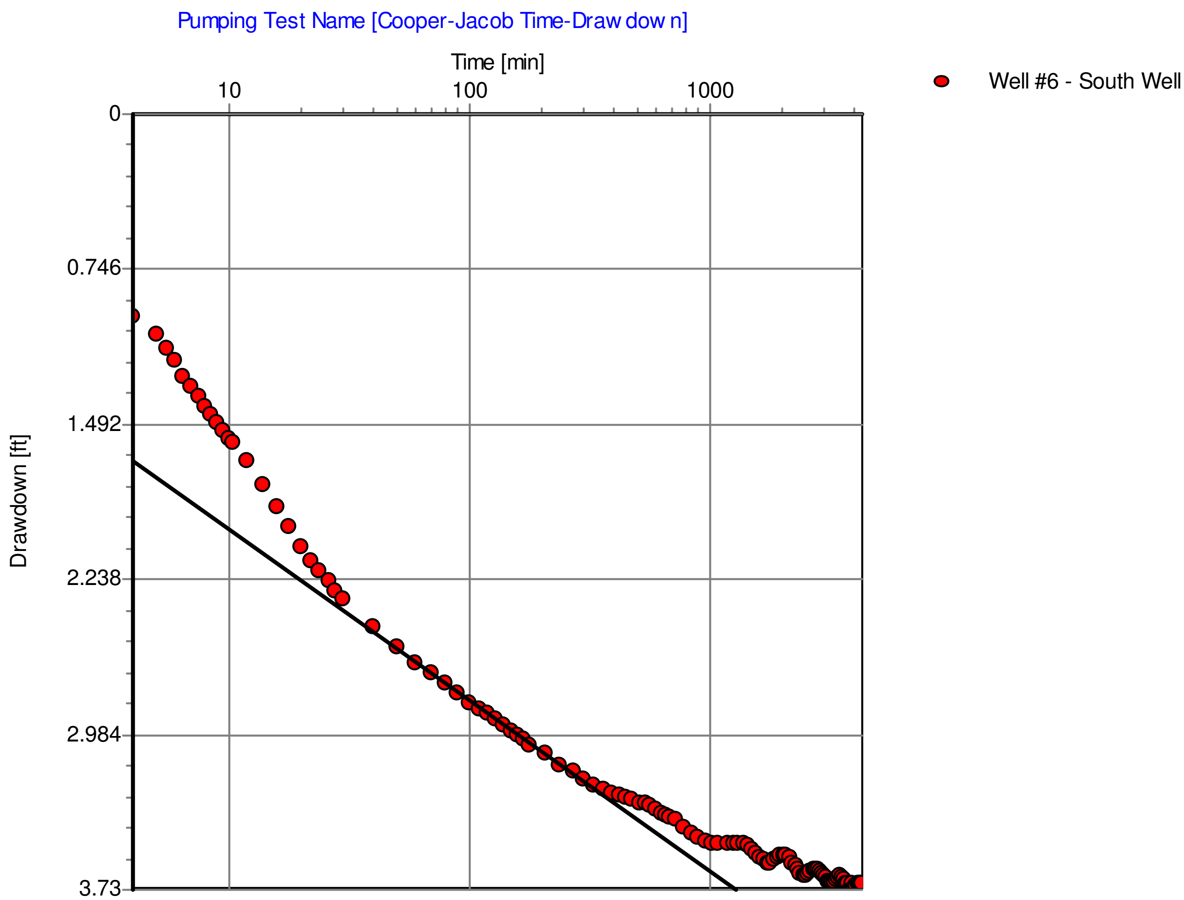
Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Rough Acres

Number:

Client:



Pumping Test: **Pumping Test Name**

Analysis Method: **Cooper-Jacob Time-Drawdown**

Analysis Results:	Transmissivity:	2.14E+3 [ft²/d]	Conductivity:	4.28E+0 [ft/d]
	Storativity:	1.01E-4		

Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Confined Aquifer	
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		

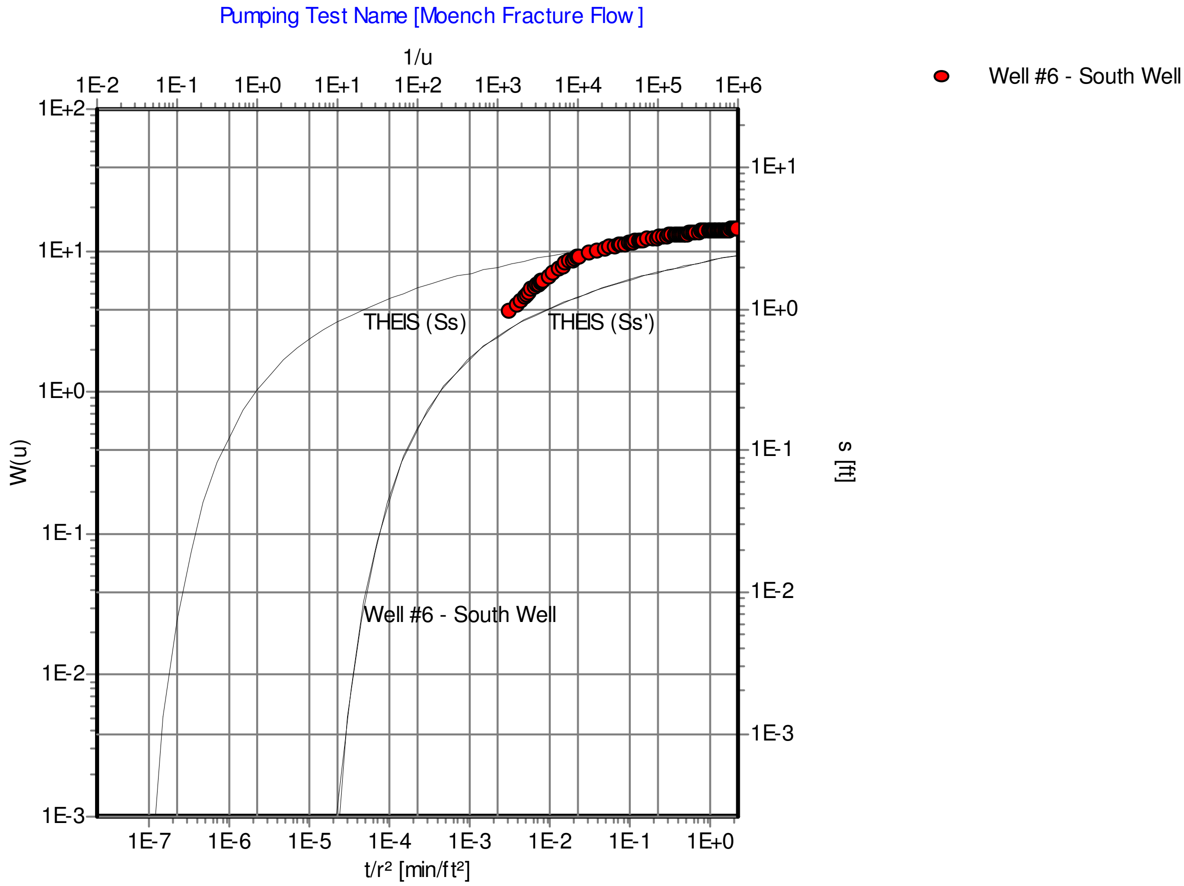
Comments: Match to middle time data. Observation Well.

Evaluated by: MWV

Evaluation Date: 11/18/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

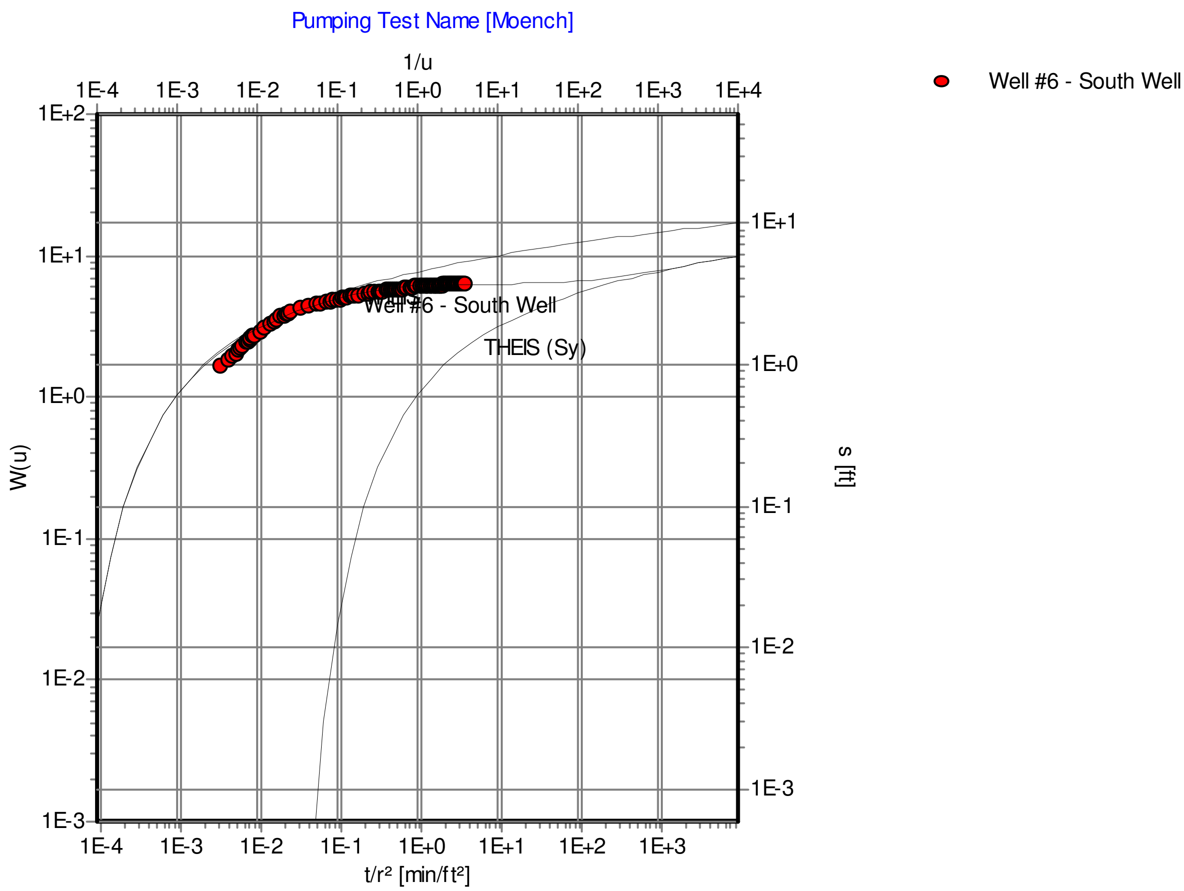
Pumping Test Analysis Report
Project: Rough Acres
Number:
Client:



Pumping Test:	**Pumping Test Name**			
Analysis Method:	**Moench Fracture Flow**			
Analysis Results:	Transmissivity:	2.95E+3 [ft²/d]	Conductivity:	5.91E+0 [ft/d]
	Storativity:	4.48E-6		
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	b:	357 [ft]
	Screen length:	310 [ft]	Kv/Kh:	0.1
	Boring radius:	0.271 [ft]	C:	0.231
	Discharge Rate:	50 [U.S. gal/min]	K(block)/K(Skin):	0.1
	Ss(blk)/Ss(fract):	200	K(block)/K(fracture):	0.1
Comments:	Match to late time data.			

Evaluated by: MWV
Evaluation Date: 11/18/2010

Waterloo Hydrogeologic, Inc. 460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798	**Pumping Test Analysis Report** Project: Rough Acres Number: Client:



Pumping Test: **Pumping Test Name**

Analysis Method: **Moench**

Analysis Results:				
	Transmissivity:	1.30E+3 [ft²/d]	Conductivity:	2.60E+0 [ft/d]
	Storativity:	7.87E-1	Conductivity (vertical):	2.60E-1 [ft/d]

Test parameters:				
	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Unconfined Aquifer	
	Screen length:	310 [ft]	S/Sy:	0.001
	Boring radius:	0.271 [ft]	Kv/Kh:	0.1
	Discharge Rate:	50 [U.S. gal/min]	Gamma:	1E9
	b:	357 [ft]		

Comments: Match to late time data.

Evaluated by: MWV

Evaluation Date: 11/18/2010

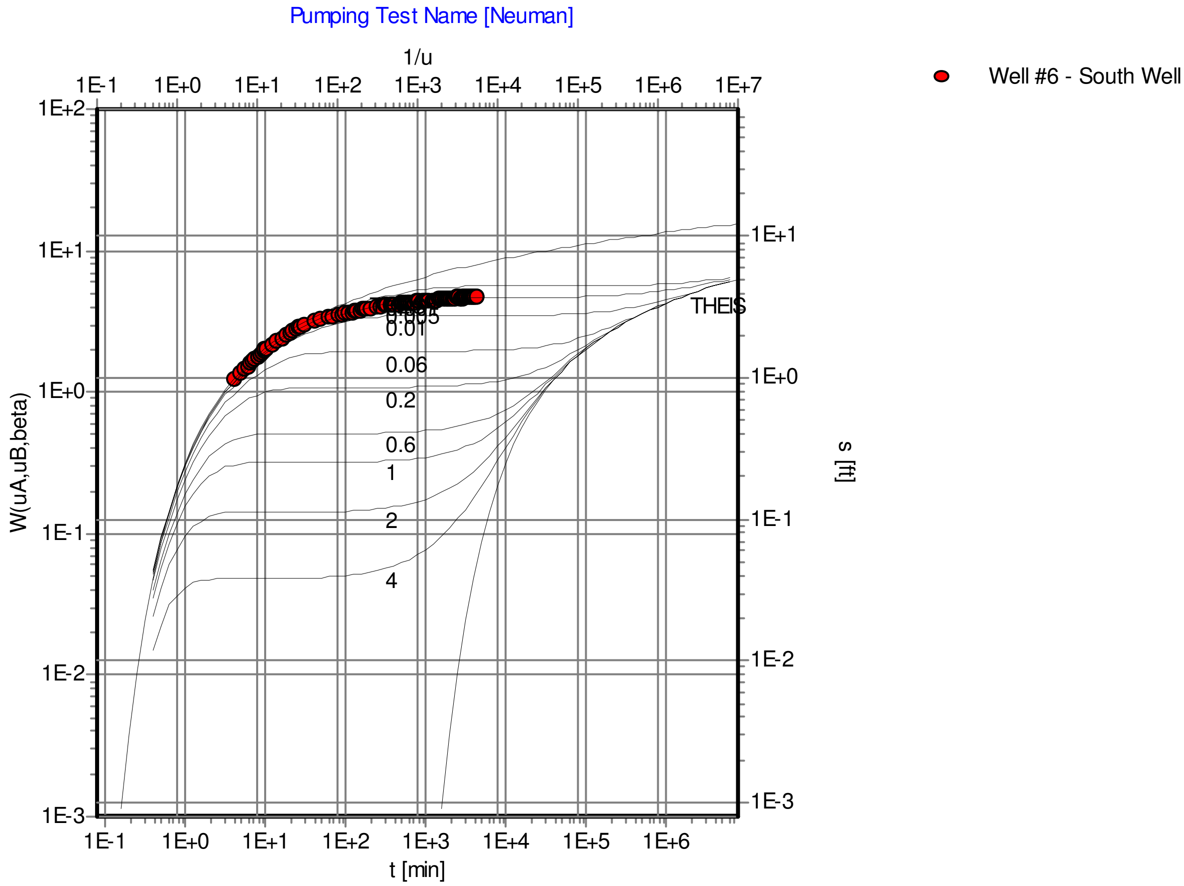
Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Rough Acres

Number:

Client:



Pumping Test:	**Pumping Test Name**			
Analysis Method:	**Neuman**			
Analysis Results:	Transmissivity:	9.67E+2 [ft²/d]	Conductivity:	1.93E+0 [ft/d]
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Beta:	0.005
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		
	LOG(Sy/S):	4		
Comments:	Match to entire data set.			

Evaluated by: MWV

Evaluation Date: 11/18/2010

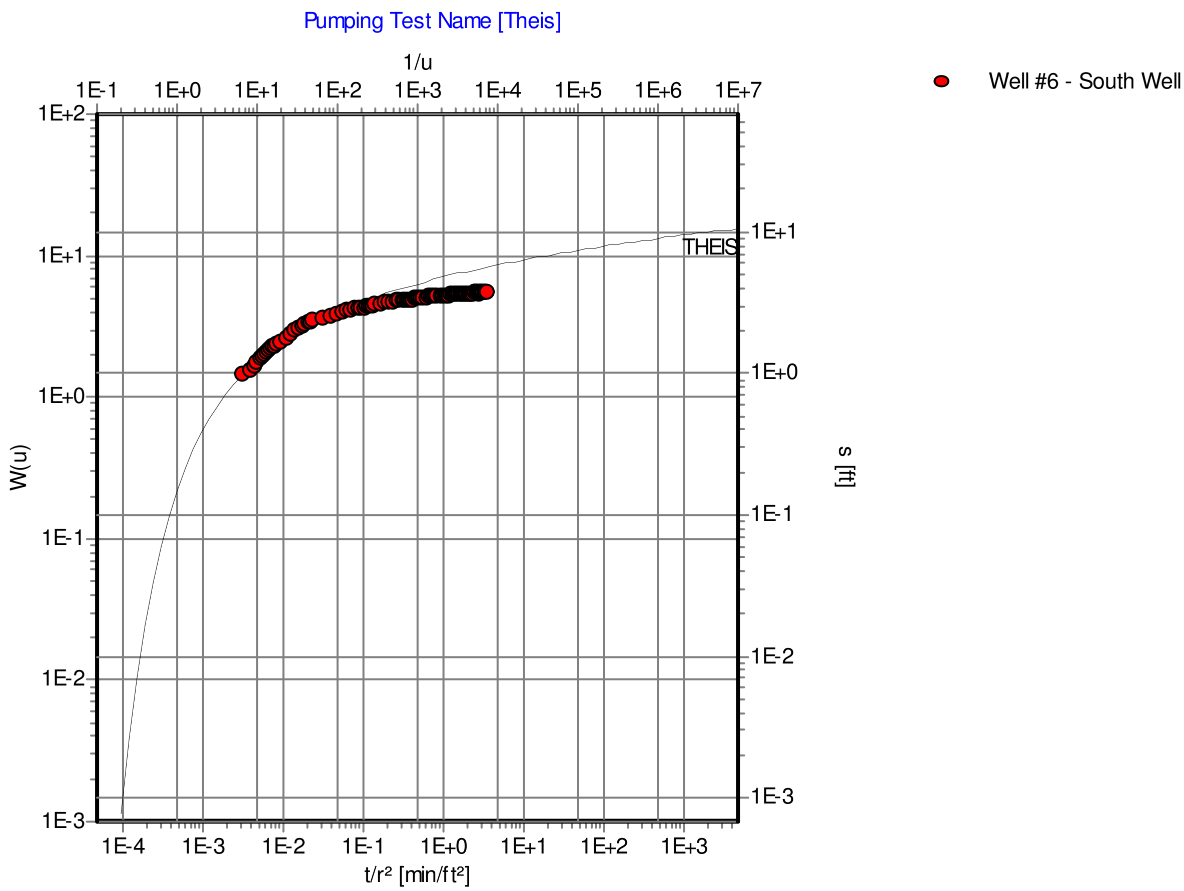
Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Rough Acres

Number:

Client:

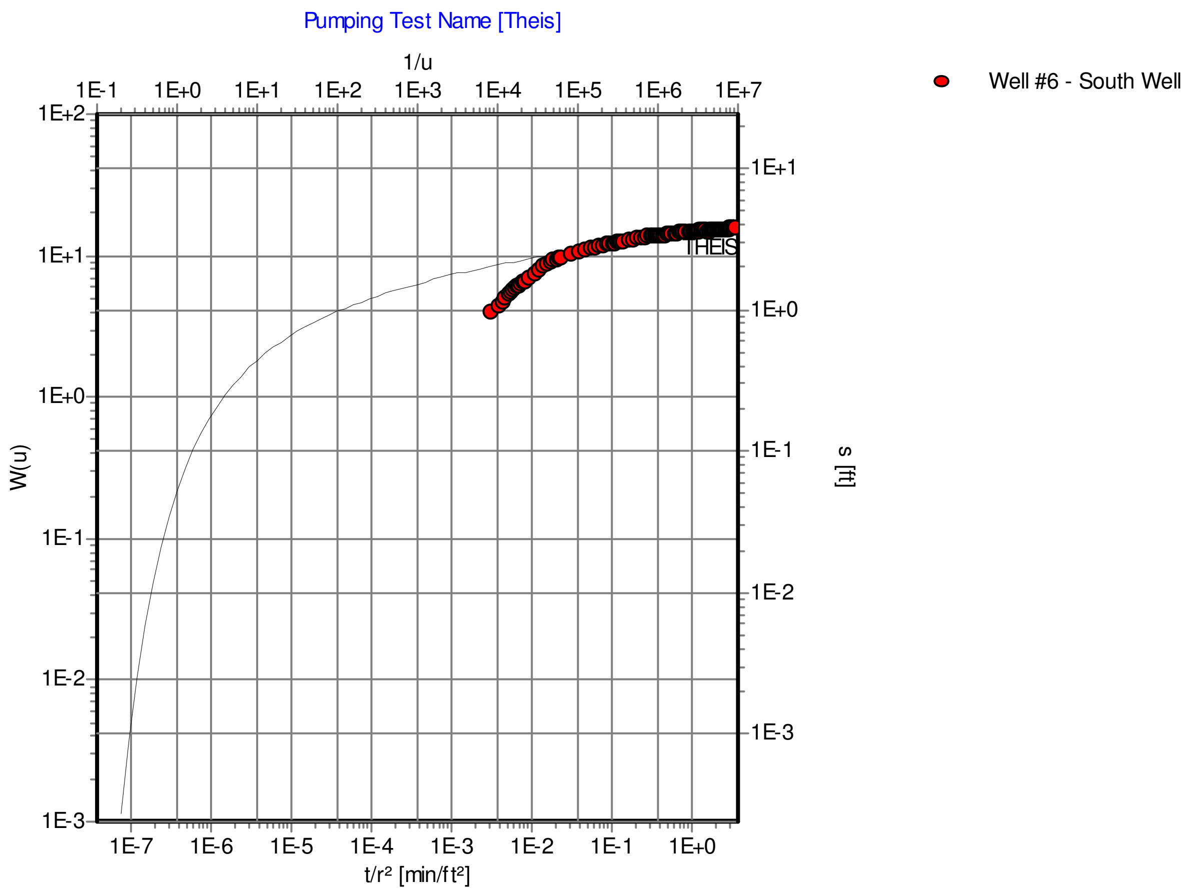


Pumping Test:	**Pumping Test Name**			
Analysis Method:	**Theis**			
Analysis Results:	Transmissivity:	1.13E+3 [ft²/d]	Conductivity:	2.26E+0 [ft/d]
	Storativity:	1.47E-3		
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Confined Aquifer	
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		
Comments:	Match to early time data. Observation Well.			

Evaluated by: MWV

Evaluation Date: 11/18/2010

Waterloo Hydrogeologic, Inc. 460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798	**Pumping Test Analysis Report** Project: Rough Acres Number: Client:



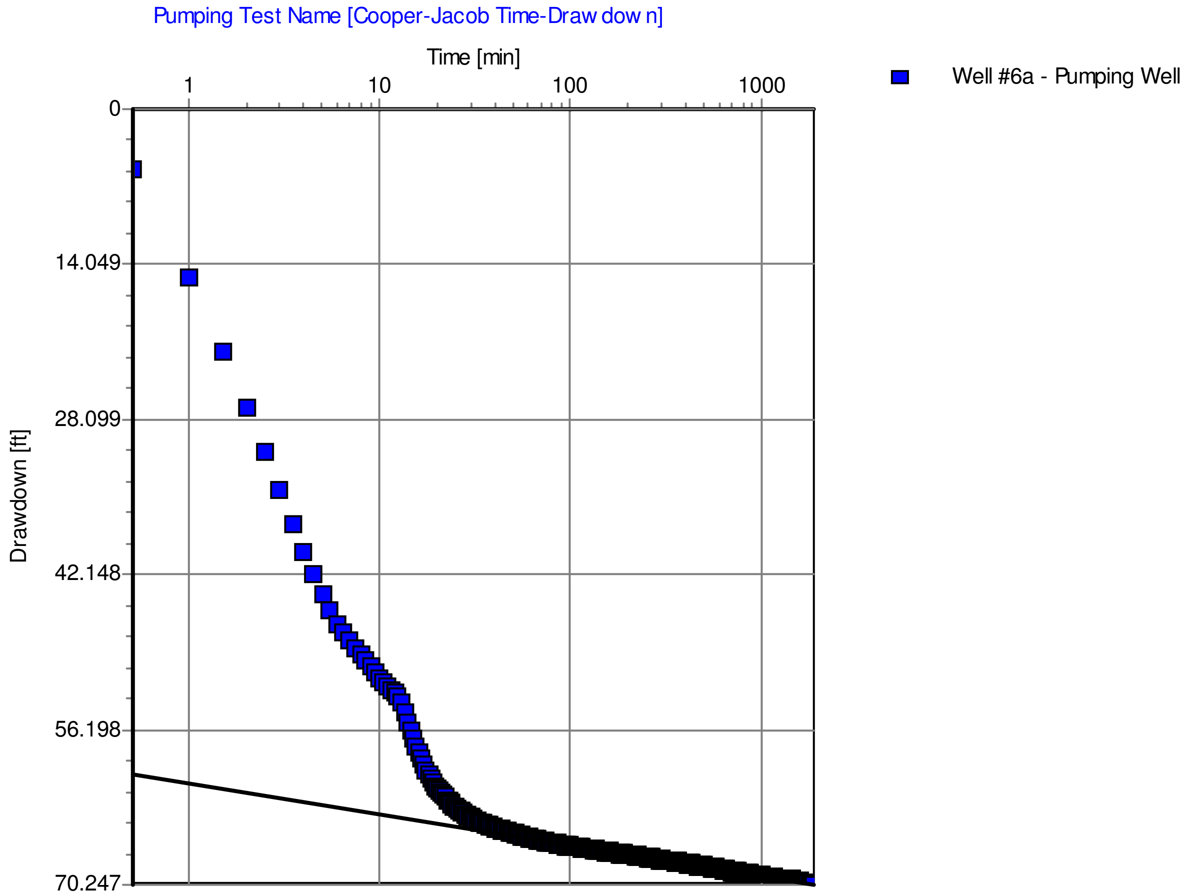
Pumping Test:	**Pumping Test Name**			
Analysis Method:	**Theis**			
Analysis Results:	Transmissivity:	3.18E+3 [ft²/d]	Conductivity:	6.36E+0 [ft/d]
	Storativity:	3.29E-6		
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Confined Aquifer	
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		
Comments:	Match to late time data.			

Evaluated by: MWV

Evaluation Date: 11/18/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

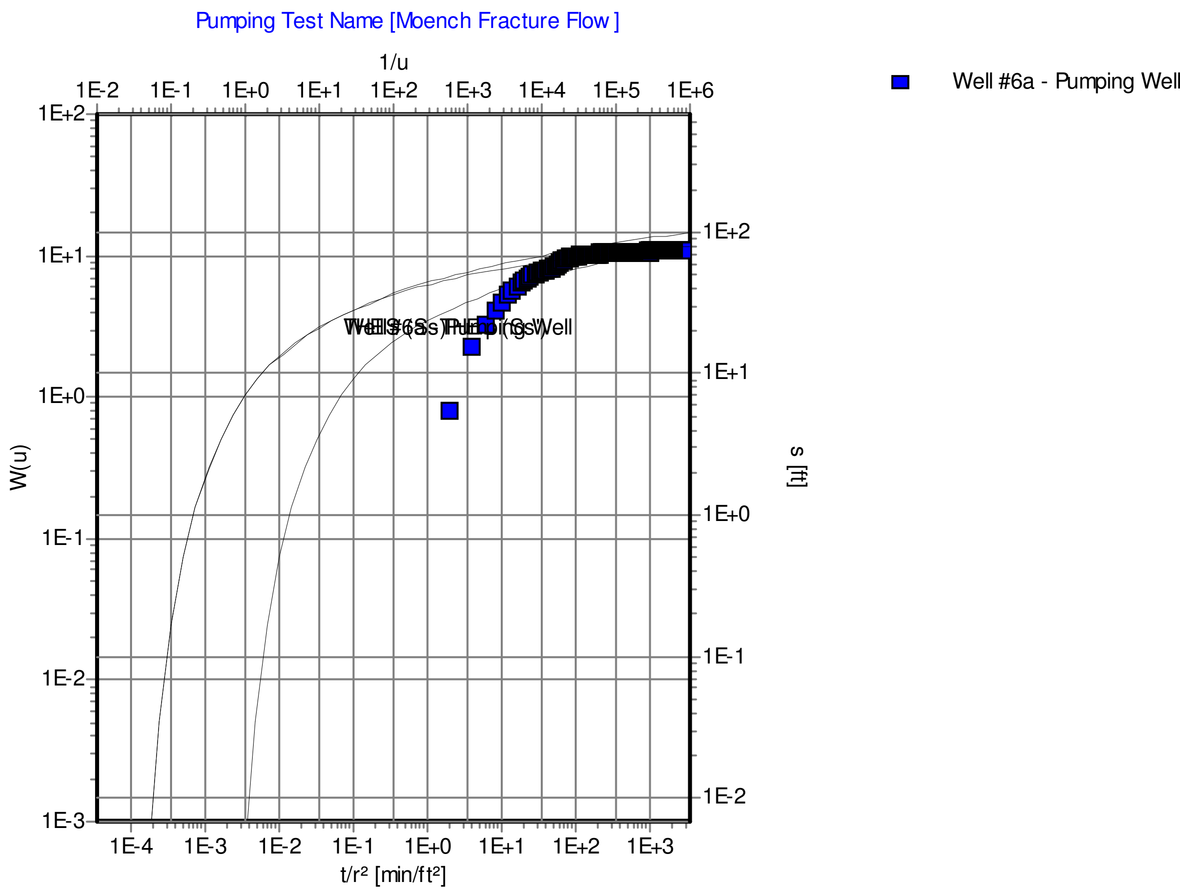
Pumping Test Analysis Report
Project: Rough Acres
Number:
Client:



Pumping Test:	**Pumping Test Name**			
Analysis Method:	**Cooper-Jacob Time-Drawdown**			
Analysis Results:	Transmissivity:	6.30E+2 [ft²/d]	Conductivity:	1.26E+0 [ft/d]
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Unconfined Aquifer	
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		
Comments:	Match to late time data.			

Evaluated by: MWV
Evaluation Date: 11/17/2010

Waterloo Hydrogeologic, Inc. 460 Philip Street - Suite 101 Waterloo, Ontario, Canada Phone: +1 519 746 1798	**Pumping Test Analysis Report** Project: Rough Acres Number: Client:



Pumping Test:	**Pumping Test Name**
Analysis Method:	**Moench Fracture Flow**

Analysis Results:	Transmissivity:	1.12E+2 [ft²/d]	Conductivity:	2.25E-1 [ft/d]
	Storativity:	2.70E-4		

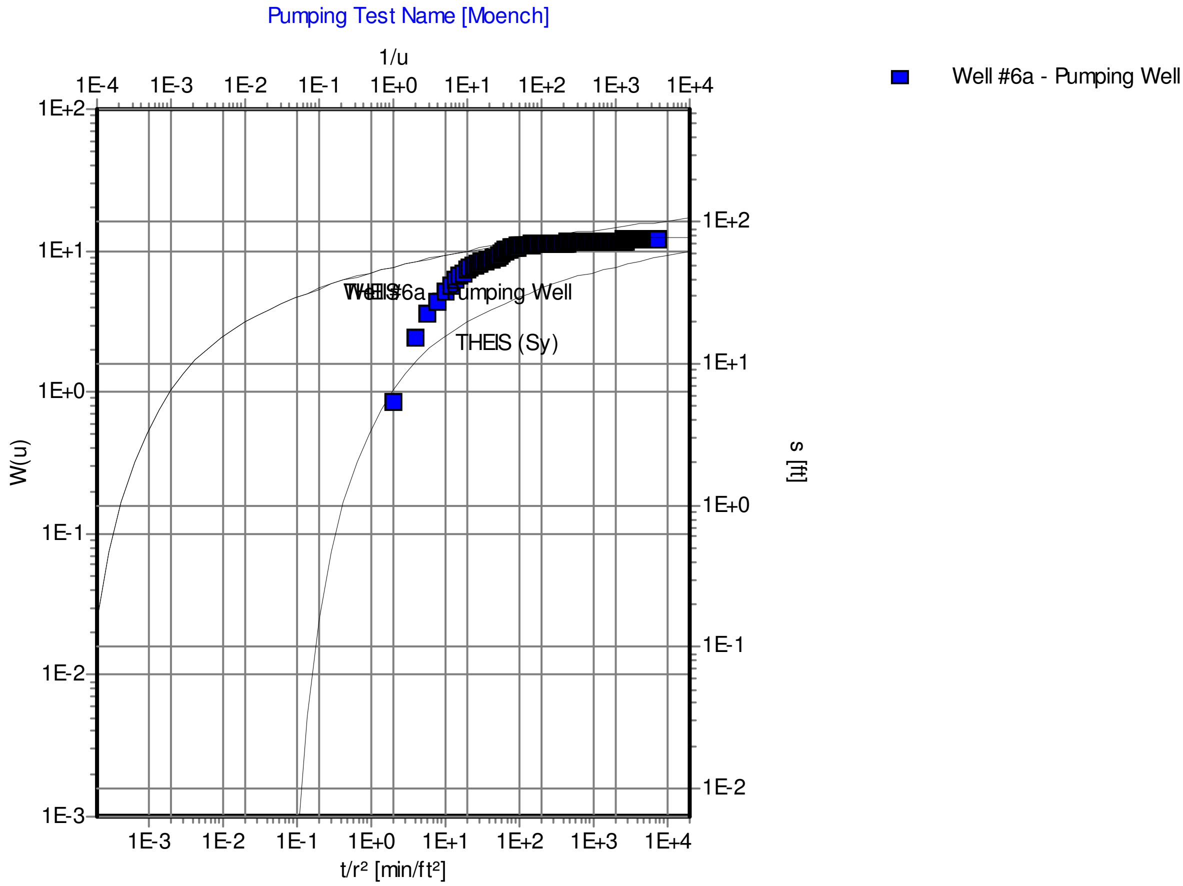
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	b:	357 [ft]
	Screen length:	310 [ft]	Kv/Kh:	1
	Boring radius:	0.271 [ft]	C:	0.231
	Discharge Rate:	50 [U.S. gal/min]	K(block)/K(Skin):	0.1
	Ss(blk)/Ss(fract):	20	K(block)/K(fracture):	0.1

Comments: Match to late time data.

Evaluated by: MWV

Evaluation Date: 11/17/2010

Waterloo Hydrogeologic, Inc.	**Pumping Test Analysis Report**
460 Philip Street - Suite 101	Project: Rough Acres
Waterloo, Ontario, Canada	Number:
Phone: +1 519 746 1798	Client:



Pumping Test: **Pumping Test Name**

Analysis Method: **Moench**

Analysis Results:				
	Transmissivity:	1.21E+2 [ft²/d]	Conductivity:	2.43E-1 [ft/d]
	Storativity:	1.72E-1	Conductivity (vertical):	2.43E-1 [ft/d]

Test parameters:				
	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Unconfined Aquifer	
	Screen length:	310 [ft]	S/Sy:	0.001
	Boring radius:	0.271 [ft]	Kv/Kh:	1
	Discharge Rate:	50 [U.S. gal/min]	Gamma:	1E9
	b:	357 [ft]		

Comments:

Evaluated by:

Evaluation Date: 11/17/2010

Waterloo Hydrogeologic, Inc.

460 Philip Street - Suite 101

Waterloo, Ontario, Canada

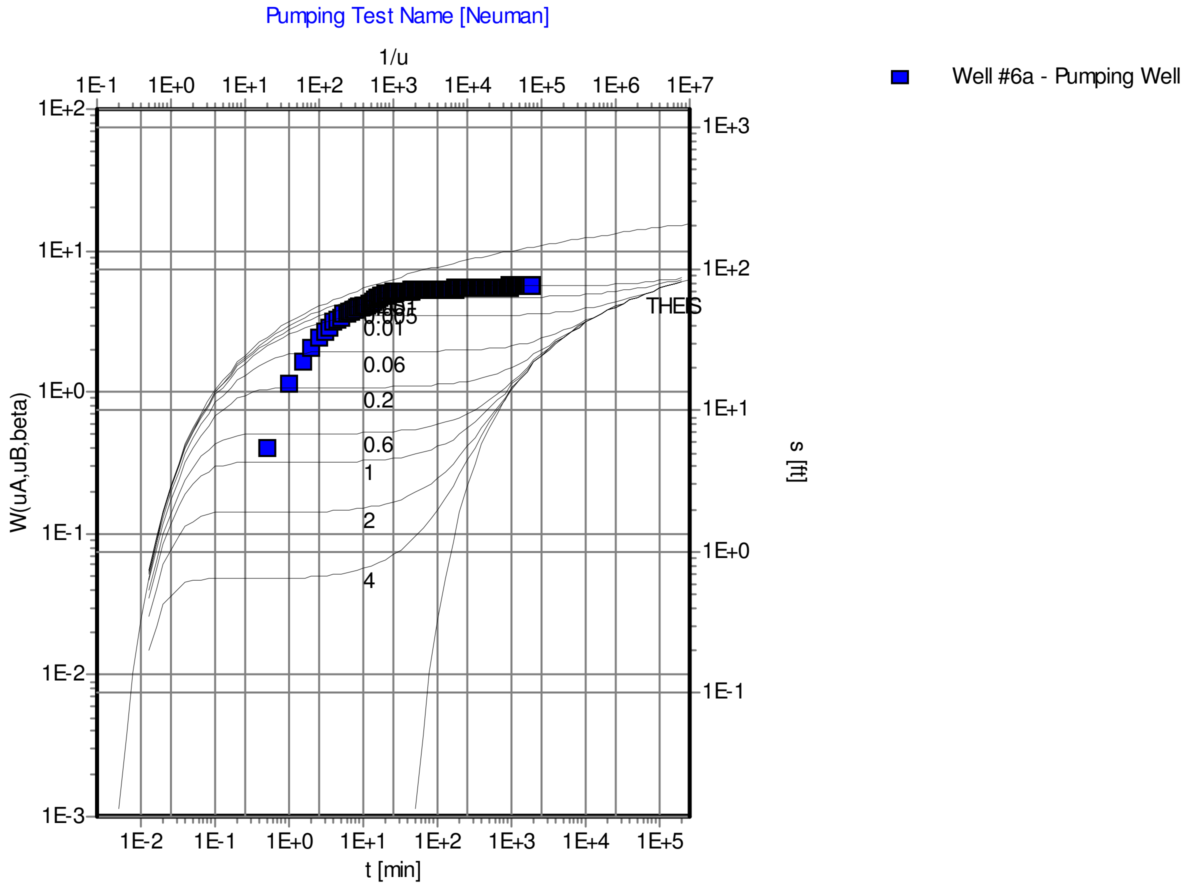
Phone: +1 519 746 1798

Pumping Test Analysis Report

Project: Rough Acres

Number:

Client:



Pumping Test: **Pumping Test Name**

Analysis Method: **Neuman**

Analysis Results:	Transmissivity:	5.69E+1 [ft²/d]	Conductivity:	1.14E-1 [ft/d]
	Storativity:	1.62E-2	Specific Yield:	1.62E+2

Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Beta:	0.005
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		
	LOG(Sy/S):	4		

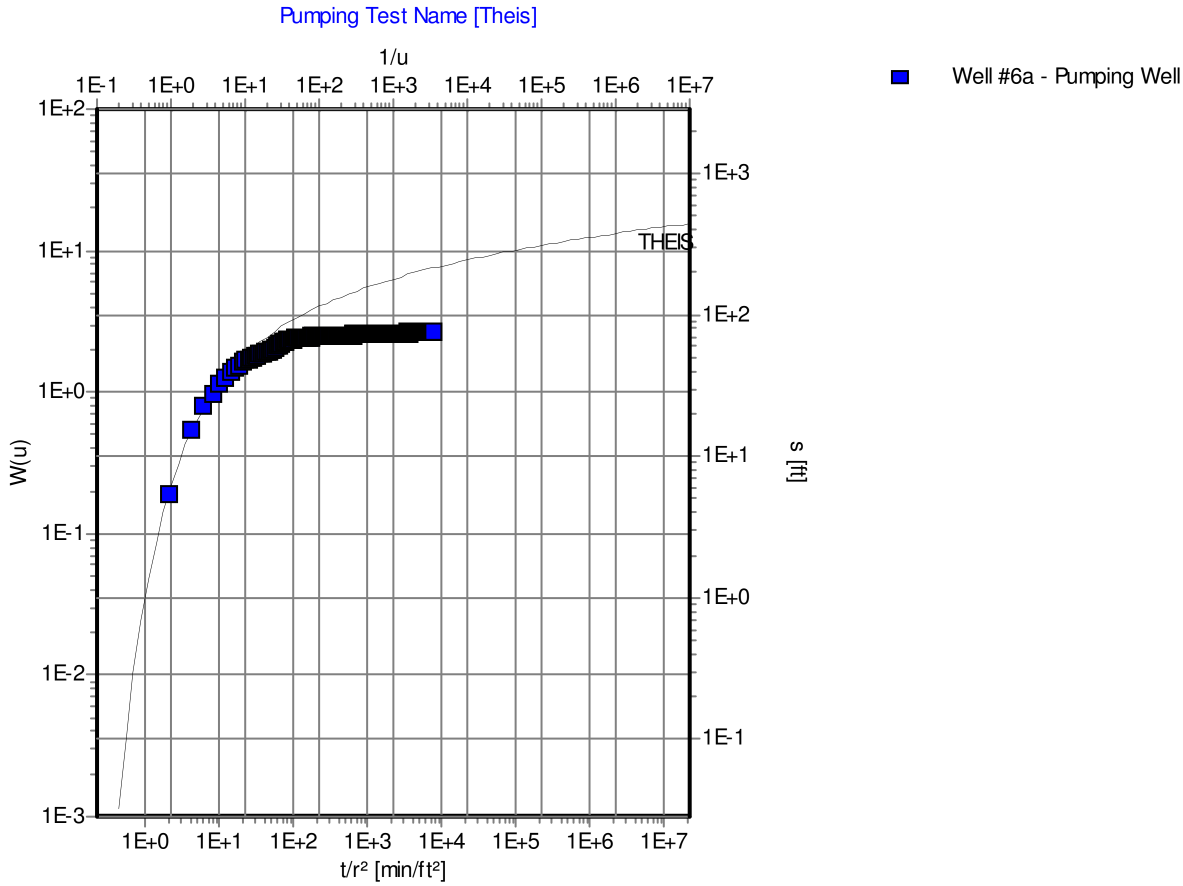
Comments: Match to late time drawdown data.

Evaluated by: MWV

Evaluation Date: 11/17/2010

Waterloo Hydrogeologic, Inc.
460 Philip Street - Suite 101
Waterloo, Ontario, Canada
Phone: +1 519 746 1798

Pumping Test Analysis Report
Project: Rough Acres
Number:
Client:



Pumping Test: **Pumping Test Name**

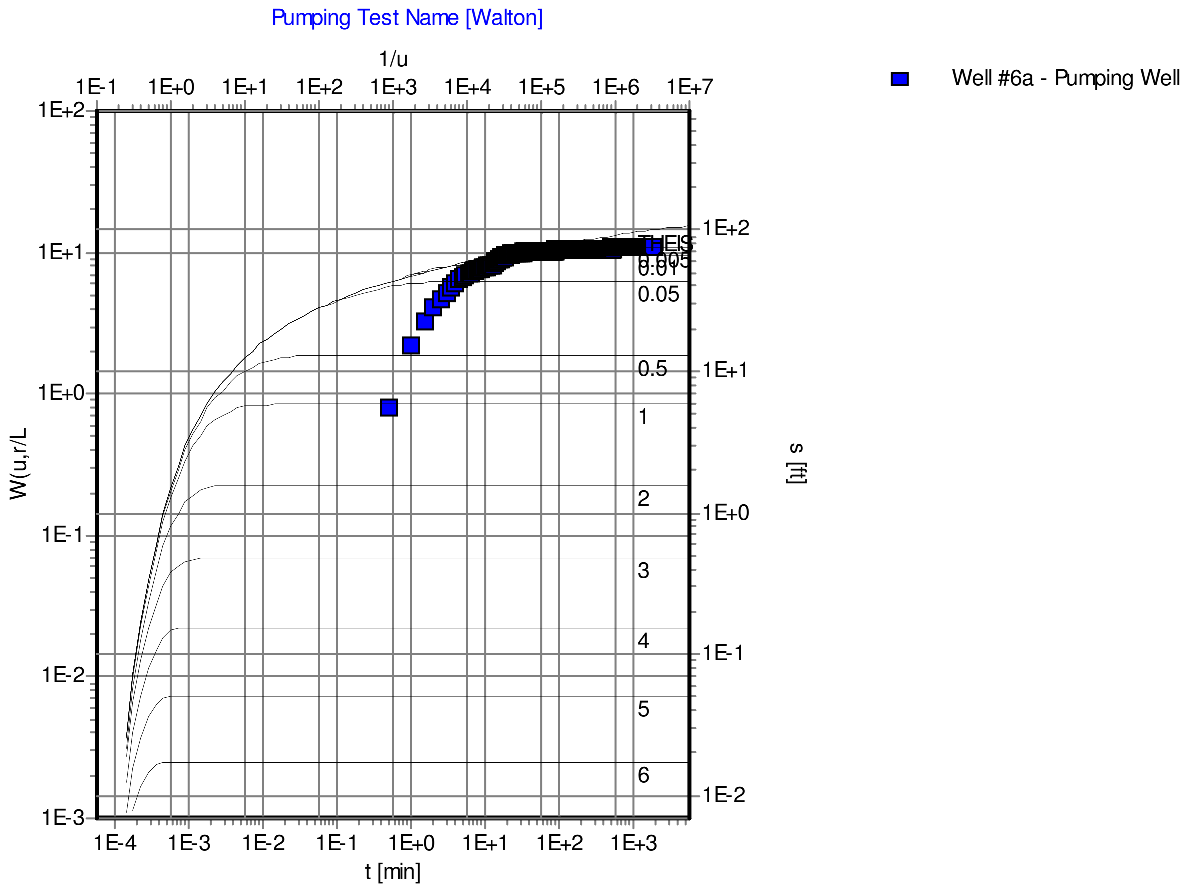
Analysis Method: **Theis**

Analysis Results:	Transmissivity:	2.69E+1 [ft²/d]	Conductivity:	5.39E-2 [ft/d]
	Storativity:	1.64E-1		
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	Confined Aquifer	
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		

Comments: Match to early time data.

Evaluated by: MWV
Evaluation Date: 11/18/2010

Waterloo Hydrogeologic, Inc.	Pumping Test Analysis Report
460 Philip Street - Suite 101	Project: Rough Acres
Waterloo, Ontario, Canada	Number:
Phone: +1 519 746 1798	Client:



Pumping Test:	**Pumping Test Name**			
Analysis Method:	**Walton**			
Analysis Results:	Transmissivity:	1.11E+2 [ft²/d]	Conductivity:	2.21E-1 [ft/d]
	Storativity:	7.08E-4	c:	1.30E+5 [min]
Test parameters:	Pumping Well:	Well #6a	Aquifer Thickness:	500 [ft]
	Casing radius:	0.167 [ft]	r/L:	0.005
	Screen length:	310 [ft]		
	Boring radius:	0.271 [ft]		
	Discharge Rate:	50 [U.S. gal/min]		

Comments:

Evaluated by: MWV

Evaluation Date: 11/17/2010

Appendix B
Department of Water Resources Well Completion Reports

#4

Power at well

NO pump

Across Road from Bathrooms in West Canyon

water was Discolored & hence quit using

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
1255 Imperial Ave
San Diego, CA 92101
619-338-2222

#4

INVOICE

ERMIT TYPE & NUMBER: LWEL 16226 **INVOICE DATE:** 16 SEP 2004

ERMIT OWNER: **CONTACT:**
ADEM ROBERT S&MARY O TRUST B1
653 OCEAN ST

92008

APPLICANT:
FADEM ROBERT S&MARY O TRUST B1

PN: ~~611-110-01-00~~ 611-060-03 611-070-01

ITE ADDRESS: ~~2533~~ MCCAIN VALLEY RD

OCATION DESCRIPTION: ~~2533~~ MCCAIN VALLEY RD,

ROJECT DESCRIPTION/SCOPE
umber of Wells on Permit Application:1
escription of Work:new
ype of Use for Each Well:private

EE/DEPOSIT DETAILS

FEE CODE	DESCRIPTION	TIME ACCT.	ACCT. CODE	AMOUNT
6LE01--EHO	WATER WELL PERMIT	429E01	9773-773	390.00
			09-16-04 11:30 9773 773 429E01 CHECK	[illegible]
			TOTAL AMOUNT DUE	$390.00

275
.15

COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH
WELL PERMIT APPLICATION

Parcel 1 ~~67~~ 600

DEH USE ONLY	
PERMIT # W	LWCL162
WELL COMPUTER #	
FEE:	
WATER DIST:	

1. Property Owner: Hamann Companies Phone: 440-7424
1000 Pioneer Way (Mailing Address) El Cajon (City) 92020 (Zip)

2. Well Location - Assessors Parcel Number ~~611-110-04~~ 611-060-03 611-070-01
(Site Address) (City) BOULEVARD 91905 (Zip)

3. Well Contractor - Well Driller Jim Mayes Company Name:
(Mailing Address) (City) (Zip)

Phone#: 445-1926 C-57#: ☐ Cash Deposit ☐ Bond Posted

4. Use: ☒ Private ☐ Public ☐ Industrial ☐ Cathodic ☐ Other

5. Type of Work: ☐ New ☐ Reconstruction ☐ Destruction Time Extension: ☐ 1st ☐ 2nd

6. Type of Equipment: Air Rotary

7. Depth of Well: Proposed: 300 Existing:

8. Proposed:

Casing	Conductor Casing	Filter/Filler Material	Perforations
Type: Steel	☐ Yes ☐ No	☐ Yes ☐ No	From: To:
Depth: 20	Depth: ft.	From: To:	From: To:
Diameter 7 in.	Diameter in.	Type:	From: To:
Wall/Gauge:	Wall/Gauge:	Wall/Gauge:	

9. Annular Seal: Depth: ft. Sealing Material:
Borehole diameter: in. Conductor diameter: in. Annular Thickness in.

10. Date of Work: Start: Complete: 7-27-04

On sites served by public water, contact the local water agency for meter protection requirements.

I hereby agree to comply with all regulations of the Department of Environmental Health, and with all ordinances and laws of the County of San Diego and the State of California pertaining to well construction, repair, modification and destruction. Immediately upon completion of work, I will furnish the Department of Environmental Health with a complete and accurate log of the well. I accept responsibility for all work done as part of this permit and all work will be performed under my direct supervision.

Contractor's Signature: Jim Mayes Date:

DISPOSITION OF APPLICATION (Department of Environmental Health Use only)

☒ **Approved** ☐ **Denied** Special Conditions: Grading and clearing associated with access to, or the construction, maintenance or destruction of water wells, may require additional permits from the County of San Diego and/or other agencies.

Specialist: Danny O'Call Date: 6/16/04

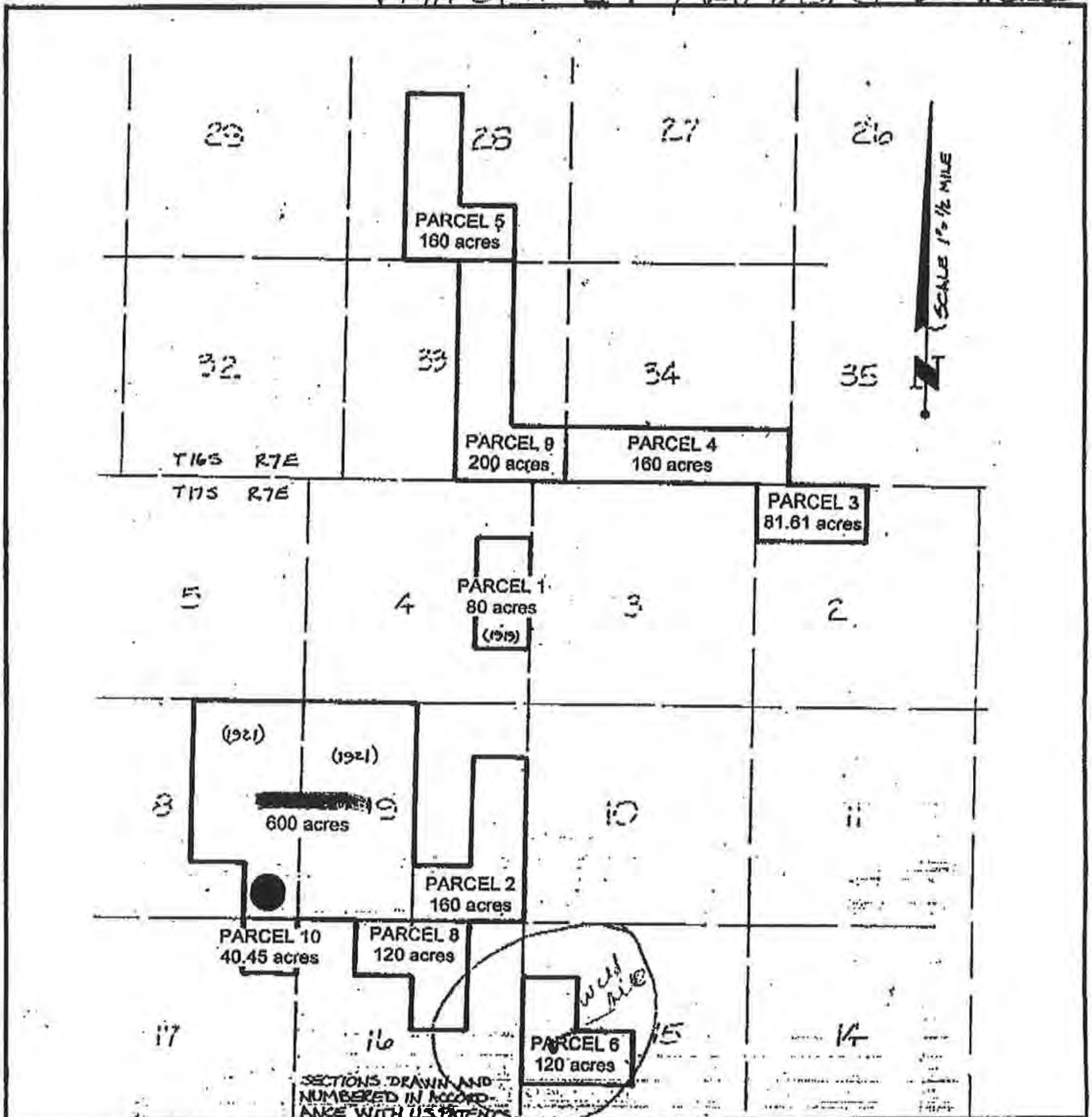
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWCL 16226
Assessor's Parcel Number:
611-060-03
611-070-01

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

Parcel # 600 ACRES



County Mail Station – A-21

FIRST CARBON COPY

ASSESSORS PARCEL NUMBER: ________

COUNTY OF SAN DIEGO
DEPARTMENT OF HEALTH SERVICES
1700 PACIFIC HIGHWAY, SAN DIEGO, CA 92101-2417

WATER WELL DRILLERS REPORT
(INSERT under ORIGINAL PAGE w/carbon of State Form)

Notice of Intent No. ________
Local Permit No. or Date ________

State Well No. ________
Other Well No. ________

(1) OWNER: Name JOHN WELL NO 2
Address ROXIN ACRES
City ________ Zip ________

(2) LOCATION OF WELL (See instructions):
County ________ Owner's Well Number ________
Well address if different from above ________
Township ________ Range ________ Section ________
Distance from cities, roads, railroads, fences, etc. ________

(12) WELL LOG: Total depth 260 ft. Depth of completed well 185 ft.
from ft. to ft. Formation (Describe by color, character, size or material)

0-91 – SANDY, D.G.
91-130 – SOFT, ORANGE, WHITE & BROWN
130-133 – GRAY SOFT (3 GPM)
133-185 – SOFT ORANGE, WHITE, BLACK
185-190 – LOOSE ROCKS (20 GPM)
190-260 – SOFT & HARD

DEPARTMENT USE ONLY
Completed Well Construction:
Date ________
Date Inspected ________
Comments ________
Water Sample Taken? ________
Sanitarian's Approval: ________

Jettey #8

(3) TYPE OF WORK:
New Well ☒ Deepening ☐
Reconstruction ☐
Reconditioning ☐
Horizontal Well ☐
Destruction ☐ (Describe destruction materials and procedures in Item (12)

(4) PROPOSED USE:
Domestic ☒
Irrigation ☒
Industrial ☐
Test Well ☐
Stock ☐
Municipal ☐
Other ☐

(5) Equipment:
Rotary ☒ Reverse ☐
Cable ☐ Air ☒
Other ☐ Bucket ☐

(6) Gravel Pack: 3/8ths
Yes ☒ No ☐ Size ________
Diameter of above 9"
Packed from 0 to 185 ft.

(7) Casing Installed:
Steel ☒ Plastic ☐ Concrete ☐

(8) Perforations:
Type of perforation or size of screen

From ft.	To ft.	Dia. in.	Gage or Wall	From ft.	To ft.	Slot Size
0	91	6 5/8	188	0	185	3/32 ths

(9) WELL SEAL:
Was surface sanitary seal provided? Yes ☒ No ☐ If yes, to depth 91' ft.
Were strata sealed against pollution? Yes ☐ No ☒ Interval ________ ft.
Method of sealing BENTONITE - CEMENT

(10) WATER LEVELS:
Depth of first water, if known 130 ft.
Standing level after well completion 85 ft.

(11) WELL TESTS:
Was well test made? Yes ☒ No ☐ If yes, by whom? DRILLER
Type of test Pump ☐ Bailer ☐ Air lift ☒
Depth to water at start of test — ft. At end of test — ft.
Discharge 15 gal/min after 1 hours Water temperature COOL
Chemical analysis made? Yes ☐ No ☒ If yes, by whom?
Was electric log made? Yes ☐ No ☒ If yes, attach copy to this report

Work Started 19 Completed 19

WELL DRILLERS STATEMENT: I hereby declare under penalty of perjury that the information provided in this report is true. This water well was installed in compliance with San Diego County Code and State of California, Department of Water Resources, Bulletin No. 74.

SIGNED ________ (Well Driller)

NAME ________
(Person, firm, or Corporation) (Type or Print)

ADDRESS ________

CITY ________ ZIP ________

LICENSE NO. ________ DATE THIS REPORT ________

DHS:EHP-732 (83 CONFIDENTIAL – NOT FOR PUBLIC USE – WATER CODE SEC. 13752

DUPLICATE
Driller's Copy

Page 1 of 1

Owner's Well No. # 1

Date Work Began 9-25-04, Ended 9-27-04

Local Permit Agency San Diego E.H.S.

Permit No. LWEL16226 Permit Date 9-16-04

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 0909442

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO./STATION NO.

LATITUDE LONGITUDE

APN/TRS/OTHER

CONFIDENTIAL — NOT FOR PUBLIC USE — WATER CODE SEC. 13752

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD rotary FLUID air

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION Describe material, grain size, color, etc.
0-91	sandy, dg
91-130	soft, orange, white & brown
130-133	very soft
133-185	soft, orange, white & black
185-190	loose rocks
190-260	soft & hard

TOTAL DEPTH OF BORING 260 (Feet)

TOTAL DEPTH OF COMPLETED WELL 185 (Feet)

WELL OWNER

Name Hamann Companies

Mailing Address 1000 Pioneer Way

El Cajon, Ca. 92020

CITY STATE ZIP

WELL LOCATION

Address McCain Valley Rd

City Jacumba

County San Diego

APN Book 611 Page 110 Parcel 01

Township 17 Range 7E Section 15

Lat ___ N Long ___ W

DEG. MIN. SEC.

LOCATION SKETCH

NORTH

WEST

EAST

SOUTH

See Attached

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (*Describe Procedures and Materials Under "GEOLOGIC LOG"*)

USES (✓)

WATER SUPPLY

X Domestic ___ Public

___ Irrigation ___ Industrial

MONITORING ___

TEST WELL ___

CATHODIC PROTECTION ___

HEAT EXCHANGE ___

DIRECT PUSH ___

INJECTION ___

VAPOR EXTRACTION ___

SPARGING ___

REMEDIATION ___

OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 130 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 35 (Ft.) & DATE MEASURED 9-27-04

ESTIMATED YIELD * 15 (GPM) & TEST TYPE airlift

TEST LENGTH 1 (Hrs.) TOTAL DRAWDOWN — (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0-91	11	x				steel	5 5/8	.188	
0-185	6½		x			pvc	4	sch 40	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0-91	x	x		
0-185			x	5/16 pea gravel

ATTACHMENTS (✓)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME JIM MANOS DRILLING & PUMP
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

16052 LAWSON VLY RD, JAMUL, CA 91935
ADDRESS CITY STATE ZIP

Signed [signature] 2-6-05 360722
C-57 LICENSED WATER WELL CONTRACTOR DATE SIGNED C-57 LICENSE NUMBER

DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

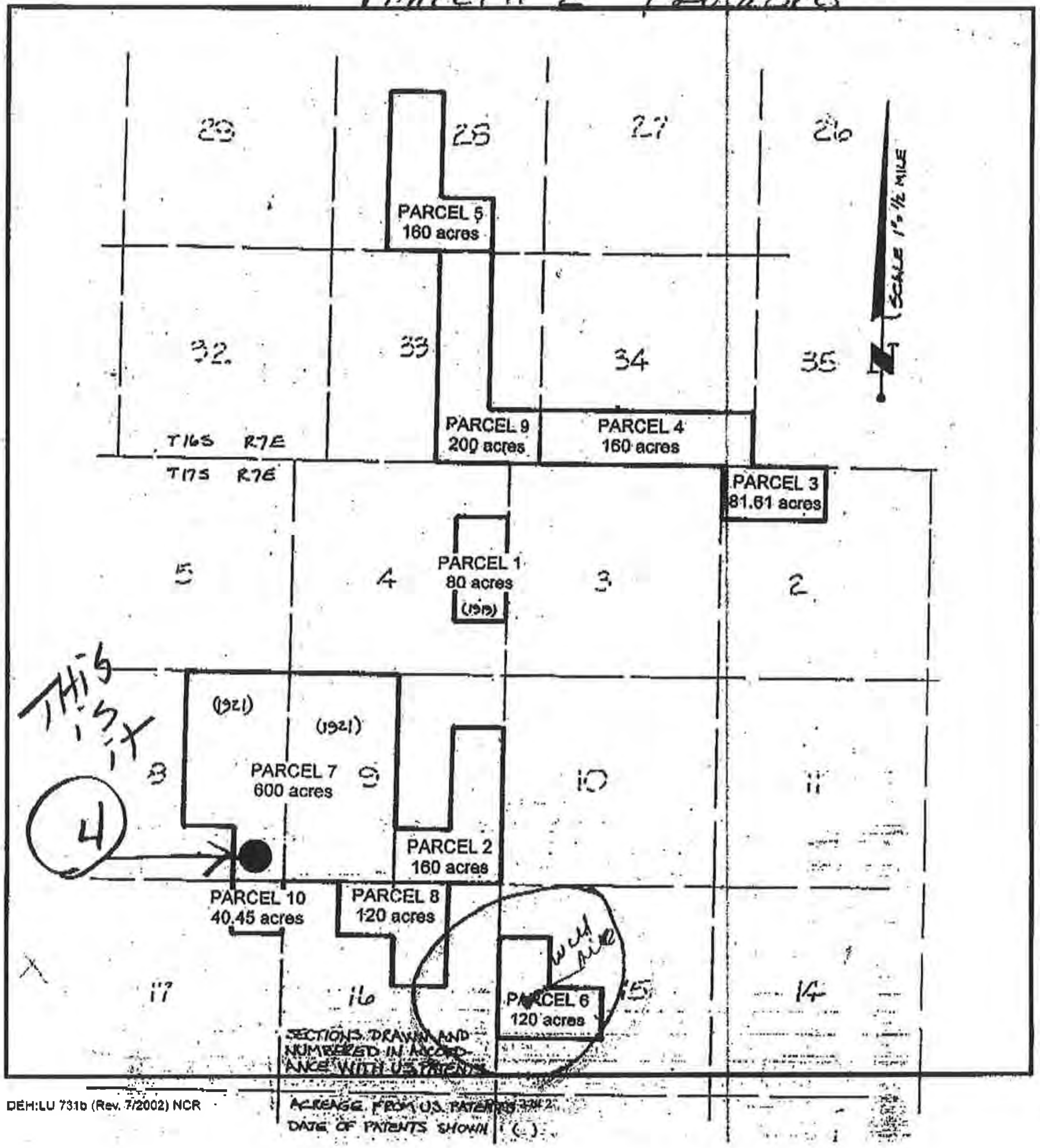
COUNTY OF SAN DIEGO
DEPARTMENT OF ENVIRONMENTAL HEALTH

Control #: LWeL 16226
Assessor's Parcel Number: 611-110-01

LOCATION

Indicate below the vicinity and exact location of well with respect to the following items: Property lines, water bodies or water courses, drainage pattern, easements, roads, existing wells, sewers and private sewage disposal systems and other potential contamination sources, including dimensions.

Parcel # 6 120 acres



Fully operational

#6 No Logs Available

origional well on Ranch

6A NEW
Public
Well

Fully operational

QUADRUPLICATE FEB 09 2010

For Local Requirements

Page 1 of 1

Owner's Well No. 1

County of San Diego
Dept. of Environmental Health
Land & Water Quality Div.

STATE OF CALIFORNIA

WELL COMPLETION REPORT

Refer to Instruction Pamphlet

No. 1089956

— DWR USE ONLY — DO NOT FILL IN —

STATE WELL NO./STATION NO.

LATITUDE | LONGITUDE

APN/TRS/OTHER

Date Work Began ~~11-4-09~~, Ended ~~11-10-09~~

Local Permit Agency ~~San Diego C.E.H.~~

Permit No. ~~LWE620420~~ Permit Date ~~11-13-09~~

CONFIDENTIAL

NOT FOR PUBLIC USE

WATER CODE

GEOLOGIC LOG

ORIENTATION (✓) ✓ VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)

DRILLING METHOD ~~ROTARY~~ FLUID ~~AIR~~

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0 - 10	sandy-rocks
10 - 30	sandy-slightly firm
30 - 32	soft
32 - 70	sandy
70 - 85	harder
85 - 87	cracks
87 - 230	black & white rock, softer areas
230 - 233	softer, orange
233 - 330	black, white & orange
330 - 332	softer, orange
332 - 395	black & white rock, softer areas
395 - 395	sand
395 - 420	black & white rock

Completed Well Construction

Date 2/9/10

Date Inspected

Comments KIVA entered at this date.

Water Sample Taken?

Reviewed By

TOTAL DEPTH OF BORING ~~420~~ (Feet)

TOTAL DEPTH OF COMPLETED WELL ~~385~~ (Feet)

WELL OWNER

Name ~~[illegible] Drive Partners~~

Mailing Address ~~1000 Pioneer Way~~

~~El Cajon, Ca 92020~~ CITY STATE ZIP

WELL LOCATION

Address ~~Mc[illegible] Valley Road~~

City ~~Jamul, Ca~~

County ~~San Diego~~

APN Book 511 Page 000 Parcel 04

Township 17 S Range 2 E Section 17

Lat ___ DEG. MIN. SEC. N Long ___ DEG. MIN. SEC. W

LOCATION SKETCH

NORTH

WEST

EAST

SOUTH

Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

✓ NEW WELL

MODIFICATION/REPAIR

___ Deepen

___ Other (Specify)

___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

USES (✓)

WATER SUPPLY

___ Domestic ___ Public

___ Irrigation X Industrial

MONITORING ___

TEST WELL ___

CATHODIC PROTECTION ___

HEAT EXCHANGE ___

DIRECT PUSH ___

INJECTION ___

VAPOR EXTRACTION ___

SPARGING ___

REMEDIATION ___

OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 30 (Ft.) BELOW SURFACE

DEPTH OF STATIC WATER LEVEL 30 (Ft.) & DATE MEASURED 11-10-09

ESTIMATED YIELD * 60 (GPM) & TEST TYPE airlift

TEST LENGTH 2 (Hrs.) TOTAL DRAWDOWN -- (Ft.)

** May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 - 56	12	x				steel		.188	
0 - 75		x				steel	6 5/8	.188	
0 - 385	6½		x			pvc	4	CL200	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 - 56	x (cement was poured)			
0 - 75		x		
0 - 385			x	3/16 pea gravel

ATTACHMENTS (✓)

___ Geologic Log

___ Well Construction Diagram

___ Geophysical Log(s)

___ Soil/Water Chemical Analyses

___ Other

ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME ~~TIM MANOS DRILLING & PUMP~~ (PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

16052 LAWSON VALLEY ROAD, JAMUL, CA 91935
ADDRESS CITY STATE ZIP

Signed [signature] C-57 LICENSED WATER WELL CONTRACTOR

1/14/10 DATE SIGNED

3601 C-57 LICENSE NUMBER

DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

8

This WELL HAS
no pump or power
NEEDS to be
relocated EAST
outside of
TRANSMISSION line
power EASEMENT

Fain Drilling & Pump Co. Inc.

12029 Old Castle Rd.
Valley Center, CA 92082
Phone (760) 749-0701
Fax (760) 749-6380

#8

Invoice

Date	Invoice #
2/11/2005	8048

Bill To
THE HAMANN COMPANIES 1000 PIONEER WAY EL CAJON, CA 92020

P.O. No.	Terms	Project
	Due on receipt	

Description	Qty	Rate	Amount
DRILLING 970 FT DEEP WELL APN 611 110 01			
PARCEL 6 120 AC			
EQUIPMENT SET UP	1	500.00	500.00
DRILLING 6.5" DIA HOLE	400	12.00	4,800.00
DRILLING 400-800' 6.5" DIA HOLE	400	14.00	5,600.00
DRILLING 800 - 970' 6.5" DIA HOLE	170	16.00	2,720.00
REAMING 6" TO 10" DIA HOLE	226	12.00	2,712.00
FURNISH AND INSTALL 6" WELL CASING	228	13.00	2,964.00
INSTALL 50 FT. SURFACE SEAL	1	1,500.00	1,500.00
WELL PERMIT AND FILING FEES	1	490.00	490.00

Total	$21,286.00
Payments/Credits	$0.00
Balance Due	$21,286.00

TRIPLICATE
Owner's Copy
Page 1 of 1
Owner's Well No. Par. 6 -120
Date Work Began 2/1/05 , Ended 2/9/05
Local Permit Agency DEH
Permit No. 16456 Permit Date 2/1/05

STATE OF CALIFORNIA
WELL COMPLETION REPORT
Refer to Instruction Pamphlet
No. 0909549

DWR USE ONLY — DO NOT FILL IN
STATE WELL NO./STATION NO.
LATITUDE LONGITUDE
APN/TRS/OTHER

GEOLOGIC LOG

ORIENTATION (✓) X VERTICAL ___ HORIZONTAL ___ ANGLE ___ (SPECIFY)
DRILLING METHOD Rotary FLUID Air

DEPTH FROM SURFACE Ft. to Ft.	DESCRIPTION *Describe material, grain size, color, etc.*
0 – 12	Slope wash - sandy decomposed granite - brown color
12 – 212	Weathered Granitic Rock
212 – 225	Broken Rock
226 – 310	Weathered granitic rock mostly white quartz
310	Water 8 gpm
310 – 961	Granitic rock large crystals of white quartz
961	Water 40+ gpm
961 – 970	Fractured granitic rock large quartz crystals

TOTAL DEPTH OF BORING 970 (Feet)
TOTAL DEPTH OF COMPLETED WELL 970 (Feet)

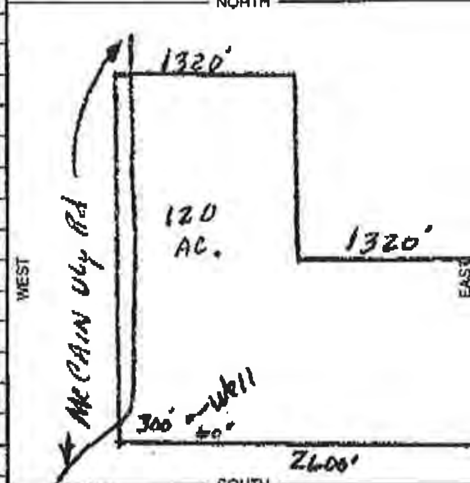
WELL OWNER

Name The Hamann Companies
Mailing Address 1000 Pioneer Way
El Cajon CITY Ca STATE 92020 ZIP

WELL LOCATION

Address Rough Acres Ranch McCain Valley Rd.
City Boulevard
County San Diego
APN Book 611 Page 110 Parcel 01
Township 17S Range 7E Section 15
Lat 36 16 772 N (DEG. MIN. SEC.) Long 115 64 465 W (DEG. MIN. SEC.)

LOCATION SKETCH



Illustrate or Describe Distance of Well from Roads, Buildings, Fences, Rivers, etc. and attach a map. Use additional paper if necessary. PLEASE BE ACCURATE & COMPLETE.

ACTIVITY (✓)

X NEW WELL
MODIFICATION/REPAIR
___ Deepen
___ Other (Specify)
___ DESTROY (Describe Procedures and Materials Under "GEOLOGIC LOG")

USES (✓)
WATER SUPPLY
X Domestic ___ Public
___ Irrigation ___ Industrial
MONITORING ___
TEST WELL ___
CATHODIC PROTECTION ___
HEAT EXCHANGE ___
DIRECT PUSH ___
INJECTION ___
VAPOR EXTRACTION ___
SPARGING ___
REMEDIATION ___
OTHER (SPECIFY) ___

WATER LEVEL & YIELD OF COMPLETED WELL

DEPTH TO FIRST WATER 30 (Ft.) BELOW SURFACE
DEPTH OF STATIC WATER LEVEL 18 (Ft.) & DATE MEASURED
ESTIMATED YIELD * 50 (GPM) & TEST TYPE airlift
TEST LENGTH 8 (Hrs.) TOTAL DRAWDOWN 800 (Ft.)
* *May not be representative of a well's long-term yield.*

CASING (S)

DEPTH FROM SURFACE Ft. to Ft.	BORE-HOLE DIA. (Inches)	BLANK	SCREEN	CON-DUCTOR	FILL PIPE	MATERIAL / GRADE	INTERNAL DIAMETER (Inches)	GAUGE OR WALL THICKNESS	SLOT SIZE IF ANY (Inches)
0 – 226	10	X				Steel	6	.188	

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft. to Ft.	CE-MENT (✓)	BEN-TONITE (✓)	FILL (✓)	FILTER PACK (TYPE/SIZE)
0 – 50	X			
50 – 226			X	

ATTACHMENTS (✓)

___ Geologic Log
___ Well Construction Diagram
___ Geophysical Log(s)
___ Soil/Water Chemical Analyses
___ Other
ATTACH ADDITIONAL INFORMATION, IF IT EXISTS.

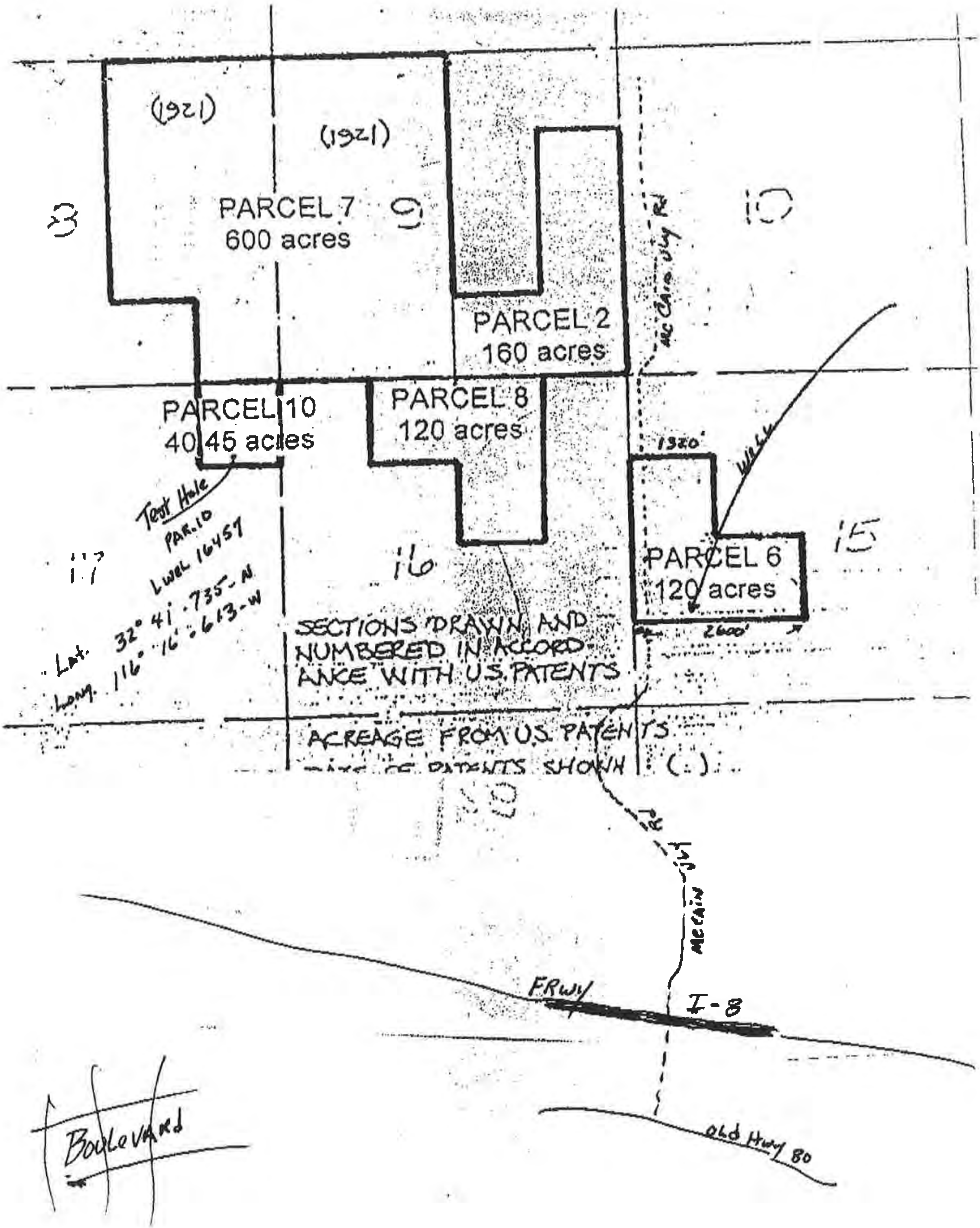
CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Fain Drilling & Pump Co. Inc.
(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)
ADDRESS 12029 Old Castle Rd. Valley Center, Ca 92082 (CITY STATE ZIP)
Signed Joe R. Fain C-57 LICENSED WATER WELL CONTRACTOR
DATE SIGNED 2/11/05
C-57 LICENSE NUMBER 328287

DWR 188 REV. 05-03

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM



(1921)
(1921)
PARCEL 7
600 acres
PARCEL 2
160 acres
PARCEL 10
40 45 acres
PARCEL 8
120 acres
PARCEL 6
120 acres
Test Hole PAR.10 LWEL 16457
Lat. 32° 41'.735-N
Long. 116° 16'.613-W
McCain Vly Rd
1320'
2600'
SECTIONS DRAWN AND NUMBERED IN ACCORDANCE WITH U.S. PATENTS
ACREAGE FROM U.S. PATENTS
FRWY
I-8
Old Hwy 80
Boulevard

9

Fully operational
old well
No info
probably 5-10 GPM
& shallow

APPENDIX C

CUMULATIVE WATER QUANTITY IMPACTS ANALYSIS

ROUGH ACRES RANCH WATER PRODUCTION AREA

MCCAIN VALLEY, EAST SAN DIEGO COUNTY, CALIFORNIA

Table 1
Estimated Groundwater Demand - Rough Acres Ranch Water Production Area

Land Use Scenario	Land Use	Quantity	Water Demand per Unit (afy)	Total Demand (afy)
Existing Conditions	Single Family Residential	7	0.5	3.5
	Cattle/Livestock Free-Range Grazing (100 head)	1	2.13	2.13
	Poultry (500 hens)	1	0.11	0.11
	Total Water Demand (Existing Conditions)			5.74
Existing Conditions Plus 9-Month Construction at 50 gpm	Single Family Residential	7	0.5	3.5
	Cattle/Livestock Free-Range Grazing (100 head)	1	2.13	2.13
	Poultry (500 hens)	1	0.11	0.11
	Project 9-month Construction (50 gpm)	1	60	60
	Total Water Demand (Existing Conditions Plus 9-Month Construction at 50 gpm)			65.74
Existing Conditions Plus 9-Month Construction at 100 gpm	Single Family Residential	7	0.5	3.5
	Cattle/Livestock Free-Range Grazing (100 head)	1	2.13	2.13
	Poultry (500 hens)	1	0.11	0.11
	Project 9-month Construction (50 gpm)	1	120	120
	Total Water Demand (Existing Conditions Plus 9-Month Construction at 100 gpm)			125.74

Note: afy - acre feet per year; gpm - gallons per minute

Table 2
Groundwater in Storage Calculation - Effects of Pumping at 50 GPM
Rough Acres Ranch Water Production Area

Hydrogeologic Unit	Area (acres)	Specific Yield (%)	Saturated Thickness (ft)	GW in Storage (af)
Fractured Rock	502	0.10%	500	251
Residuum	502	5%	10	251
Alluvium	250	10%	20	500
Total				**1002**

Change in Groundwater in Storage (50 gpm)

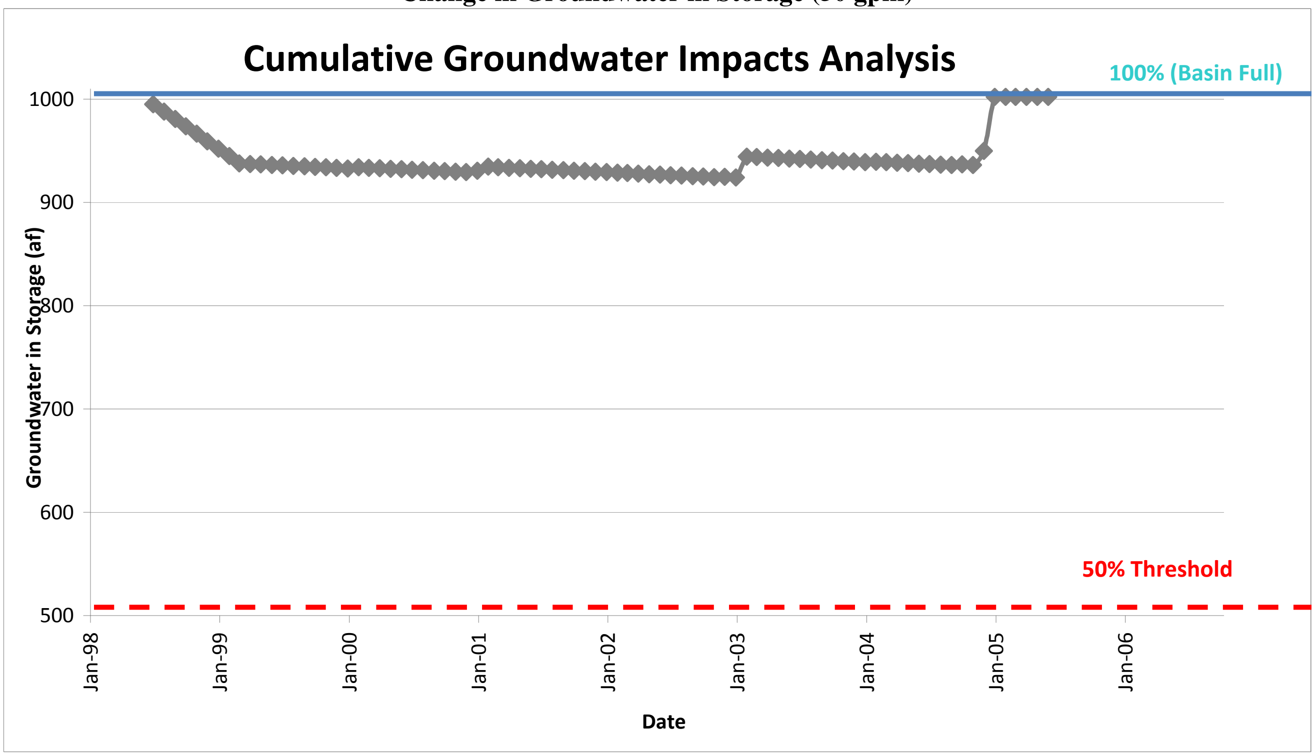


Table 3
Groundwater in Storage Calculation - Effects of Pumping at 100 GPM
Rough Acres Ranch Water Production Area

Hydrogeologic Unit	Area (acres)	Specific Yield (%)	Saturated Thickness (ft)	GW in Storage (af)
Fractured Rock	502	0.10%	500	251
Residuum	502	5%	10	251
Alluvium	250	10%	20	500
Total				**1002**

Change in Groundwater in Storage (100 gpm)

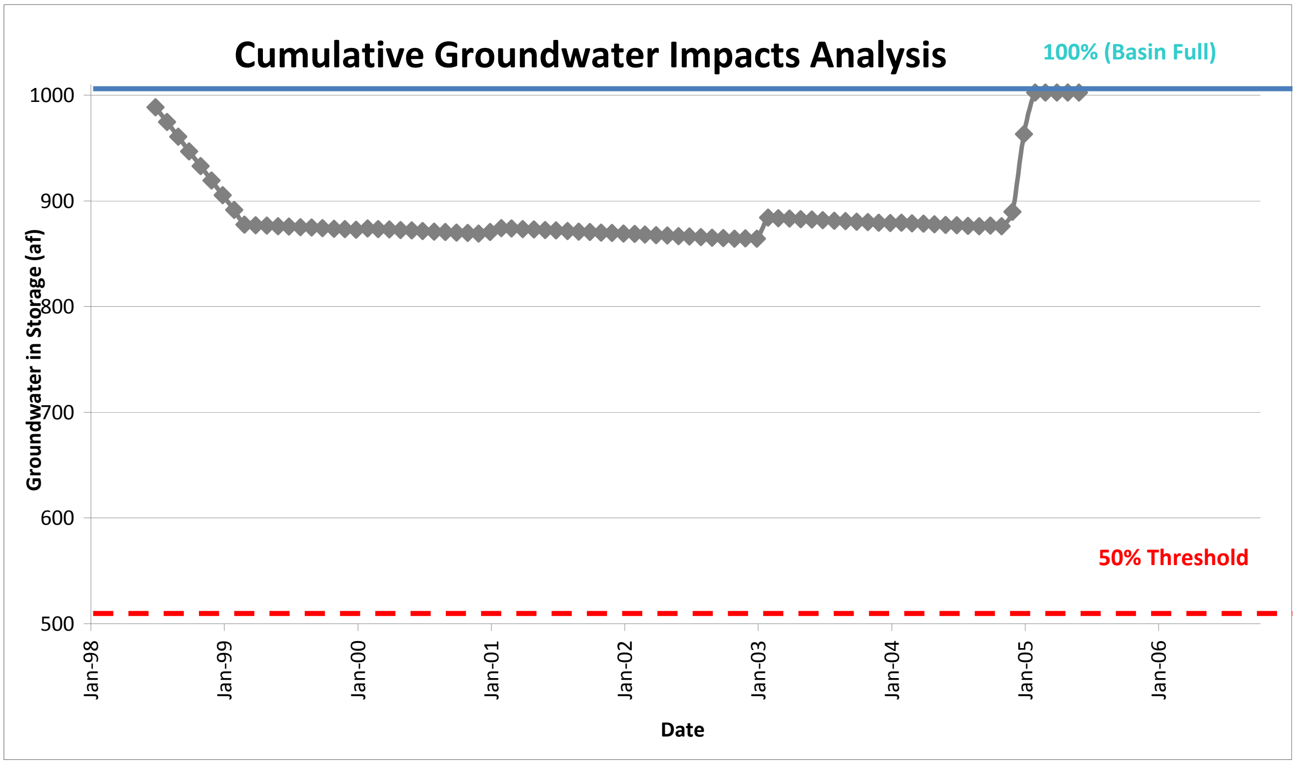
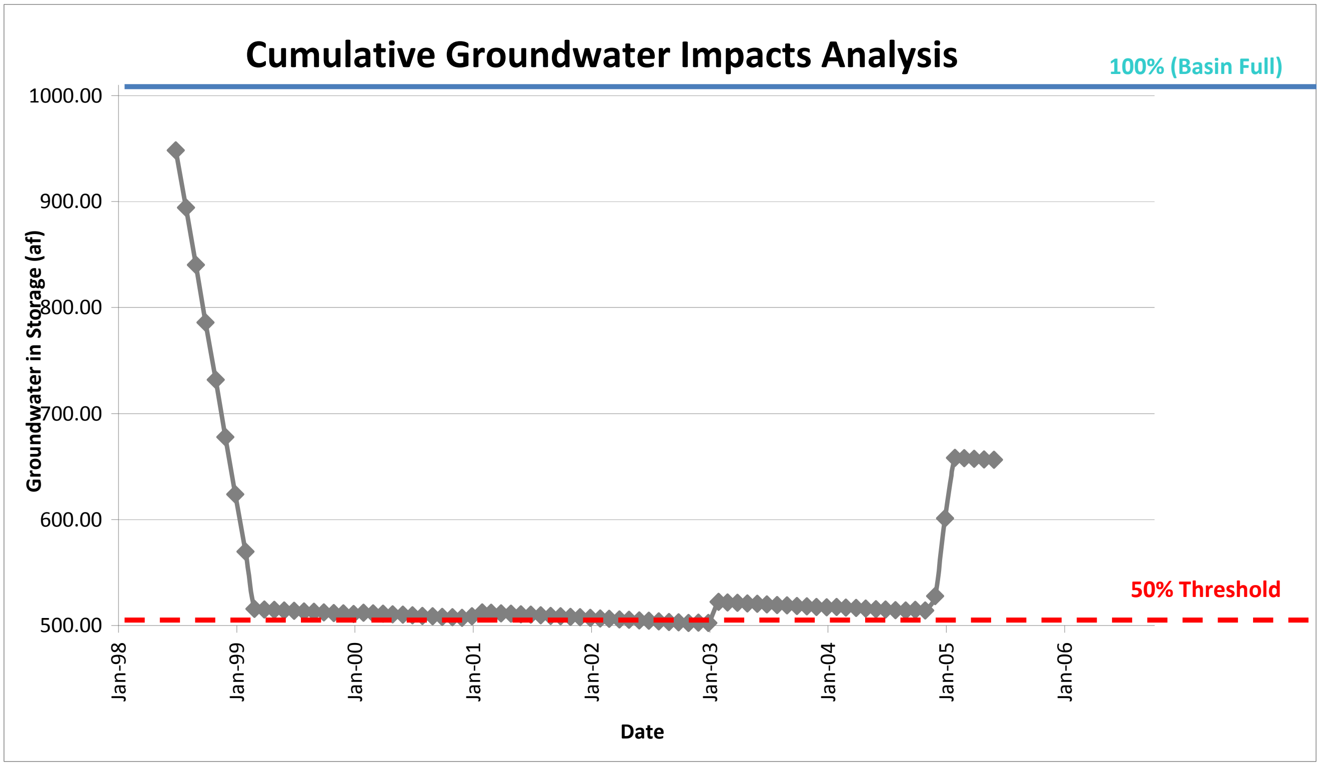


Table 4
Groundwater in Storage Calculation - Effects of Pumping at 400 GPM
Rough Acres Ranch Water Production Area

Hydrogeologic Unit	Area (acres)	Specific Yield (%)	Saturated Thickness (ft)	GW in Storage (af)
Fractured Rock	502	0.10%	500	251
Residuum	502	5%	10	251
Alluvium	250	10%	20	500
Total				**1002**

Change in Groundwater in Storage (400 gpm)



LINSCOTT LAW & GREENSPAN engineers

FULL TRAFFIC IMPACT STUDY

TULE WIND PROJECT

MUP 09-019

County of San Diego, California
September 13, 2010

Prepared for:

The County of San Diego

On behalf of:
Pacific Wind Development, LLC

LLG Ref. 3-09-1935

Prepared by:

R.VidhyaShankar, P.E
Transportation Engineer III

Christopher Mendiara
Senior Transportation Planner

Under the Supervision of:

John Boarman, P.E.
Principal

Linscott, Law & Greenspan, Engineers
4542 Ruffner Street
Suite 100
San Diego, CA 92111
858.300.8800 T
858.300.8810 F
www.llgengineers.com

EXECUTIVE SUMMARY

Linscott, Law & Greenspan Engineers (LLG) has been retained to assess the traffic impacts associated with the proposed Tule Wind Project in the County of San Diego. Iberdola Renewables, Inc. (IBR), is proposing to construct and operate the Tule Wind Project. The proposed project includes the construction of wind turbines capable of generating up to 200 megawatts of electricity. The project site is located in the McCain Valley in the In-Ko-Pah Mountains. It is north of U.S. Interstate-8 in eastern San Diego County. The project access is via Crestwood Road, Ribbonwood Road and McCain Valley Road along Interstate 8.

A Full Traffic Impact Study was conducted in accordance with the *County of San Diego Traffic Impact Study Guidelines (June 30, 2009)*. The following scenarios are evaluated in this report:

- Existing
- Existing + Project
- Existing + Project + Cumulative Projects

Existing weekday AM/PM peak hour turning movement counts and average daily traffic (ADT) counts were commissioned by LLG Engineers and conducted on December 16, 2009 (Tuesday). Supplemental traffic counts were also conducted on March 24, 2010 (Tuesday).

Construction will consist of site preparation (e.g. grading, earthwork) and assembly of the turbine units and related infrastructure. The project construction is expected to occur over a 9- to 12-month period. A typical busy day during the construction period is calculated to generate a maximum of 1,250 ADT. With the addition of project and cumulative project traffic, all the study area intersections and roadway segments are calculated to operate at LOS B or better. Based on the County of San Diego significance criteria, the proposed project will have no significant direct or cumulative impacts. Therefore no mitigation measures are required or recommended.

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APPENDICES

APPENDIX

List of Figures

List of Tables

FULL TRAFFIC IMPACT STUDY

TULE WIND PROJECT

County of San Diego, California
September 13, 2010

1.0 INTRODUCTION

1.1 Purpose of the Report

Linscott, Law & Greenspan Engineers (LLG) has been retained to assess the traffic impacts associated with the proposed Tule Wind Project in the County of San Diego. Included in this Full Traffic Impact Study are the following.

- Project Description
- Significance Criteria
- Existing Conditions Discussion
- Analysis Approach and Methodology
- Construction Traffic Trip Generation/Distribution/Assignment
- Existing + Project Analyses
- Cumulative Projects Discussion
- Existing + Project + Cumulative Projects Analyses
- Significance of Impacts and Mitigation Measures

1.2 Project Location

The project area is located in the eastern portion of San Diego County, approximately 50 miles east of City of San Diego, 90 miles west of Arizona, and north of the community of Boulevard. The area is accessible via Interstate 8 (I-8), State Route 94 (SR-94) and Ribbonwood Road, and McCain Valley Road off of Old Highway 80. The majority of the project area lies in the In-Ko-Pah Mountains adjacent to the Tecate Divide, south of the Cleveland National Forest.

The project area contains lands administered by the BLM, the Ewiiaapaayp Reservation, the Campo and Manzanita Reservations (access only), the California State Lands Commission (CSLC), and privately-owned parcels under the jurisdiction of the County of San Diego. ***Figure 1*** and ***Figure 2*** depict the project vicinity and project area map respectively.

1.3 Project Description

Iberdrola Renewables is proposing to construct and operate the Tule Wind Project located near Boulevard, California. The proposed project will consist of wind turbines, an overhead and underground electrical collection system and transmission line, a project collector substation, an operation and maintenance building, transportation haul routes and access roads, a concrete batch plant , a parking area, laydown (staging) areas, meteorological towers, and a sonic detection and ranging system (SODAR) unit. The project area encompasses approximately 24,500 acres. However, the construction footprint of the project would impact a maximum of 773 acres, and does not include the entire parcels.

The Tule Wind Project will consist of the following project components:

- Up to 134 wind turbines, ranging in size between 1.5 MW (328 feet in height) and 3.0 MW (492 feet in height), to produce 200 MW of electricity;
- A 34.5 kilovolt (kV) overhead and underground collector cable system linking each turbine to the next and to the project collector substation;
- A 138 kV overhead transmission line will run south from the project collector substation to be interconnected with the SDG&E proposed Rebuilt Boulevard Substation;
- A 5-acre collector substation site and 5-acre operation and maintenance (O&M) building site;
- Access roads between turbines, as well as improvements to existing roadways and new roadways to accommodate construction and delivery of equipment;
- A temporary batch plant for construction located on a 5 acre area;
- A temporary 10-acre parking area;
- Nineteen 2-acre temporary laydown areas; and
- Two permanent meteorological towers and one SODAR Unit.

The maximum build-out of the project allows for up to 134 1.5 MW turbines. In order for the project to function at full capacity (200 MW), a minimum of 67 3.0 MW turbines would be necessary. Turbines with a smaller output can be spaced closer together, whereas turbines with a larger output require larger spacing; nonetheless the total project extent is similar in both cases. The turbine locations include 97 wind turbines on BLM land, 17 turbines on Tribal lands, 7 turbines on State lands, and 13 wind turbines on private parcels (Rough Acres Ranch), as shown in ***Figure 3***.

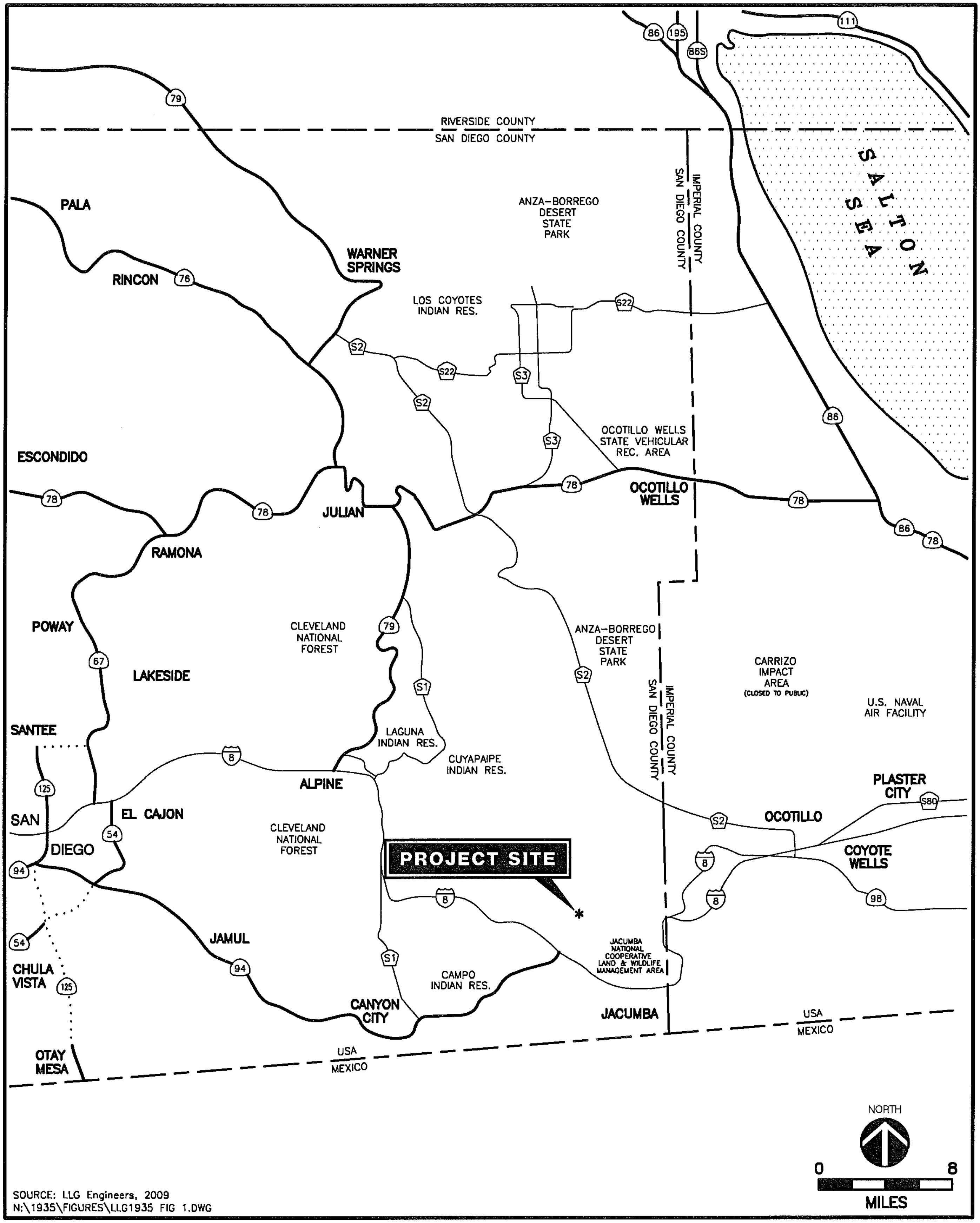

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Figure 1

Vicinity Map

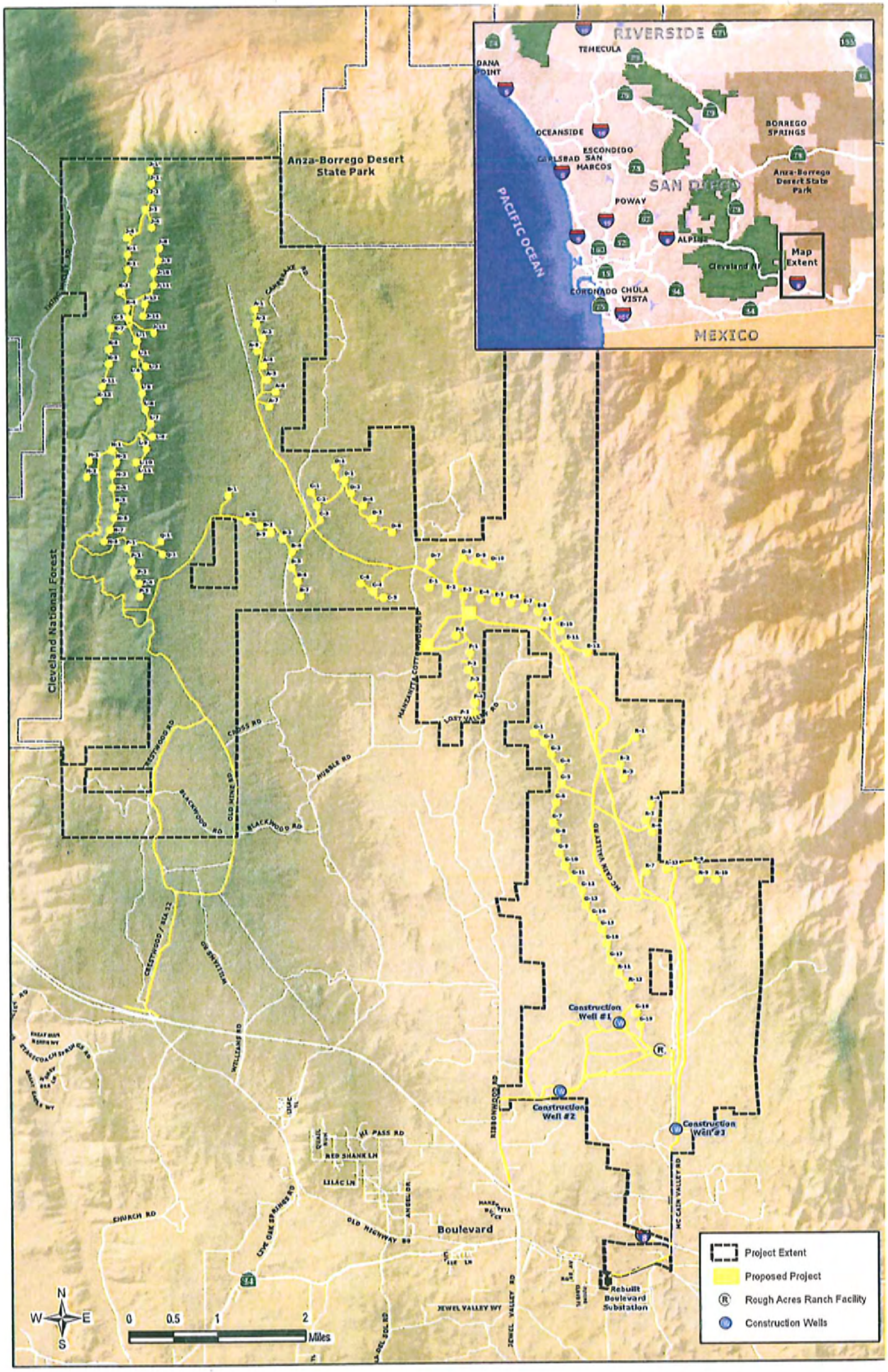

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Figure 2

Project Area Map

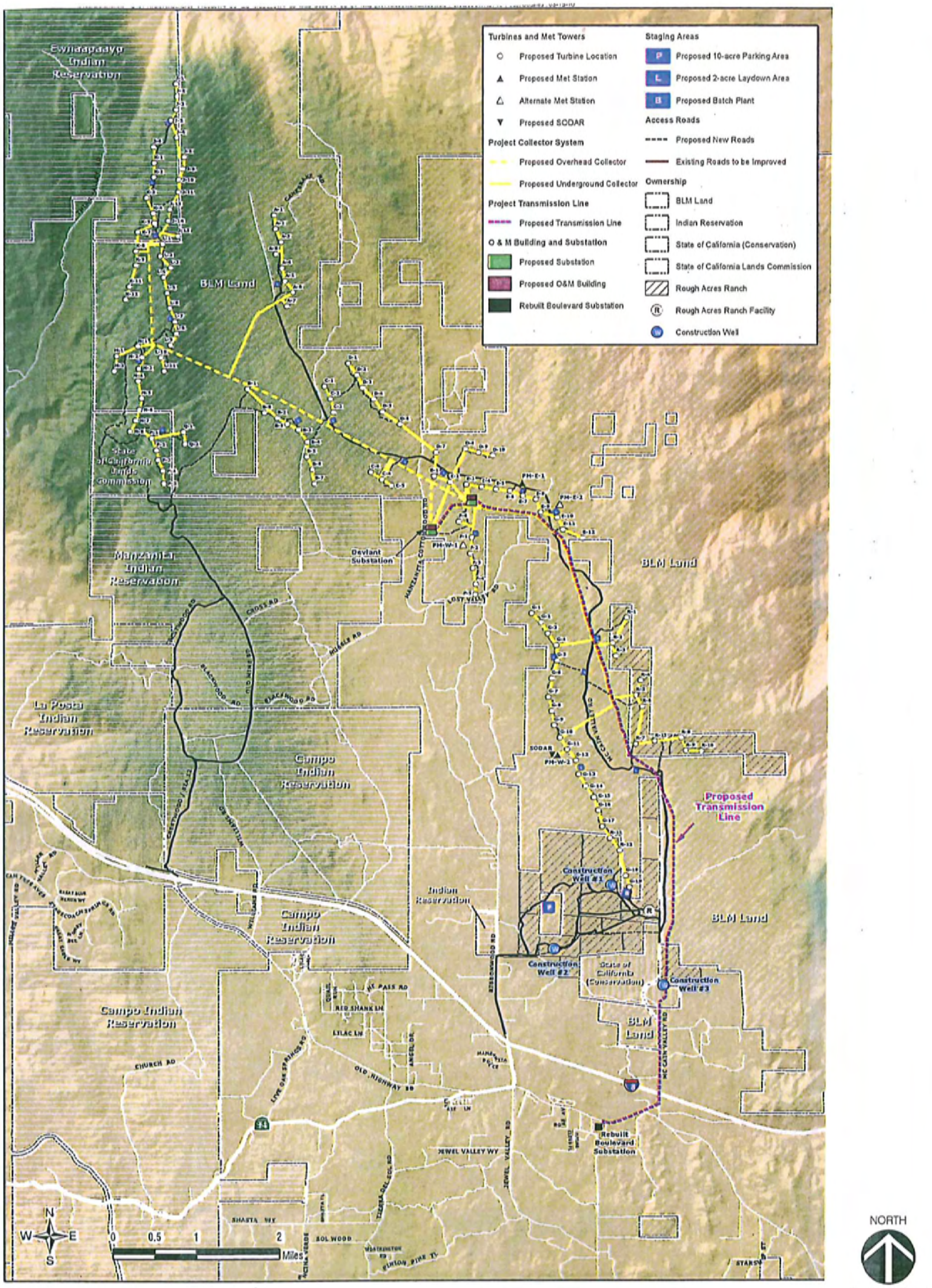

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Figure 3

Proposed Project Map

1.4 Summary of County of San Diego Significance Criteria

The following criterion was utilized to evaluate potential significant impacts, based on the County's published *Guidelines for Determining Significance (June 30, 2009).*

1.4.1 *Road Segments*

Pursuant to the County's *General Plan Public Facilities Element (PFE)*, new development must provide improvements or other measures to mitigate traffic impacts to avoid:

a. Reduction in Level of Service (LOS) below "C" for on-site Circulation Element roads;

b. Reduction in LOS below "D" for off-site and on-site abutting Circulation Element roads; and

c. "Significantly impacting congestion" on roads that operate at LOS "E" or "F". If impacts cannot be mitigated, the project will be denied unless a statement of overriding findings is made pursuant to the State CEQA Guidelines. The PFE, however, does not include specific guidelines/thresholds for determining the amount of additional traffic that would "significantly impact congestion" on such roads, as that phrase is used in item (c) above.

The County has created the following guidelines to evaluate likely traffic impacts of a proposed project for road segments and intersections serving that project site, for purposes of determining whether the development would "significantly impact congestion" on the referenced LOS E and F roads. The guidelines are summarized in ***Table 1***. The thresholds in *Table 1* are based upon average operating conditions on County roadways. It should be noted that these thresholds only establish general guidelines, and that the specific project location must be taken into account in conducting an analysis of traffic impact from new development.

TABLE 1
MEASURES OF SIGNIFICANT PROJECT IMPACTS TO CONGESTION ON ROAD SEGMENTS
ALLOWABLE INCREASES ON CONGESTED ROAD SEGMENTS

Level of Service	Two-Lane Road	Four-Lane Road	Six-Lane Road
LOS E	200 ADT	400 ADT	600 ADT
LOS F	100 ADT	200 ADT	300 ADT

General Notes:

1. By adding proposed project trips to all other trips from a list of projects, this same table must be used to determine if total cumulative impacts are significant. If cumulative impacts are found to be significant, each project that contributes any trips must mitigate a share of the cumulative impacts.
2. The County may also determine impacts have occurred on roads even when a project's traffic or cumulative impacts do not trigger an unacceptable level of service, when such traffic uses a significant amount of remaining road capacity.
3. ADT – Average Daily Traffic

On-site Circulation Element Roads—PFE, Transportation, Policy 1.1 states that "new development shall provide needed roadway expansion and improvements on-site to meet demand created by the development, and to maintain a Level of Service C on Circulation Element Roads during peak traffic hours". Pursuant to this policy, a significant traffic impact would result if:

- The additional or redistributed average daily traffic (ADT) generated by the proposed land development project will cause on-site Circulation Element Roads to operate below LOS C during peak traffic hours.

Off-Site Circulation Element Roads—PFE, Transportation, Policy 1.1 also states that "new development shall provide needed roadway expansion and improvements off-site to meet demand created by the development, and to maintain a Level of Service D on Circulation Element Roads." "New development that would significantly impact congestion on roads operating at LOS E or F, either currently or as a result of the project, will be denied unless improvements are scheduled to improve the LOS to D or better or appropriate mitigation is provided." The PFE, however, does not specify what would significantly impact congestion or establish criteria for evaluating when increased traffic volumes would significantly impact congestion. The following significance guidelines provided are the County's preferred method for evaluating whether or not increased traffic volumes generated or redistributed from a proposed project will "significantly impact congestion" on County roads, operating at LOS E or F, either currently or as a result of the project.

Traffic volume increases from projects that result in one or more of the following criteria will have a significant traffic impact on a road segment, unless specific facts show that there are other circumstances that mitigate or avoid such impacts:

- The additional or redistributed ADT generated by the proposed project will significantly increase congestion on a Circulation Element Road or State Highway currently operating at LOS E or LOS F, or will cause a Circulation Element Road or State Highway to operate at a LOS E or LOS F as a result of the proposed project as identified in *Table 1*, or
- The additional or redistributed ADT generated by the proposed project will cause a residential street to exceed its design capacity.

1.4.2 *Intersections*

This section provides guidance for evaluating adverse environmental effects a project may have on signalized and unsignalized intersections.

Signalized Intersections—Traffic volume increases from public or private projects that result in one or more of the following criteria will have a significant traffic volume or level of service traffic impact on a signalized intersection:

- The additional or redistributed ADT generated by the proposed project will significantly increase congestion on a signalized intersection currently operating at LOS E or LOS F, or will cause a signalized intersection to operate at a LOS E or LOS F as identified in ***Table 2***.

Unsignalized Intersections—The operating parameters and conditions for unsignalized intersections differ dramatically from those of signalized intersections. Very small volume increases on one leg or turn and/or through movement of an unsignalized intersection can substantially affect the calculated delay for the entire intersection. Significance criteria for unsignalized intersections are based upon a minimum number of trips added to a critical movement at an unsignalized intersection.

Traffic volume increases from public or private projects that result in one or more of the following criteria will have a significant traffic volume or level of service traffic impact on an unsignalized intersection:

- The additional or redistributed ADT generated by the proposed project will add 20 or more peak hour trips to a critical movement of an unsignalized intersection, and cause an unsignalized intersection to operate below LOS D, or
- The additional or redistributed ADT generated by the proposed project will add 20 or more peak hour trips to a critical movement of an unsignalized intersection currently operating at LOS E, or
- The additional or redistributed ADT generated by the proposed project will add 5 or more peak hour trips to a critical movement of an unsignalized intersection, and cause the unsignalized intersection to operate at LOS F, or
- The additional or redistributed ADT generated by the proposed project will add 5 or more peak hour trips to a critical movement of an unsignalized intersection currently operating at LOS F, or
- Based upon an evaluation of existing accident rates, the signal priority list, intersection geometrics, proximity of adjacent driveways, sight distance or other factors, it is found that the generation rate is less than those specified above, and would significantly impact the operations of the intersection.

TABLE 2
MEASURES OF SIGNIFICANT PROJECT IMPACTS TO CONGESTION ON INTERSECTIONS
ALLOWABLE INCREASES ON CONGESTED INTERSECTIONS

Level of service	Signalized	Unsignalized
LOS E	Delay of 2 seconds	20 peak hour trips on a critical movement
LOS F	Delay of 1 second, or 5 peak hour trips on a critical movement	5 peak hour trips on a critical movement

General Notes:

1. A critical movement is one that is experiencing excessive queues.
2. By adding proposed project trips to all other trips from a list of projects, these same tables are used to determine if total cumulative impacts are significant. If cumulative impacts are found to be significant, each project that contributes any trips must mitigate a share of the cumulative impacts.
3. The County may also determine impacts have occurred on roads even when a project's traffic or cumulative impacts do not trigger an unacceptable level of service, when such traffic uses a significant amount of remaining road capacity.

1.5 Summary of Regional Congestion Management Program Requirements

The region's published *Final 2008 Congestion Management Program Update (CMP)* is intended to link land use, transportation and air quality through level of service performance. The CMP requires an Enhanced CEQA Review for projects that are expected to generate more than 2,400 ADT or more than 200 peak hour trips. As the project trip generation does not exceed the CMP thresholds, a CMP analysis was not conducted.

2.0 Existing Conditions

The following intersections and segments are included in the study area as they are expected to carry the majority of the construction traffic.

Intersections

1. Crestwood Road/ I-8 WB ramps (u)
2. Crestwood Road/ I-8 EB ramps (u)
3. Ribbonwood Road/ I-8 WB ramps (u)
4. Ribbonwood Road/ I-8 EB ramps (u)
5. Ribbonwood Road/ Old Highway 80 (u)
6. McCain Valley Road/ Old Highway 80 (u)

(u) – Unsignalized intersection

Street Segments

Crestwood Road

- North of I-8

Ribbonwood Road

- North of I-8
- I-8 to Old Highway 80

McCain Valley Road

- Old Highway 80

Old Highway 80

- Ribbonwood Road to McCain Valley Road

2.1 Existing Transportation Conditions

This section describes the existing study area street system including a description of the existing peak hour intersection volumes with Level of Service (LOS) and existing daily roadway volumes with LOS,

Interstate 8 (I-8) is currently built as a 4-lane east-west freeway connecting the San Diego area to the California-Arizona border and beyond. It provides 2-lanes in each direction in the project area. The posted speed limit is 70 miles per hour (mph). In the project vicinity, a local interchange is provided at Ribbonwood Road.

Crestwood Road is an unclassified roadway on the *Mountain Empire Mobility Network* and currently built as a 2-lane roadway in the project area. South of Interstate 8, Crestwood Road turns into Old Highway 80. Parking is prohibited on Crestwood Road.

Ribbonwood Road is currently classified and built as a 2-lane Rural Collector roadway in the project area. According to the County of San Diego GP Update *Mountain Empire Mobility Network*, Ribbonwood Road is classified as a *Light Collector with Intermittent Turn Lanes* from Interstate 8 to Old Highway 80. The posted speed limit on Ribbonwood Road between I-8 and Old Highway 80 is 55 mph. Shoulders are provided on Ribbonwood Road between I-8 and Old Highway 80.

McCain Valley Road is an unclassified roadway on the *Mountain Empire Mobility Network* and currently built as a 2-lane roadway in the project area. The posted speed limit on McCain Valley Road is 35 mph.

Old Highway 80 is currently built as a 2-lane roadway in the project area. According to the County of San Diego GP Update *Mountain Empire Mobility Network*, Old Highway 80 is classified as a *Light Collector with Improvement Options* from SR 94 to Jacumba Street. Shoulders are provided on both sides of the road.

Figure 4 depicts the existing traffic conditions for the roadway segments and study area intersections.

2.1.1 *Existing Traffic Volumes*

Existing weekday AM /PM peak hour turning movement counts and average daily traffic (ADT) counts were commissioned by LLG Engineers and conducted on Tuesday, December 16, 2009 and Tuesday, March 24, 2010. ***Appendix A*** contains the manual count sheets. ***Figure 5*** shows the existing peak hour intersection turning movements and ADT volumes.

2.1.2 *Existing Intersection Operations*

Table 3 summarizes the existing intersections level of service. As seen in *Table 3*, all the study area intersections are calculated to currently operate at LOS B or better during the AM and PM peak hours.

Appendix B contains the existing intersection analysis worksheets.

2.1.3 *Existing Street Segment Operations*

Table 4 summarizes the existing roadway segment operations. As seen in *Table 4*, all the study area roadway segments are calculated to currently operate at LOS A on a daily basis.

TABLE 3
EXISTING INTERSECTION OPERATIONS

Intersection	Traffic Control	Minor Street[d]	Peak Hour	Existing	
				Delay[a]	LOS[b]
1. Crestwood Road/ I-8 WB ramps	TWSC[c]	WBL	AM PM	10.2 10.2	B B
2. Crestwood Road/ I-8 EB ramps	TWSC	EBL	AM PM	9.0 9.2	A A
3. Ribbonwood Road/ I-8 WB ramps	TWSC	WBL	AM PM	9.0 9.0	A A
4. Ribbonwood Road/ I-8 EB ramps	TWSC	EBL	AM PM	8.6 8.6	A A
5. Ribbonwood Road/ Old Highway 80	TWSC	NB/SB	AM PM	9.7 9.6	A A
6. Ribbonwood Road/ McCain Valley Road	TWSC	SB	AM PM	8.5 8.7	A A

Footnotes:

a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. TWSC – Two-Way Stop Controlled Intersection.
d. Worst minor street movement delay reported.

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DELAY/LOS THRESHOLDS

Delay	LOS
0.0 < 10.0	A
10.1 to 15.0	B
15.1 to 25.0	C
25.1 to 35.0	D
35.1 to 50.0	E

TABLE 4
EXISTING STREET SEGMENT OPERATIONS

Roadway Segment	Lanes	Functional Classification	Capacity (LOS E) [a]	Existing ADT [b]	LOS [c]
Crestwood Road					
North of I-8	2	Rural Collector	16,200	1,060	A
Ribbonwood Road					
North of I-8	2	Rural Collector	16,200	270	A
I-8 to Old Highway 80	2	Light Collector	16,200	1,230	A
McCain Valley Road					
North of Old Highway 80	2	Rural Collector	16,200	110	A
Old Highway 80					
Ribbonwood Road to McCain Valley Road	2	Light Collector	16,200	990	A

Footnotes:

a. Capacity based on *County of San Diego Roadway Classification* at LOS E.
b. Average Daily Traffic Volumes.
c. Level of Service.

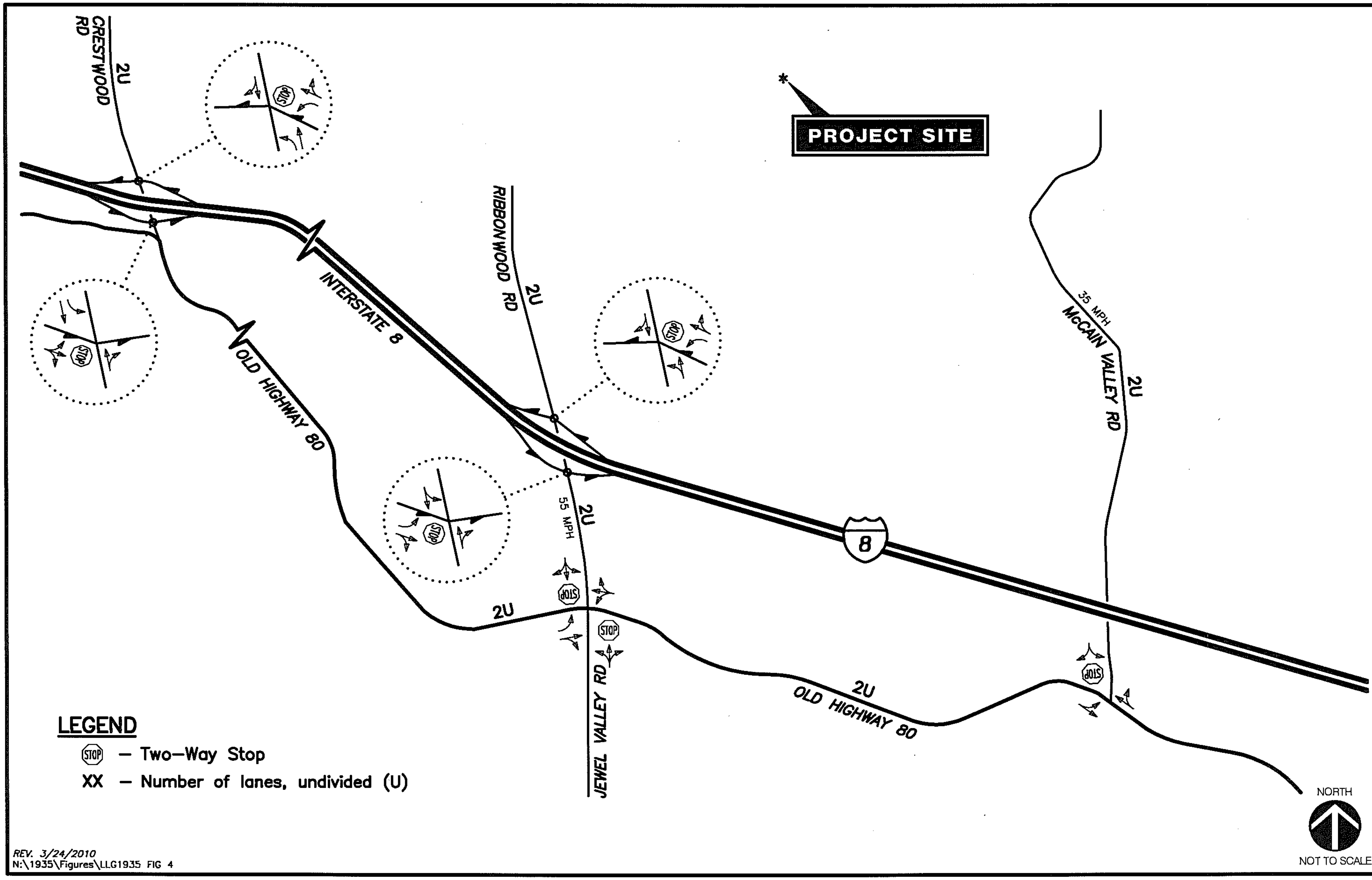

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Figure 4

Existing Conditions Diagram

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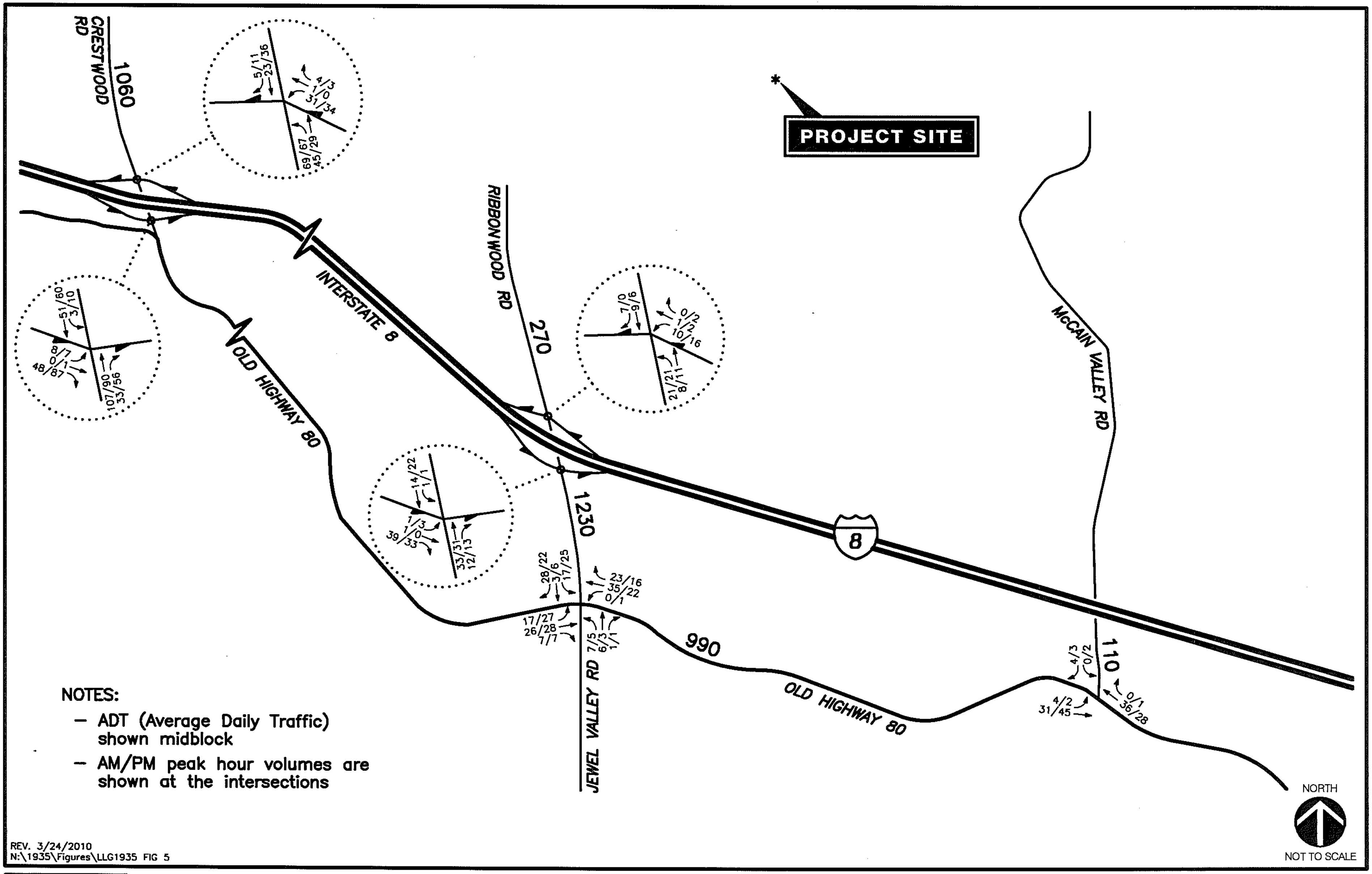

NOTES:

- ADT (Average Daily Traffic) shown midblock
- AM/PM peak hour volumes are shown at the intersections

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Figure 5

Existing Traffic Volumes AM/PM Peak Hours & ADT

TULE WIND PROJECT

3.0 PROJECT IMPACT ANALYSIS

3.1 Analysis Methodology

Level of service (LOS) is the term used to denote the different operating conditions which occur on a given roadway segment under various traffic volume loads. It is a qualitative measure used to describe a quantitative analysis taking into account factors such as roadway geometries, signal phasing, speed, travel delay, freedom to maneuver, and safety. Level of service provides an index to the operational qualities of a roadway segment or an intersection. Level of service designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions. Level of service designation is reported differently for signalized intersections, unsignalized intersections and roadway segments.

3.1.1 *Intersections*

Unsignalized intersections were analyzed under AM and PM peak hour conditions. Average vehicle delay and LOS was determined based upon the procedures found in Chapter 17 of the *2000 Highway Capacity Manual (HCM),* with the assistance of *Synchro* (version 7.0) computer software. Unsignalized intersection calculation worksheets and a more detailed explanation of the methodology are attached in ***Appendix C***.

3.1.2 *Street Segments*

Street segment analysis is based upon the comparison of daily traffic volumes (ADTs) to the County of San Diego's *Roadway Classification, Level of Service, and ADT Table*. This table provides segment capacities for different street classifications, based on traffic volumes and roadway characteristics. The County of San Diego's *Roadway Classification, Level of Service, and ADT Table* is attached in *Appendix C.*

3.0 PROJECT IMPACT ANALYSIS

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3.1.1 *Intersections*

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3.2 Construction Project Trip Generation

The project trip generation consists of two phases – trips during construction and post-construction operational/maintenance trips. There may be traffic impacts to the adjacent roadway system during the construction period, which include construction worker (employee) trips in passenger vehicles/light trucks, as well as equipment/material delivery trips made in heavy vehicles (trucks). The traffic analyses in this report deals with the trips during the construction period as the day-to-day trips post-construction are expected to be very low. Post-construction, the project is expected to be supported by 5 permanent full-time and 5 part-time employees. Typically, these staff will be present on-site during normal business hours for operational and maintenance purposes.

Project construction is expected to occur over a 9- to 12-month period. A typical day during the peak of the construction period would include approximately 200 trucks, which would help in the transportation of turbines, movement of heavy equipment, transport of material and concrete as well as trips for pump trucks and subcontractor trucks. In addition, approximately 125 construction employees are expected to access the work area.

The construction project trip generation is therefore based on 125 employees and 200 trucks. To estimate the employee trips, LLG assumed that 80% of the employees (approximately 100 employees) would access the work area during the normal commuter peak hours (7 AM to 4 PM). This is considered conservative, as the project trip generation does not account for potential carpooling, which is likely to occur given the remote location of the project.

The project traffic also consists of heavy vehicles (trucks). Based on discussions with the applicant, the assumed percent of ADT to occur during the peak hour for truck traffic is 15% as the truck trips are expected to be equally spread throughout the day, with little more in the peak hours.

According to *Highway Capacity Manual 2000*, a passenger car equivalent (PCE) factor of 2.5 for trucks is used to account for the effects of heavy vehicles in the traffic flow. PCE is defined as the number of passenger cars that are displaced by a single heavy vehicle of a particular type under the prevailing traffic conditions. Heavy vehicles have a greater traffic impact than passenger cars since:

- They are larger than passenger cars, and therefore, occupy more roadway space; and
- Their performance characteristics are generally inferior to passenger cars, leading to the formation of downstream gaps in the traffic stream (especially on upgrades), which cannot always be effectively filled by normal passing maneuvers.

Exhibit 21-8, PCE's on Extended General Highway Segments, (*obtained from "Highway Capacity Manual prepared by Transportation Research Board," dated Year 2000*) summarizes PCE factors for various types of vehicles. The type of terrain in the project area is "rolling". As seen in *Exhibit 21-8*, the passenger car equivalents are 2.5 for trucks on a rolling terrain (See *Appendix C*).

Table 5 tabulates the total project traffic generation. The total project is calculated to generate approximately 1,250 ADT.

TABLE 5
CONSTRUCTION PROJECT TRIP GENERATION

Use	Size	PCE	Daily Trips		AM Peak Hour		PM Peak Hour	
			Rate (In + Out)	Volume (ADT)[a]	Volume		Volume	
					In	Out	In	Out
Employees	125	1.0	2.0 /employee	250	90 [b]	10 [b]	10	90
Trucks	200	2.5	2.0 /truck	1,000	75 [c]	75 [c]	75	75
Subtotal	-	-	-	***1,250***	***165***	***85***	***85***	***165***

Footnotes:

a. ADT – Average daily traffic

b. To estimate the employee traffic, it is assumed that 80% of the employee traffic would access the work area during the normal commuter peak hours. The In/Out splits assumed are 90:10 during AM peak hour and 10:90 during the PM peak hour.

c. The assumed percent of ADT to occur during the peak hour for truck traffic is 15 % as the truck trips are expected to be equally spread throughout the day, with little more in the peak hours. The In/Out splits are assumed 50:50 during the AM/PM peak hours.

3.3 Project Trip Distribution

Based on the information provided by the applicant, the construction truck and employee trips are anticipated to originate from the west. Hence 100% of the project traffic was distributed to/from the west.

The local access routes in the project vicinity include Crestwood Road, Ribbonwood Road and McCain Valley Road. The project distribution was deduced based on the number of turbines and their proximity to these access roads. Crestwood Road and Ribbonwood Road interchanges would serve as main access points with Crestwood Road carrying majority of the construction traffic due to its location. Depending on the location of the turbines and construction staging areas, some trips may also use McCain Valley Road. To access McCain Valley Road, trips would use Ribbonwood Road and Old Highway 80.

Figure 6 shows the project traffic distribution and ***Figure 7*** shows the project traffic assignment.

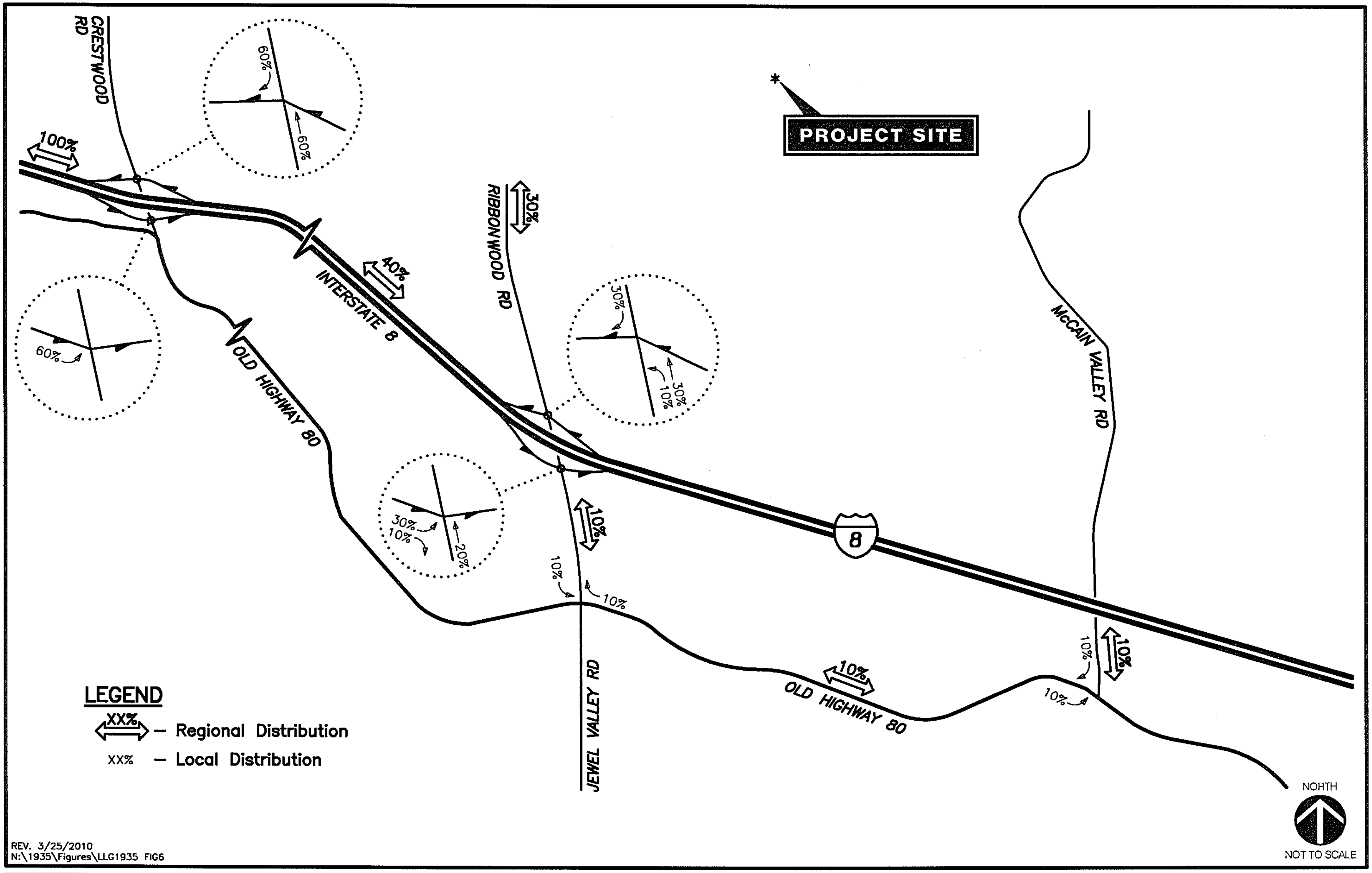

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Figure 6

Project Traffic Distribution

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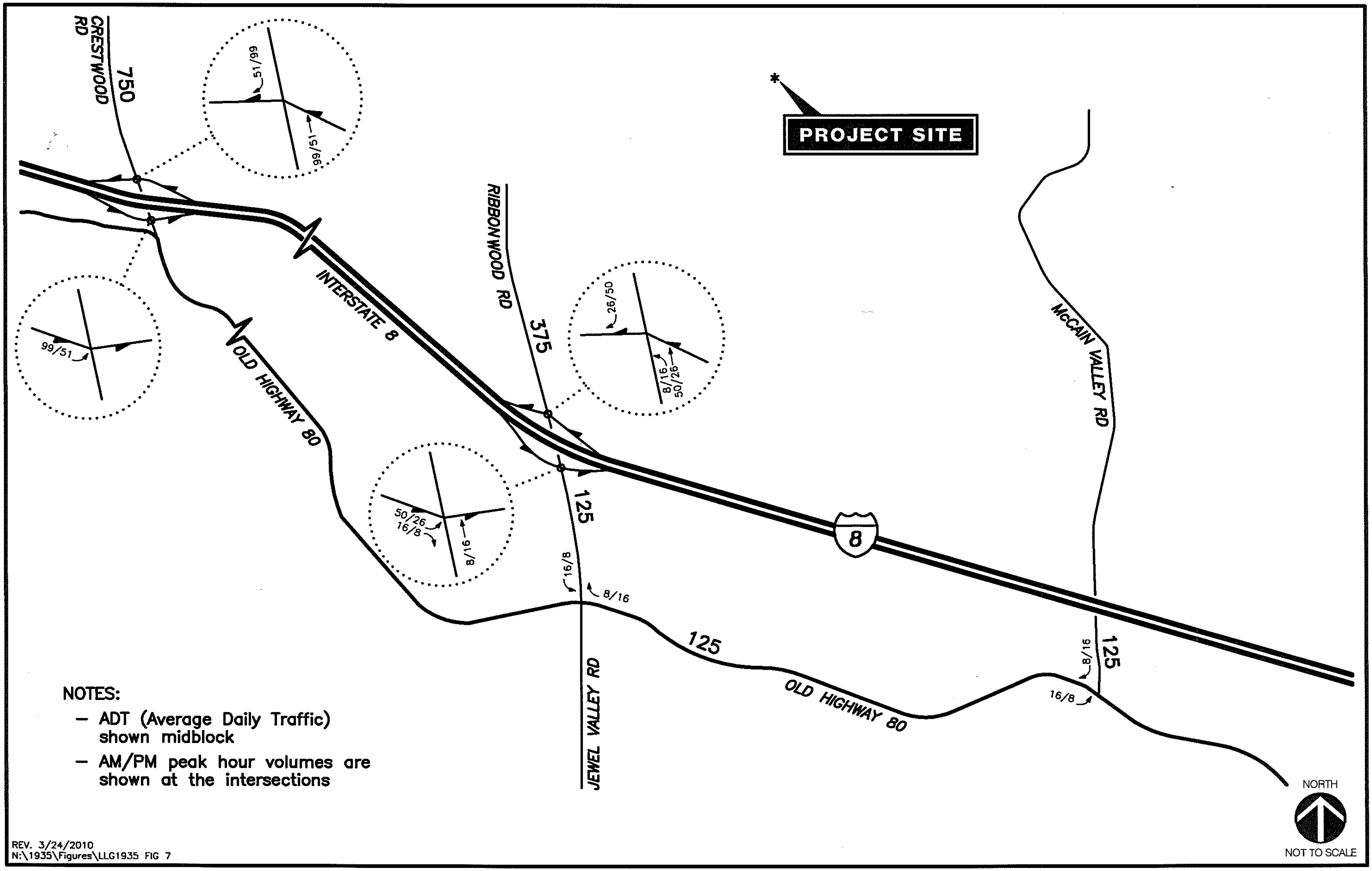

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Figure 7

Project Traffic Assignment AM/PM Peak Hours & ADT

TULE WIND PROJECT

3.4 Existing + Project Conditions

This section summarizes the analyses for the addition of project traffic onto the existing background traffic (existing + project). ***Figure 8*** shows the existing + project traffic volumes.

3.4.1 *Intersection Operations*

Table 6 summarizes the existing + project intersection levels of service. As seen in *Table 6,* with the addition of project traffic, all the study area intersections are calculated to continue to operate at LOS B or better.

Based on the *County of San Diego* significance criteria, the proposed project is calculated to have ***no significant direct impacts*** at the above study area intersections.

Appendix D contains the existing + project intersection analyses worksheets.

3.4.2 *Segment Operations*

Table *7* summarizes the existing + project roadway segment levels of service on a daily basis (ADT). As seen in *Table 7*, with the addition of project traffic, all the roadway segments are calculated to continue to operate at LOS A.

Based on the *County of San Diego* significance criteria, the proposed project is calculated to have ***no significant direct impacts*** on the study area segments.

TABLE 6
EXISTING + PROJECT INTERSECTION OPERATIONS

Intersection	Traffic Control	Minor Street[d]	Peak Hour	Existing		Existing + Project			Delay Increase	Sig?[e]
				Delay[a]	LOS[b]	Delay	LOS	CM Vol		
1. Crestwood Road/ I-8 WB ramps	TWSC[c]	WBL	AM	10.2	B	11.4	B	31	1.2	No
			PM	10.2	B	11.2	B	34	1.0	No
2. Crestwood Road / I-8 EB ramps	TWSC	EBL	AM	9.0	A	10.5	B	99	1.5	No
			PM	9.2	A	10.0	B	51	0.8	No
3. Ribbonwood Road/ I-8 WB ramps	TWSC	WBL	AM	9.0	A	9.6	A	10	0.6	No
			PM	9.0	A	9.6	A	16	0.6	No
4. Ribbonwood Road/ I-8 EB ramps	TWSC	EBL	AM	8.6	A	8.9	A	50	0.3	No
			PM	8.6	A	8.8	A	26	0.2	No
5. Ribbonwood Road/ Old Highway 80	TWSC	NB/SB	AM	9.7	A	9.7	A	16	0.0	No
			PM	9.6	A	9.7	A	8	0.1	No
6. McCain Valley Road/ Old Highway 80	TWSC	SB	AM	8.5	A	8.5	A	8	0.0	No
			PM	8.7	A	8.7	A	16	0.0	No

Footnotes:

a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. TWSC – Two-Way Stop Controlled Intersection.
d. Worst minor street approach delay reported.
e. Sig? = Does the addition of project result in a significant impact. (For criteria, refer to *Section 1.3* of Traffic Study).

General Notes:

CM – Critical Movement

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DELAY/LOS THRESHOLDS

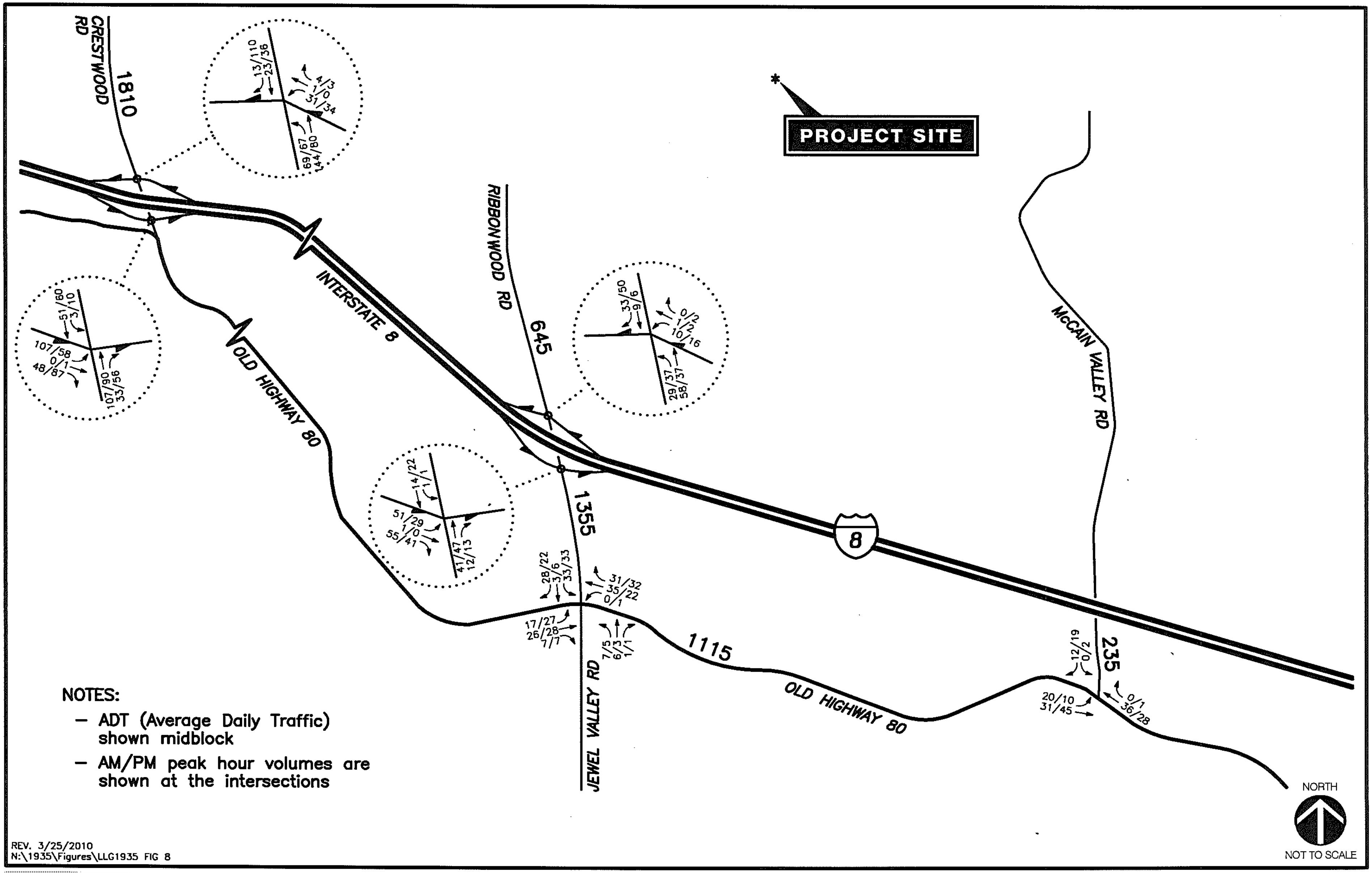
Delay	LOS
0.0 < 10.0	A
10.1 to 15.0	B
15.1 to 25.0	C
25.1 to 35.0	D
35.1 to 50.0	E
> 50.1	F

TABLE 7
EXISTING + PROJECT STREET SEGMENT OPERATIONS

Roadway Segment	Lanes	Functional Classification	Capacity (LOS E) [a]	Existing		Project ADT	Existing + Project		Sig? [d]
				ADT [b]	LOS [c]		ADT	LOS	
Crestwood Road									
North of I-8	2	Rural Collector	16,200	1,060	A	750	1,810	A	No
Ribbonwood Road									
North of I-8	2	Rural Collector	16,200	270	A	375	645	A	No
I-8 to Old Highway 80	2	Light Collector	16,200	1,230	A	125	1,355	A	No
McCain Valley Road									
North of Old Highway 80	2	Rural Collector	16,200	110	A	125	235	A	No
Old Highway 80									
Ribbonwood Road to McCain Valley Road	2	Light Collector	16,200	990	A	125	1,115	A	No

Footnotes:

a. Capacity based on *County of San Diego* roadway classification operating at LOS E.
b. Average Daily Traffic.
c. Level of Service.
d. Sig? = Does the addition of project result in a significant impact. (For criteria, refer to *Section 1.3* of Traffic Study).



NOTES:

- ADT (Average Daily Traffic) shown midblock
- AM/PM peak hour volumes are shown at the intersections

REV. 3/25/2010
N:\1935\Figures\LLG1935 FIG 8

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Figure 8

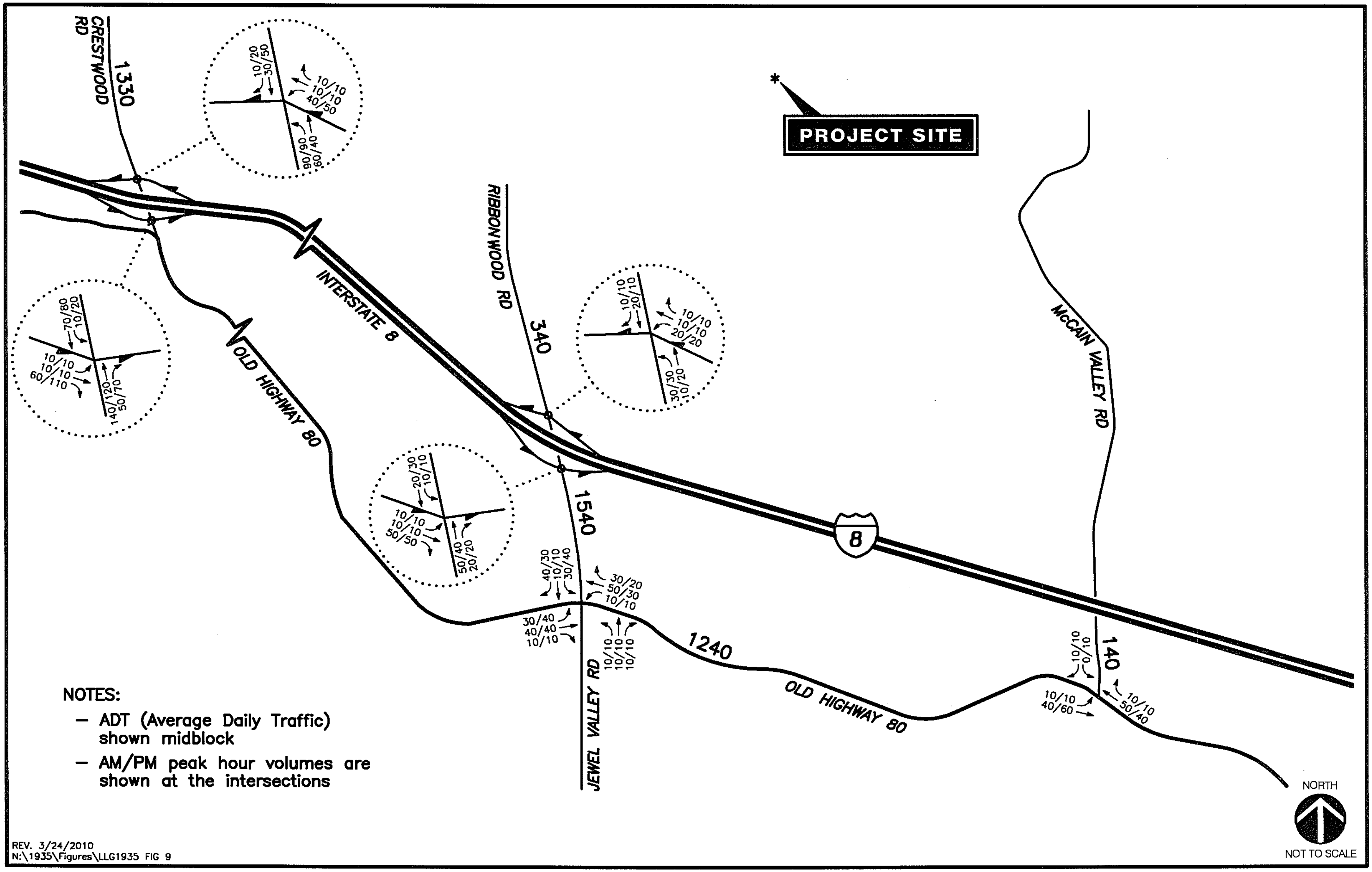
Existing + Project Traffic Volumes AM/PM Peak Hours & ADT

TULE WIND PROJECT

3.5 Cumulative Traffic

Cumulative projects are other projects in the study area that will add traffic to the local circulation system in the near future. LLG conducted research on the nearby cumulative projects from the County of San Diego KIVA system. There are only a few potential cumulative projects in the area.

To be conservative, LLG applied a 25% growth factor to existing traffic volumes to account for future cumulative projects traffic. ***Figure 9*** shows the cumulative project traffic volumes. ***Appendix E*** contains the list of cumulative projects.



NOTES:

- ADT (Average Daily Traffic) shown midblock
- AM/PM peak hour volumes are shown at the intersections

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Figure 9

Cumulative Project Traffic Volumes AM/PM Peak Hours & ADT

TULE WIND PROJECT

3.6 Existing + Project + Cumulative Projects Conditions

This scenario accounts for the addition of the proposed project and cumulative traffic onto existing traffic. ***Figure 10*** shows the existing + cumulative projects + project traffic volumes.

3.6.1 *Intersection Operations*

Table 8 summarizes the existing + project + cumulative projects intersection levels of service. As seen in *Table 8*, with the addition of project and cumulative traffic, all the study area intersections are calculated to operate at LOS C or better.

Based on the *County of San Diego* significance criteria, the proposed project is calculated to have ***no significant cumulative impacts*** at the above study area intersections.

Appendix F contains the existing + project + cumulative projects intersection analyses worksheets.

3.6.2 *Segment Operations*

Table 9 summarizes the existing + project + cumulative projects daily roadway segment level of service. As seen in *Table 9*, with the addition of project and cumulative traffic, all the roadway segments are calculated to operate at LOS B or better.

Based on the *County of San Diego* significance criteria, the proposed project is calculated to have ***no significant cumulative impacts*** on the study area segments.

TABLE 8
EXISTING + PROJECT + CUMULATIVE PROJECTS INTERSECTION OPERATIONS

Intersection	Traffic Control	Minor Street[d]	Peak Hour	Existing + Project		Existing + Project Cumulative Projects		Sig?[e]
				Delay[a]	LOS[b]	Delay	LOS	
1. Crestwood Road/ I-8 WB ramps	TWSC[c]	WBL	AM	11.4	B	16.5	C	No
			PM	11.2	B	17.4	C	No
2. Crestwood Road/ I-8 EB ramps	TWSC	EBL	AM	10.5	B	14.6	B	No
			PM	10.0	B	14.0	B	No
3. Ribbonwood Road/ I-8 WB ramps	TWSC	WBL	AM	9.6	A	10.4	B	No
			PM	9.6	A	10.4	B	No
4. Ribbonwood Road/ I-8 EB ramps	TWSC	EBL	AM	8.9	A	9.5	A	No
			PM	8.8	A	9.4	A	No
5. Ribbonwood Road/ Old Highway 80	TWSC	NB/SB	AM	9.7	A	11.8	B	No
			PM	9.7	A	12.1	B	No
6. McCain Valley Road/ Old Highway 80	TWSC	SB	AM	8.5	A	8.9	A	No
			PM	8.7	A	9.2	A	No

Footnotes:
a. Average delay expressed in seconds per vehicle.
b. Level of Service.
c. TWSC – Two-Way Stop Controlled Intersection.
d. Worst minor street approach delay reported.
e. Sig? = Does the addition of project result in a significant impact. (For criteria, refer to Section 1.3 of Traffic Study).

UNSIGNALIZED

DELAY/LOS THRESHOLDS

Delay	LOS
0.0 < 10.0	A
10.1 to 15.0	B
15.1 to 25.0	C
25.1 to 35.0	D
35.1 to 50.0	E
> 50.1	F

TABLE 9
EXISTING + PROJECT+ CUMULATIVE PROJECTS STREET SEGMENT OPERATIONS

Roadway Segment	Lanes	Functional Classification	Capacity (LOS E) [a]	Existing + Project		Existing + Project + Cumulative		Sig? [d]
				ADT [b]	LOS [c]	ADT	LOS	
Crestwood Road								
North of I-8	2	Rural Collector	16,200	1,810	A	3,140	B	No
Ribbonwood Road								
North of I-8	2	Rural Collector	16,200	645	A	985	A	No
I-8 to Old Highway 80	2	Light Collector	16,200	1,355	A	2,895	B	No
McCain Valley Road								
North of Old Highway 80	2	Rural Collector	16,200	235	A	375	A	No
Old Highway 80								
Ribbonwood Road to McCain Valley Road	2	Light Collector	16,200	1,115	A	2,355	B	No

Footnotes:

a. Capacity based on *County of San Diego* roadway classification operating at LOS E.
b. Average Daily Traffic.
c. Level of Service.
d. Sig? = Does the addition of project result in a significant impact. (For criteria, refer to Section 1.3 of Traffic Study).

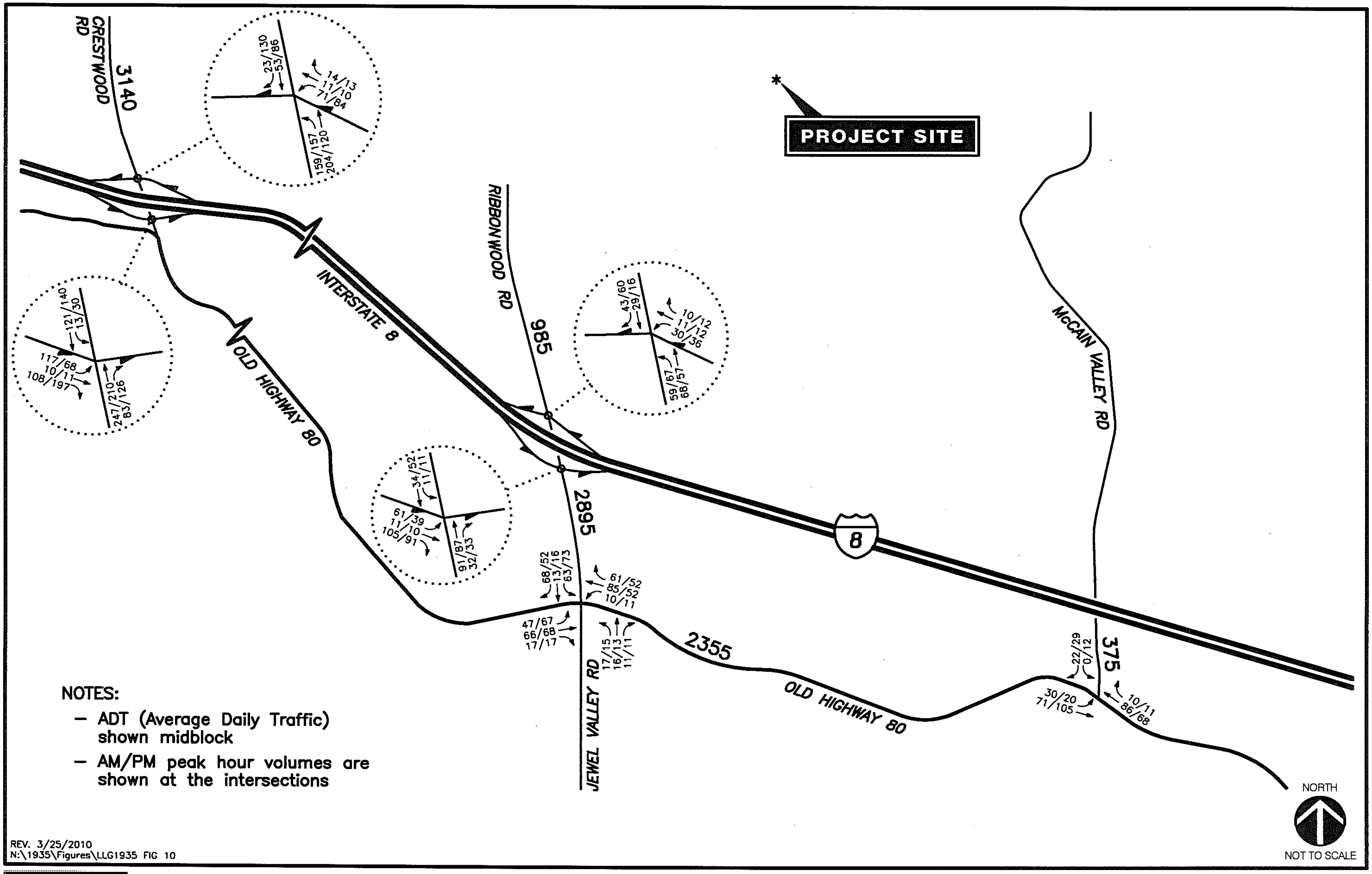

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Figure 10

Existing + Project + Cumulative Projects Traffic Volumes AM/PM Peak Hours & ADT

TULE WIND PROJECT

4.0 IMPACT SUMMARY

4.1 Impact Summary Table

The project is calculated to have no direct and cumulative impacts based on the published *County of San Diego Significance Criteria (June 30, 2009).*

4.2 Summary of Recommended Project Design Features, Impacts and Mitigation

The project is calculated to have no significant direct and cumulative impacts based on the published County of San Diego significance criteria. Hence no mitigation measures are required or recommended.

4.3 Truck Height and Vertical Clearance

A typical construction day would generate approximately 200 trucks, which would include the transportation of steel pipe, movement of heavy equipment for turbine construction, dump trucks, concrete trucks, pump trucks and subcontractor trucks. These trucks are expected to use local access roads such as Crestwood Road, Ribbonwood Road and McCain Valley Road. LLG Engineers conducted a field survey to determine the height of Crestwood Road, Ribbonwood Road and McCain Valley Road under-crossings on Interstate 8, to calculate the maximum height of the trucks that can possibly use these access roads.

LLG coordinated with Caltrans and obtained as-builts of the under-crossings in the project study area to determine the vertical clearances. ***Appendix G*** contains a copy of the as-builts.

Based on the as-builts, Crestwood Road undercrossing has a minimum vertical clearance of 16 feet and 11 inches and Ribbonwood Road undercrossing has a minimum vertical clearance of 19 feet and 1 inch.

Based on a field survey, the McCain Valley Road undercrossing currently has a vertical clearance sign of 15 feet and 1 inch. This is considered as "low" vertical clearance and hence appropriate signs are currently placed on Old Highway 80 and McCain Valley Road.

The California vehicle code (*Section 35250*) suggests that the maximum height of a vehicle cannot exceed 14 feet. The project will need to contact Caltrans and obtain special permits for vehicles that exceed 14 feet.

5.0 REFERENCES

Highway Capacity Manual (HCM) 2000

Institute of Transportation Engineers (ITE) Trip Generation Book, 7th Edition

County of San Diego, KIVA Website

California Vehicle Code

6.0 LIST OF PREPARERS AND ORGANIZATIONS CONTACTED

Preparers

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R.VidhyaShankar, P.E, Transportation Engineer III—*Linscott, Law & Greenspan, Engineers*

Organizations Contacted

Teresa Montano, Caltrans D11

Dennis Campbell, County of San Diego

APPENDIX A

INTERSECTION AND SEGMENT COUNT SHEETS

TDSSW, Inc.
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Weather : Clear & Dry
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Board #: D1-1426
Loc: Ribbonwood Rd & I-8 WB Ramps

File Name : 09186010
Site Code : 00186010
Start Date : 12/15/2009
Page No : 1

Groups Printed- Group 1

	Ribbonwood Road Southbound					I-8 WB Off Ramp Westbound					Ribbonwood Road Northbound					I-8 WB On Ramp Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00	0	2	0	0	2	1	0	0	0	1	9	0	0	0	9	0	0	0	0	0	12
07:15	0	0	0	0	0	1	0	0	0	1	7	0	0	0	7	0	0	0	0	0	8
07:30	0	0	0	0	0	3	0	0	0	3	7	1	0	0	8	0	0	0	0	0	11
07:45	0	0	2	0	2	3	0	0	0	3	5	2	0	0	7	0	0	0	0	0	12
Total	0	2	2	0	4	8	0	0	0	8	28	3	0	0	31	0	0	0	0	0	43
08:00	0	3	0	0	3	0	0	0	0	0	10	3	0	0	13	0	0	0	0	0	16
08:15	0	3	2	0	5	5	0	0	0	5	3	2	0	0	5	0	0	0	0	0	15
08:30	0	3	3	0	6	2	1	0	0	3	3	1	1	0	5	0	0	0	0	0	14
08:45	0	1	0	0	1	1	0	0	0	1	5	3	0	0	8	0	0	0	0	0	10
Total	0	10	5	0	15	8	1	0	0	9	21	9	1	0	31	0	0	0	0	0	55
Grand Total	0	12	7	0	19	16	1	0	0	17	49	12	1	0	62	0	0	0	0	0	98
Apprch %	0.0	63.2	36.8	0.0		94.1	5.9	0.0	0.0		79.0	19.4	1.6	0.0		0.0	0.0	0.0	0.0		
Total %	0.0	12.2	7.1	0.0	19.4	16.3	1.0	0.0	0.0	17.3	50.0	12.2	1.0	0.0	63.3	0.0	0.0	0.0	0.0	0.0	

	Ribbonwood Road Southbound					I-8 WB Off Ramp Westbound					Ribbonwood Road Northbound					I-8 WB On Ramp Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 07:00 to 08:45 - Peak 1 of 1																					
Intersection	07:45																				
Volume	0	9	7	0	16	10	1	0	0	11	21	8	1	0	30	0	0	0	0	0	57
Percent	0.0	56.3	43.8	0.0		90.9	9.1	0.0	0.0		70.0	26.7	3.3	0.0		0.0	0.0	0.0	0.0		
08:00 Volume	0	3	0	0	3	0	0	0	0	0	10	3	0	0	13	0	0	0	0	0	16
Peak Factor																					0.891
High Int.	08:30					08:15					08:00					6:45:00 AM					
Volume	0	3	3	0	6	5	0	0	0	5	10	3	0	0	13						
Peak Factor					0.667					0.550					0.577						

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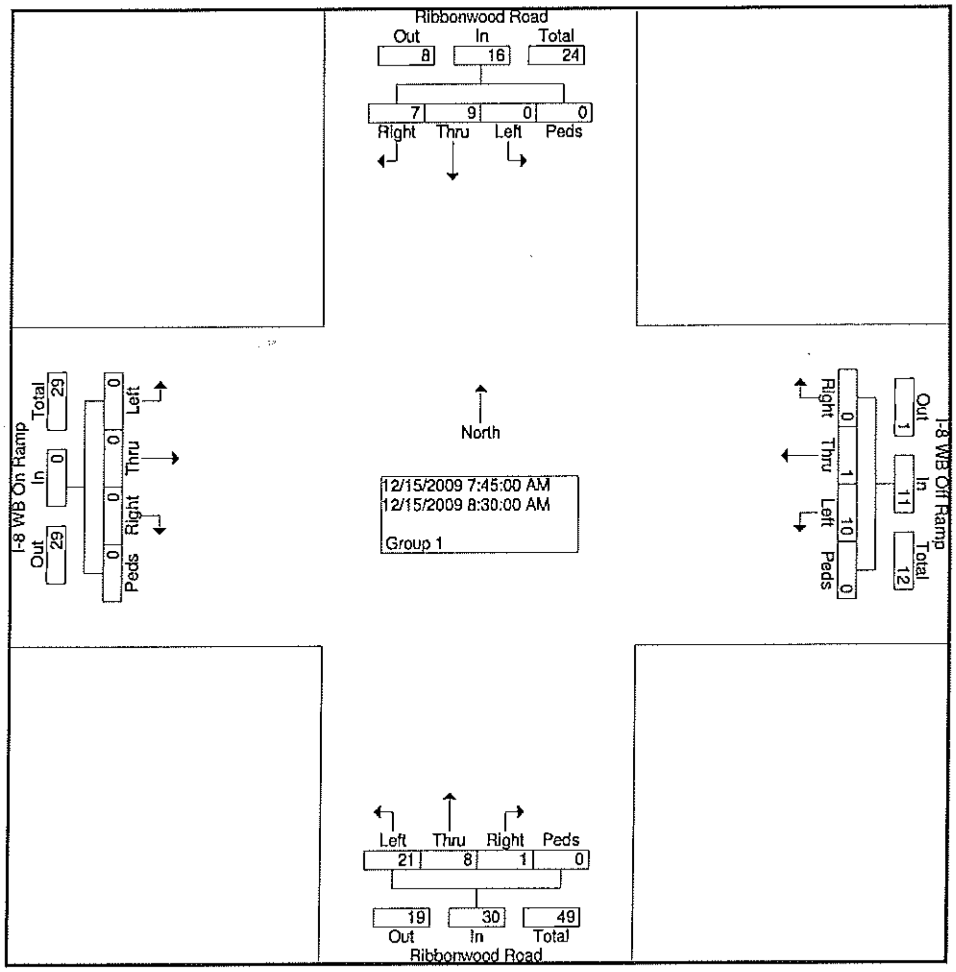
File Name : 09186010
Site Code : 00186010
Start Date : 12/15/2009
Page No : 2



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	Ribbonwood Road Southbound					I-8 WB Off Ramp Westbound					Ribbonwood Road Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
16:00	0	3	0	0	3	4	0	0	0	4	13	2	0	0	15	0	0	0	0	0	22
16:15	0	1	0	0	1	3	0	1	0	4	3	5	0	0	8	0	0	0	0	0	13
16:30	0	0	0	0	0	2	0	1	0	3	2	3	0	0	5	0	0	0	0	0	8
16:45	0	2	0	0	2	7	2	0	0	9	3	1	0	0	4	0	0	0	0	0	15
Total	0	6	0	0	6	16	2	2	0	20	21	11	0	0	32	0	0	0	0	0	58
17:00	0	1	0	0	1	2	0	0	0	2	2	3	0	0	5	0	0	0	0	0	8
17:15	0	0	0	0	0	3	0	0	0	3	4	2	0	0	6	0	0	0	0	0	9
17:30	0	1	0	0	1	1	0	1	0	2	11	3	0	0	14	0	0	0	0	0	17
17:45	0	0	0	0	0	0	1	1	0	2	5	2	0	0	7	0	0	0	0	0	9
Total	0	2	0	0	2	6	1	2	0	9	22	10	0	0	32	0	0	0	0	0	43
Grand Total	0	8	0	0	8	22	3	4	0	29	43	21	0	0	64	0	0	0	0	0	101
Apprch %	0.0	100.0	0.0	0.0		75.9	10.3	13.8	0.0		67.2	32.8	0.0	0.0		0.0	0.0	0.0	0.0		
Total %	0.0	7.9	0.0	0.0	7.9	21.8	3.0	4.0	0.0	28.7	42.6	20.8	0.0	0.0	63.4	0.0	0.0	0.0	0.0	0.0	

	Ribbonwood Road Southbound					I-8 WB Off Ramp Westbound					Ribbonwood Road Northbound					Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 16:00 to 17:45 - Peak 1 of 1																					
Intersection	16:00																				
Volume	0	6	0	0	6	16	2	2	0	20	21	11	0	0	32	0	0	0	0	0	58
Percent	0.0	100.0	0.0	0.0		80.0	10.0	10.0	0.0		65.6	34.4	0.0	0.0		0.0	0.0	0.0	0.0		
16:00 Volume	0	3	0	0	3	4	0	0	0	4	13	2	0	0	15	0	0	0	0	0	22
Peak Factor																					0.659
High Int.	16:00					16:45					16:00					3:45:00 PM					
Volume	0	3	0	0	3	7	2	0	0	9	13	2	0	0	15						
Peak Factor					0.500					0.556					0.533						

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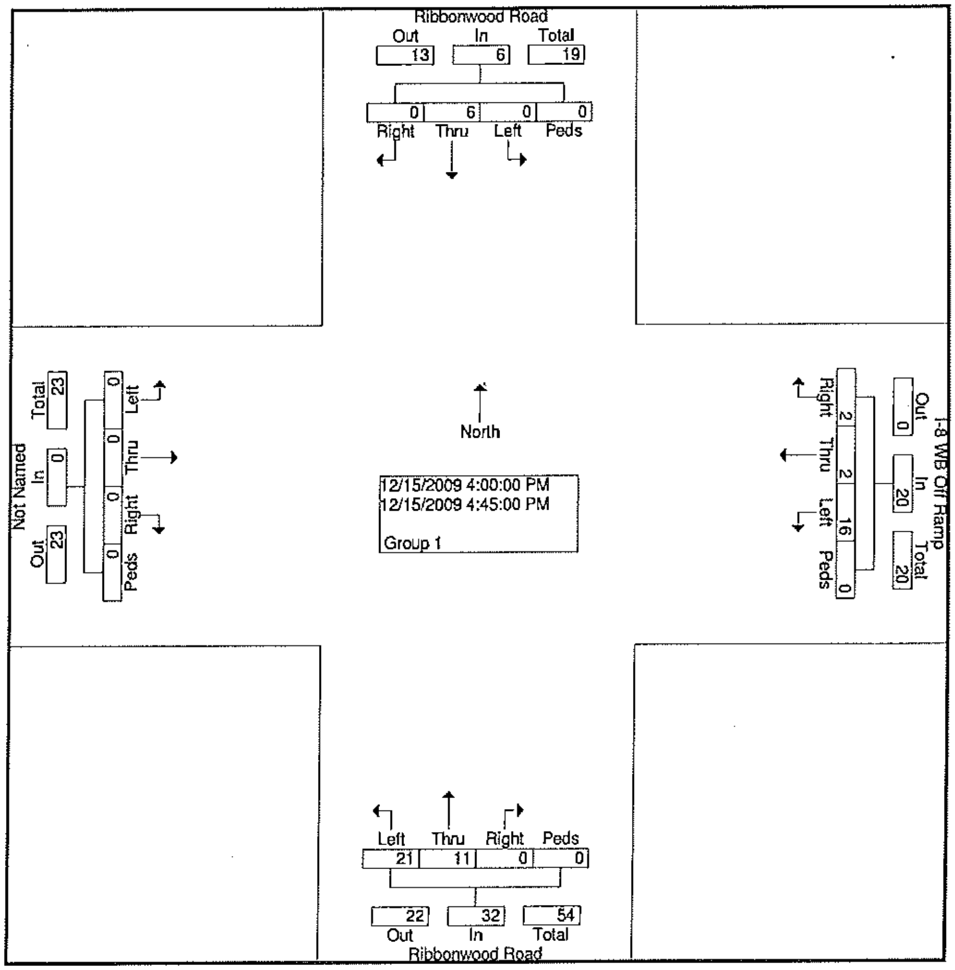

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File Name : 09186020
Site Code : 00186020
Start Date : 12/15/2009

Groups Printed- Group 1

	Ribbonwood Road Southbound					Westbound					Ribbonwood Road Northbound					I-8 EB Off Ramp Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
07:00	0	3	0	0	3	0	0	0	0	0	0	9	1	0	10	0	0	3	0	3	16
07:15	0	1	0	0	1	0	0	0	0	0	0	6	0	0	6	0	0	9	0	9	16
07:30	0	2	1	0	3	0	0	0	0	0	0	10	3	0	13	0	0	9	0	9	25
07:45	0	2	0	0	2	0	0	0	0	0	0	7	1	0	8	0	0	14	0	14	24
Total	0	8	1	0	9	0	0	0	0	0	0	32	5	0	37	0	0	35	0	35	81
08:00	0	3	0	0	3	0	0	0	0	0	0	10	1	0	11	1	1	9	0	11	25
08:15	0	7	0	0	7	0	0	0	0	0	0	6	7	0	13	0	0	7	0	7	27
08:30	0	5	0	0	5	0	0	0	0	0	0	5	4	0	9	0	0	2	0	2	16
08:45	1	2	0	0	3	0	0	0	0	0	0	9	3	0	12	1	0	6	0	7	22
Total	1	17	0	0	18	0	0	0	0	0	0	30	15	0	45	2	1	24	0	27	90
Grand Total	1	25	1	0	27	0	0	0	0	0	0	62	20	0	82	2	1	59	0	62	171
Apprch %	3.7	92.6	3.7	0.0		0.0	0.0	0.0	0.0		0.0	75.6	24.4	0.0		3.2	1.6	95.2	0.0		
Total %	0.6	14.6	0.6	0.0	15.8	0.0	0.0	0.0	0.0	0.0	0.0	36.3	11.7	0.0	48.0	1.2	0.6	34.5	0.0	36.3	

	Ribbonwood Road Southbound					Westbound					Ribbonwood Road Northbound					I-8 EB Off Ramp Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 07:00 to 08:45 - Peak 1 of 1																					
Intersection	07:30																				
Volume	0	14	1	0	15	0	0	0	0	0	0	33	12	0	45	1	1	39	0	41	101
Percent	0.0	93.3	6.7	0.0		0.0	0.0	0.0	0.0		0.0	73.3	26.7	0.0		2.4	2.4	95.1	0.0		
08:15 Volume	0	7	0	0	7	0	0	0	0	0	0	6	7	0	13	0	0	7	0	7	27
Peak Factor																					0.935
High Int.	08:15					6:45:00 AM					07:30					07:45					
Volume	0	7	0	0	7	0	0	0	0	0	0	10	3	0	13	0	0	14	0	14	
Peak Factor					0.536										0.865					0.732	

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Loc: Ribbonwood Rd & I-8 eB Ramps

File Name : 09186020
Site Code : 00186020
Start Date : 12/15/2009
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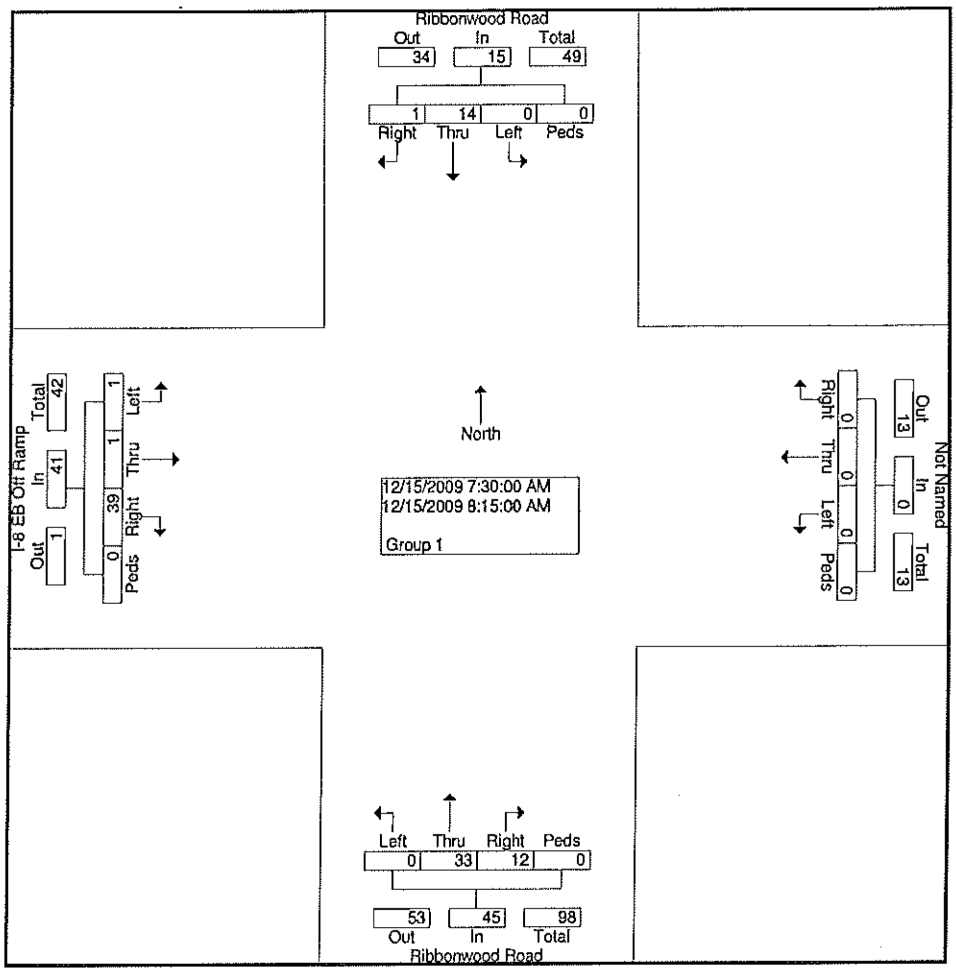

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File Name : 09186021
Site Code : 00186021
Start Date : 12/15/2009
Page No : 1

Groups Printed- Group 1

	Ribbonwood Road Southbound					Westbound					Ribbonwood Road Northbound					I-8 EB Off Ramp Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Factor	1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		1.0	1.0	1.0	1.0		
16:00	0	7	0	0	7	0	0	0	0	0	0	14	3	0	17	2	0	8	0	10	34
16:15	0	5	1	0	6	0	0	0	0	0	0	8	2	0	10	1	0	8	0	9	25
16:30	0	2	0	0	2	0	0	0	0	0	0	5	7	0	12	0	0	11	0	11	25
16:45	0	8	0	0	8	0	0	0	0	0	0	4	1	0	5	0	0	6	0	6	19
Total	0	22	1	0	23	0	0	0	0	0	0	31	13	0	44	3	0	33	0	36	103
17:00	0	3	0	0	3	0	0	0	0	0	0	3	2	0	5	2	0	11	0	13	21
17:15	0	2	0	0	2	0	0	0	0	0	0	3	5	0	8	3	0	10	0	13	23
17:30	0	2	0	0	2	0	0	0	0	0	0	11	2	0	13	1	0	7	0	8	23
17:45	0	0	0	0	0	0	0	0	0	0	0	6	4	0	10	1	0	9	0	10	20
Total	0	7	0	0	7	0	0	0	0	0	0	23	13	0	36	7	0	37	0	44	87
Grand Total	0	29	1	0	30	0	0	0	0	0	0	54	26	0	80	10	0	70	0	80	190
Apprch %	0.0	96.7	3.3	0.0		0.0	0.0	0.0	0.0		0.0	67.5	32.5	0.0		12.5	0.0	87.5	0.0		
Total %	0.0	15.3	0.5	0.0	15.8	0.0	0.0	0.0	0.0	0.0	0.0	28.4	13.7	0.0	42.1	5.3	0.0	36.8	0.0	42.1	

	Ribbonwood Road Southbound					Westbound					Ribbonwood Road Northbound					I-8 EB Off Ramp Eastbound					
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Int. Total
Peak Hour From 16:00 to 17:45 - Peak 1 of 1																					
Intersection	16:00																				
Volume	0	22	1	0	23	0	0	0	0	0	0	31	13	0	44	3	0	33	0	36	103
Percent	0.0	95.7	4.3	0.0		0.0	0.0	0.0	0.0		0.0	70.5	29.5	0.0		8.3	0.0	91.7	0.0		
16:00 Volume	0	7	0	0	7	0	0	0	0	0	0	14	3	0	17	2	0	8	0	10	34
Peak Factor																					0.757
High Int.	16:45					3:45:00 PM					16:00					16:30					
Volume	0	8	0	0	8	0	0	0	0	0	0	14	3	0	17	0	0	11	0	11	
Peak Factor					0.719										0.647					0.818	

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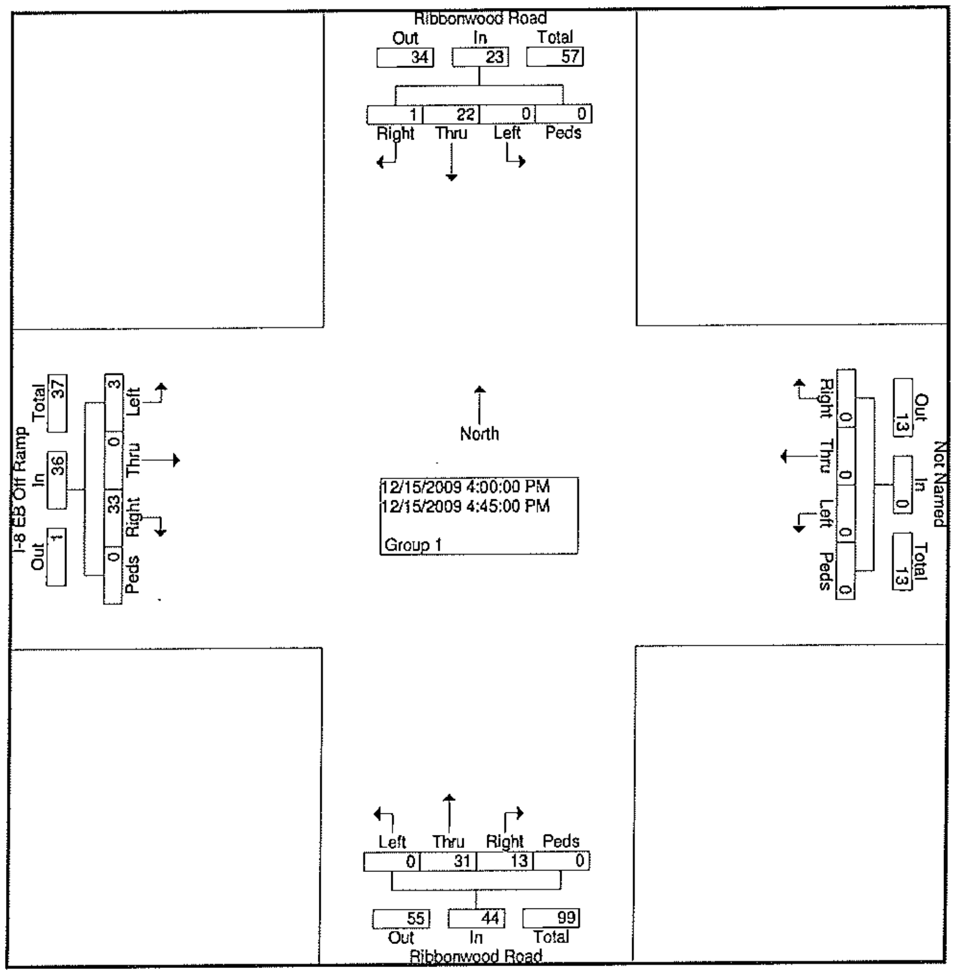
Weather : Clear & Dry
Counted By: J. Green
Board #: D1-1424
Loc: Ribbonwood Rd & I-8 EB Ramps

File Name : 09186021
Site Code : 00186021
Start Date : 12/15/2009
Page No : 2



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Weather : Clear & Dry
Counted By: D. Wellman
Board #: D1-1427
Loc:Ribbonwood/Jewel Valley & Old Hwy 80

File Name : 09186030
Site Code : 00186030
Start Date : 12/15/2009
Page No : 1

Groups Printed- Group 1

	Ribbonwood Road Southbound					Old Hwy 80 Westbound					Jewel Valley Road Northbound					Old Hwy 80 Eastbound							
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
07:00	2	0	4	0	6	0	5	8	0	13	2	2	1	1	5	2	2	0	0	4	1	28	29
07:15	4	0	2	0	6	1	8	4	0	13	0	1	0	0	1	0	1	2	0	3	0	23	23
07:30	3	0	5	0	8	0	4	6	0	10	1	1	0	0	2	1	2	2	0	5	0	25	25
07:45	2	0	8	0	10	1	8	2	0	11	3	2	0	0	5	3	3	2	0	8	0	34	34
Total	11	0	19	0	30	2	25	20	0	47	6	6	1	1	13	6	8	6	0	20	1	110	111
08:00	3	1	6	0	10	0	7	9	0	16	3	2	0	0	5	4	4	3	0	11	0	42	42
08:15	9	1	10	0	20	0	11	5	0	16	2	0	0	1	2	1	7	1	0	9	1	47	48
08:30	4	1	5	0	10	0	5	4	0	9	1	2	1	0	4	6	10	2	0	18	0	41	41
08:45	1	0	7	0	8	0	12	5	0	17	1	2	0	0	3	6	5	1	0	12	0	40	40
Total	17	3	28	0	48	0	35	23	0	58	7	6	1	1	14	17	26	7	0	50	1	170	171
Grand Total	28	3	47	0	78	2	60	43	0	105	13	12	2	2	27	23	34	13	0	70	2	280	282
Apprch %	35.9	3.8	60.3			1.9	57.1	41.0			48.1	44.4	7.4			32.9	48.6	18.6					
Total %	10.0	1.1	16.8		27.9	0.7	21.4	15.4		37.5	4.6	4.3	0.7		9.6	8.2	12.1	4.6		25.0	0.7	99.3	

	Ribbonwood Road Southbound				Old Hwy 80 Westbound				Jewel Valley Road Northbound				Old Hwy 80 Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 07:00 to 08:45 - Peak 1 of 1																	
Intersection	08:00																
Volume	17	3	28	48	0	35	23	58	7	6	1	14	17	26	7	50	170
Percent	35.4	6.3	58.3		0.0	60.3	39.7		50.0	42.9	7.1		34.0	52.0	14.0		
08:15 Volume	9	1	10	20	0	11	5	16	2	0	0	2	1	7	1	9	47
Peak Factor																	0.904
High Int.	08:15				08:45				08:00				08:30				
Volume	9	1	10	20	0	12	5	17	3	2	0	5	6	10	2	18	
Peak Factor				0.600				0.853				0.700				0.694	

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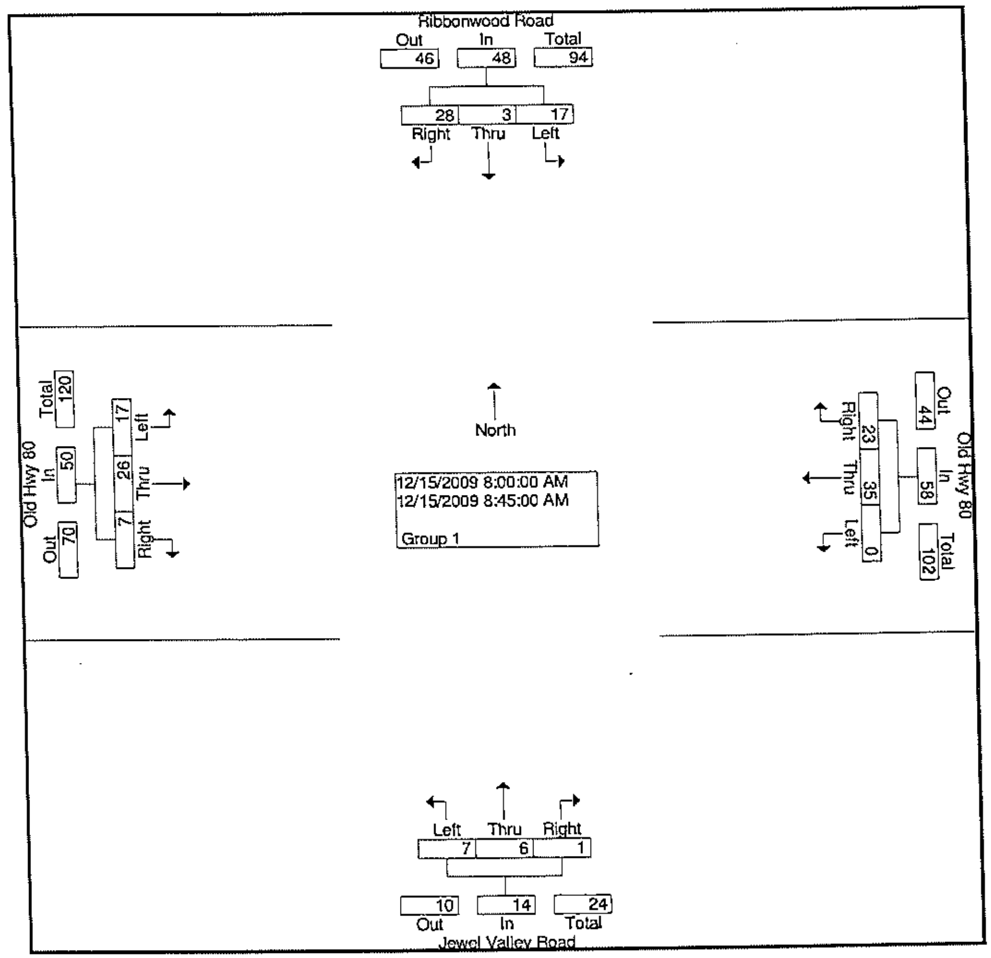
Weather : Clear & Dry
Counted By: D. Wellman
Board #: D1-1427
Loc:Ribbonwood/Jewel Valley & Old Hwy 80

File Name : 09186030
Site Code : 00186030
Start Date : 12/15/2009
Page No : 2



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Weather : Clear & Dry
Counted By: D. Wellman
Board #: D1-1427
Loc:Ribbonwood/Jewel Valley & Old Hwy 80

File Name : 09186031
Site Code : 00186031
Start Date : 12/15/2009
Page No : 1

Groups Printed- Group 1

	Ribbonwood Road Southbound					Old Hwy 80 Westbound					Jewel Valley Road Northbound					Old Hwy 80 Eastbound							
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
16:00	7	0	8	0	15	0	7	5	0	12	3	2	0	0	5	10	7	5	0	22	0	54	54
16:15	7	1	6	0	14	0	8	1	0	9	0	0	0	0	0	9	9	1	0	19	0	42	42
16:30	10	4	3	0	17	0	5	5	0	10	2	1	1	0	4	6	7	1	0	14	0	45	45
16:45	1	1	5	1	7	1	2	5	0	8	0	0	0	0	0	2	5	0	0	7	1	22	23
Total	25	6	22	1	53	1	22	16	0	39	5	3	1	0	9	27	28	7	0	62	1	163	164
17:00	4	1	9	0	14	0	7	1	0	8	0	0	1	0	1	7	3	5	0	15	0	38	38
17:15	6	1	6	0	13	0	2	3	0	5	0	0	0	0	0	0	7	0	0	7	0	25	25
17:30	3	1	5	2	9	0	6	2	1	8	2	0	0	0	2	5	6	2	0	13	3	32	35
17:45	6	3	5	0	14	0	8	0	0	8	1	3	0	0	4	3	5	1	1	9	1	35	36
Total	19	6	25	2	50	0	23	6	1	29	3	3	1	0	7	15	21	8	1	44	4	130	134
Grand Total	44	12	47	3	103	1	45	22	1	68	8	6	2	0	16	42	49	15	1	106	5	293	298
Apprch %	42.7	11.7	45.6			1.5	66.2	32.4			50.0	37.5	12.5			39.6	46.2	14.2					
Total %	15.0	4.1	16.0		35.2	0.3	15.4	7.5		23.2	2.7	2.0	0.7		5.5	14.3	16.7	5.1		36.2	1.7	98.3	

	Ribbonwood Road Southbound				Old Hwy 80 Westbound				Jewel Valley Road Northbound				Old Hwy 80 Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 16:00 to 17:45 - Peak 1 of 1																	
Intersection	16:00																
Volume	25	6	22	53	1	22	16	39	5	3	1	9	27	28	7	62	163
Percent	47.2	11.3	41.5		2.6	56.4	41.0		55.6	33.3	11.1		43.5	45.2	11.3		
16:00 Volume	7	0	8	15	0	7	5	12	3	2	0	5	10	7	5	22	54
Peak Factor																	0.755
High Int.	16:30				16:00				16:00				16:00				
Volume	10	4	3	17	0	7	5	12	3	2	0	5	10	7	5	22	
Peak Factor				0.779				0.813				0.450				0.705	

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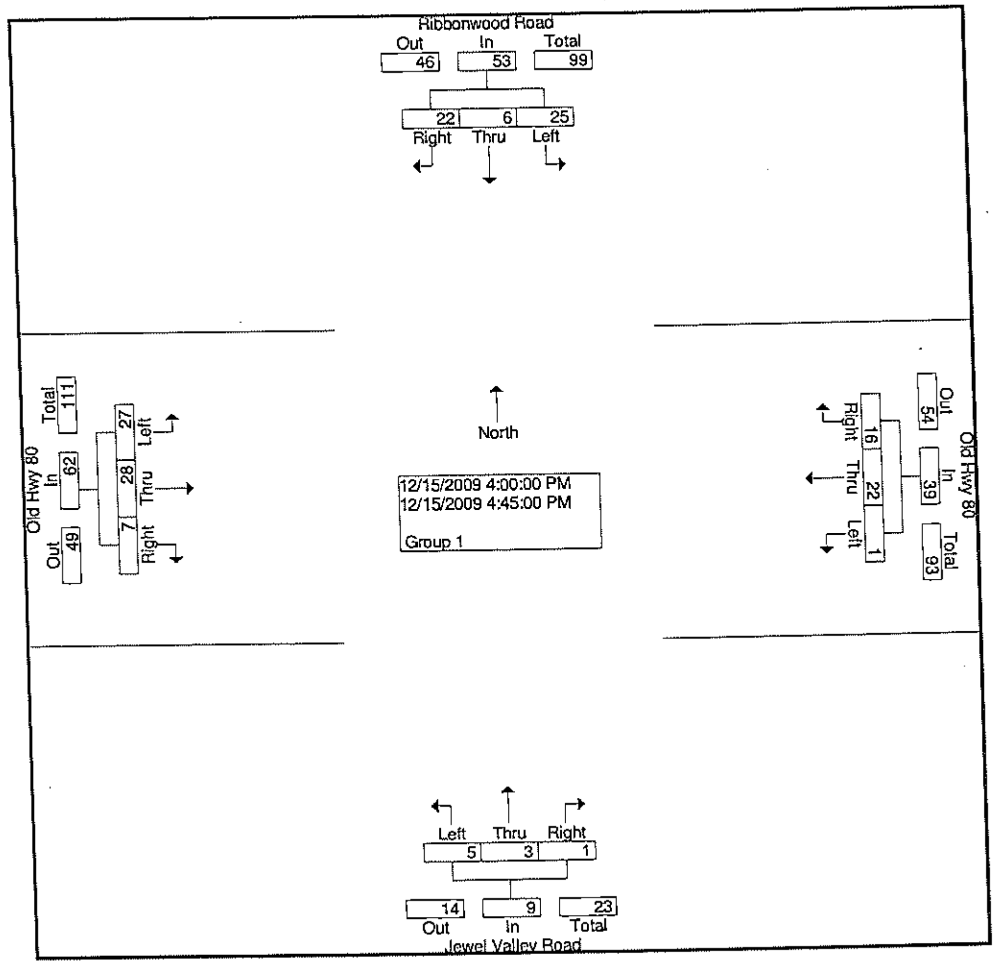
Weather : Clear & Dry
Counted By: D. Wellman
Board #: D1-1427
Loc:Ribbonwood/Jewel Valley & Old Hwy 80

File Name : 09186031
Site Code : 00186031
Start Date : 12/15/2009
Page No : 2



Weather : Clear & Dry
Counted By: W. Willeford
Board #: D1-1428
Loc: Mccain Valley Rd & Old Hwy 80

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File Name : 09186040
Site Code : 00186040
Start Date : 12/15/2009
Page No : 1

Groups Printed- Group 1

	Mccain Valley Road Southbound					Old Hwy 80 Westbound					Northbound					Old Hwy 80 Eastbound							
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
07:00	0	0	0	0	0	0	7	2	0	9	0	0	0	0	0	0	3	0	0	3	0	12	12
07:15	0	0	1	0	1	0	11	1	0	12	0	0	0	0	0	2	3	0	0	5	0	18	18
07:30	1	0	1	0	2	0	7	0	0	7	0	0	0	0	0	3	2	0	0	5	0	14	14
07:45	0	0	3	0	3	0	6	0	0	6	0	0	0	0	0	0	2	0	0	2	0	11	11
Total	1	0	5	0	6	0	31	3	0	34	0	0	0	0	0	5	10	0	0	15	0	55	55
08:00	0	0	0	0	0	0	10	0	0	10	0	0	0	0	0	3	3	0	0	6	0	16	16
08:15	0	0	2	0	2	0	7	0	0	7	0	0	0	0	0	0	4	0	0	4	0	13	13
08:30	0	0	0	0	0	0	7	0	0	7	0	0	0	0	0	1	21	0	0	22	0	29	29
08:45	0	0	2	0	2	0	12	0	0	12	0	0	0	0	0	0	3	0	0	3	0	17	17
Total	0	0	4	0	4	0	36	0	0	36	0	0	0	0	0	4	31	0	0	35	0	75	75
Grand Total	1	0	9	0	10	0	67	3	0	70	0	0	0	0	0	9	41	0	0	50	0	130	130
Apprch %	10.0	0.0	90.0			0.0	95.7	4.3			0.0	0.0	0.0			18.0	82.0	0.0					
Total %	0.8	0.0	6.9		7.7	0.0	51.5	2.3		53.8	0.0	0.0	0.0		0.0	6.9	31.5	0.0		38.5	0.0	100.0	

	Mccain Valley Road Southbound				Old Hwy 80 Westbound				Northbound				Old Hwy 80 Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 07:00 to 08:45 - Peak 1 of 1																	
Intersection	08:00																
Volume	0	0	4	4	0	36	0	36	0	0	0	0	4	31	0	35	75
Percent	0.0	0.0	100.0		0.0	100.0	0.0		0.0	0.0	0.0		11.4	88.6	0.0		
08:30 Volume	0	0	0	0	0	7	0	7	0	0	0	0	1	21	0	22	29
Peak Factor																	0.647
High Int.	08:15				08:45				6:45:00 AM				08:30				
Volume	0	0	2	2	0	12	0	12	0	0	0	0	1	21	0	22	
Peak Factor				0.500				0.750								0.398	

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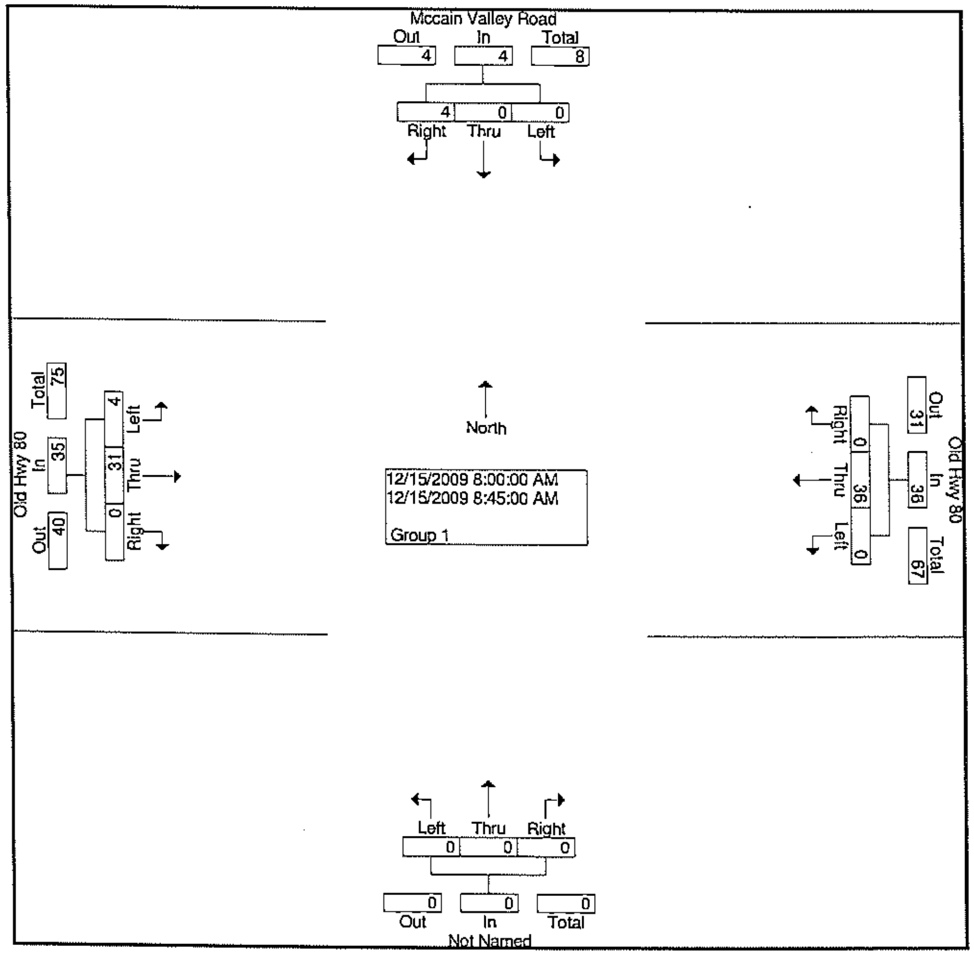
Weather : Clear & Dry
Counted By: W. Willeford
Board #: D1-1428
Loc: Mccain Valley Rd & Old Hwy 80

File Name : 09186040
Site Code : 00186040
Start Date : 12/15/2009
Page No : 2



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Weather : Clear & Dry
Counted By: W. Willeford
Board #: D1-1428
Loc: Mccain Valley Rd & Old Hwy 80

File Name : 09186041
Site Code : 00186041
Start Date : 12/15/2009
Page No : 1

Groups Printed- Group 1

	Mccain Valley Road Southbound					Old Hwy 80 Westbound					Northbound					Old Hwy 80 Eastbound							
Start Time	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Left	Thru	Right	Peds	App. Total	Exclu. Total	Inclu. Total	Int. Total
16:00	1	0	0	0	1	0	7	0	0	7	0	0	0	0	0	1	9	0	0	10	0	18	18
16:15	0	0	1	0	1	0	9	1	0	10	0	0	0	0	0	1	15	0	0	16	0	27	27
16:30	1	0	0	0	1	0	7	0	0	7	0	0	0	0	0	0	14	0	0	14	0	22	22
16:45	0	0	2	0	2	0	5	0	0	5	0	0	0	0	0	0	7	0	0	7	0	14	14
Total	2	0	3	0	5	0	28	1	0	29	0	0	0	0	0	2	45	0	0	47	0	81	81
17:00	0	0	1	0	1	0	5	0	0	5	0	0	0	0	0	0	5	0	0	5	0	11	11
17:15	0	0	3	0	3	0	2	1	0	3	0	0	0	0	0	0	13	0	0	13	0	19	19
17:30	0	0	0	0	0	0	5	1	0	6	0	0	0	0	0	2	6	0	0	8	0	14	14
17:45	0	0	0	0	0	0	3	0	0	3	0	0	0	0	0	1	3	0	0	4	0	7	7
Total	0	0	4	0	4	0	15	2	0	17	0	0	0	0	0	3	27	0	0	30	0	51	51
Grand Total	2	0	7	0	9	0	43	3	0	46	0	0	0	0	0	5	72	0	0	77	0	132	132
Apprch %	22.2	0.0	77.8			0.0	93.5	6.5			0.0	0.0	0.0			6.5	93.5	0.0					
Total %	1.5	0.0	5.3		6.8	0.0	32.6	2.3		34.8	0.0	0.0	0.0		0.0	3.8	54.5	0.0		58.3	0.0	100.0	

	Mccain Valley Road Southbound				Old Hwy 80 Westbound				Northbound				Old Hwy 80 Eastbound				
Start Time	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Left	Thru	Right	App. Total	Int. Total
Peak Hour From 16:00 to 17:45 - Peak 1 of 1																	
Intersection	16:00																
Volume	2	0	3	5	0	28	1	29	0	0	0	0	2	45	0	47	81
Percent	40.0	0.0	60.0		0.0	96.6	3.4		0.0	0.0	0.0		4.3	95.7	0.0		
16:15 Volume	0	0	1	1	0	9	1	10	0	0	0	0	1	15	0	16	27
Peak Factor																	0.750
High Int.	16:45				16:15				3:45:00 PM				16:15				
Volume	0	0	2	2	0	9	1	10	0	0	0	0	1	15	0	16	
Peak Factor				0.625				0.725								0.734	

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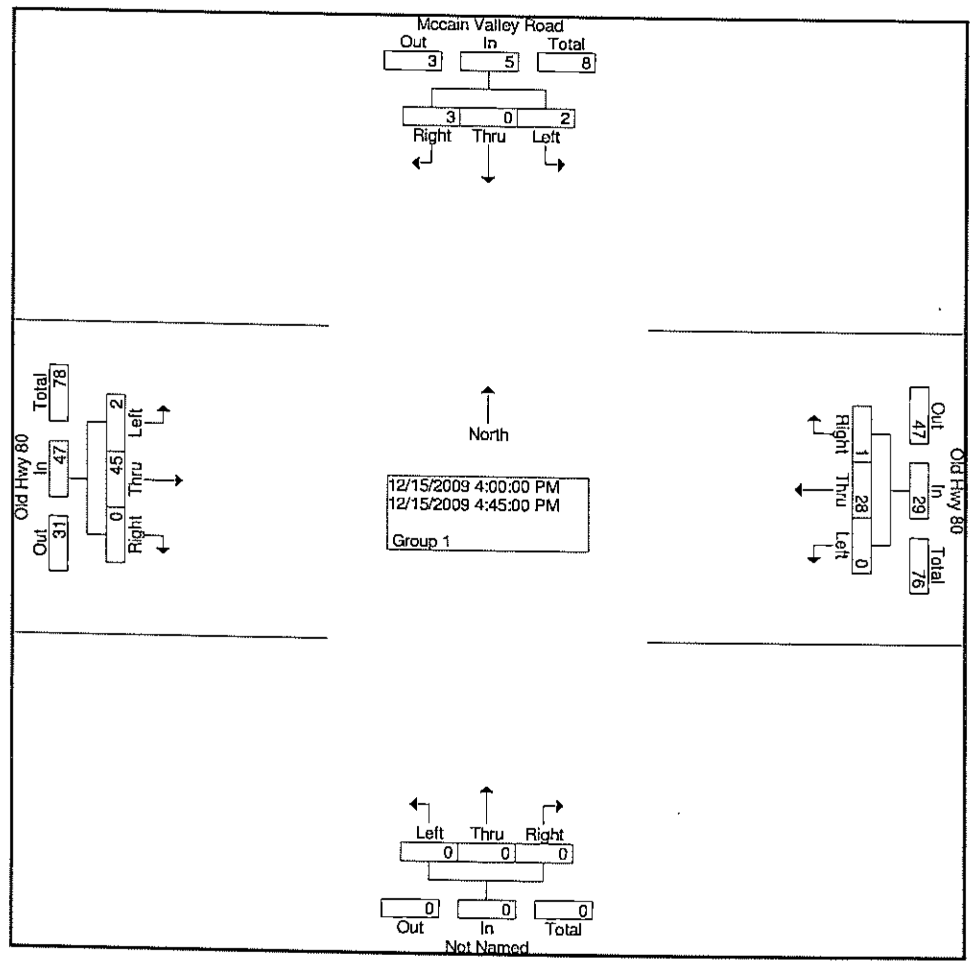
Weather : Clear & Dry
Counted By: W. Willeford
Board #: D1-1428
Loc: Mccain Valley Rd & Old Hwy 80

File Name : 09186041
Site Code : 00186041
Start Date : 12/15/2009
Page No : 2



TDSSW, Inc.
Vehicle Counts

VehicleCount-308 -- English (ENU)

Datasets:

Site: [18601] Ribbonwood Road N/O of I-8 W/B Ramps
Direction: 5 - South bound A>B, North bound B>A. **Lane:** 0
Survey Duration: 15:58 Monday, December 14, 2009 => 13:09 Tuesday, December 22, 2009
Zone: North America
File: 1860122Dec2009.EC0 (Plus)
Identifier: M504J6JA MC56-6 [MC55] (c)Microcom 02/03/01
Algorithm: Factory default (v3.21 - 15275)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time: **16:00 Monday, December 14, 2009 => 16:00 Wednesday, December 16, 2009**
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range: 0 - 100 mph.
Direction: North (bound)
Separation: All - (Headway)
Name: Default Profile
Scheme: Vehicle classification (Scheme F99)
Units: Non metric (ft, mi, ft/s, mph, lb, ton)
In profile: Vehicles = 258 / 1043 (24.74%)

*** Monday, December 14, 2009 - Total=49 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	12	10	8	3	5	1	1	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	5	2	3	2	1	0	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	5	2	1	0	0	1	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	2	1	1	0	3	1	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	3	2	2	0	1	0	0	0

*** Tuesday, December 15, 2009 - Total=137, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
0	0	0	0	0	0	5	4	7	5	13	14	7	7	12	16	13	13	5	8	5	2	1	0	
0	0	0	0	0	0	1	1	2	2	3	4	0	1	6	5	4	1	0	0	2	1	1	0	0
0	0	0	0	0	0	1	0	2	2	2	1	2	1	2	4	4	5	2	2	2	1	0	0	0
0	0	0	0	0	0	2	0	1	1	4	3	4	4	2	2	4	4	0	4	1	0	0	0	0
0	0	0	0	0	0	1	3	2	0	4	6	1	1	2	5	1	3	3	2	0	0	0	0	0

AM Peak 1015 - 1115 (14), AM PHF=0.88 PM Peak 1545 - 1645 (17), PM PHF=0.85

*** Wednesday, December 16, 2009 - Total=72 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
0	0	0	1	0	2	3	8	8	3	2	7	12	7	9	10	-	-	-	-	-	-	-	-	
0	0	0	1	0	0	0	2	3	0	1	1	4	1	3	5	-	-	-	-	-	-	-	-	-
0	0	0	0	0	1	1	2	2	1	0	2	3	3	3	1	-	-	-	-	-	-	-	-	-
0	0	0	0	0	1	0	1	1	1	1	3	2	1	1	3	-	-	-	-	-	-	-	-	-
0	0	0	0	0	0	2	3	2	1	0	1	3	2	2	1	-	-	-	-	-	-	-	-	-

AM Peak 1130 - 1230 (11), AM PHF=0.69

137 + 133

= 270

TDSSW, Inc.
Vehicle Counts

VehicleCount-309 -- English (ENU)

Datasets:
Site: [18601] Ribbonwood Road N/O of I-8 W/B Ramps
Direction: 5 - South bound A>B, North bound B>A. Lane: 0
Survey Duration: 15:58 Monday, December 14, 2009 => 13:09 Tuesday, December 22, 2009
Zone: North America
File: 1860122Dec2009.EC0 (Plus)
Identifier: M504J6JA MC56-6 [MC55] (c)Microcom 02/03/01
Algorithm: Factory default (v3.21 - 15275)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:
Filter time: 16:00 Monday, December 14, 2009 => 16:00 Wednesday, December 16, 2009
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range: 0 - 100 mph.
Direction: South (bound)
Separation: All - (Headway)
Name: Default Profile
Scheme: Vehicle classification (Scheme F99)
Units: Non metric (ft, mi, ft/s, mph, lb, ton)
In profile: Vehicles = 264 / 1043 (25.31%)

*** Monday, December 14, 2009 - Total=22 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**7**	**3**	**1**	**5**	**2**	**2**	**2**	**0**	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	0	1	3	0	1	2	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	2	0	0	1	1	0	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	1	0	1	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	1	1	0	0	0	0

*** Tuesday, December 15, 2009 - Total=133, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
0	**0**	**0**	**0**	**2**	**8**	**13**	**5**	**16**	**8**	**12**	**13**	**11**	**8**	**13**	**10**	**5**	**1**	**1**	**4**	**1**	**1**	**1**	**0**	
0	0	0	0	0	1	3	3	2	3	2	3	4	1	2	4	2	1	1	1	0	0	0	0	0
0	0	0	0	0	1	2	0	6	5	5	1	3	4	3	2	1	0	0	2	0	1	1	0	0
0	0	0	0	1	4	4	0	3	0	3	5	3	0	4	4	0	0	0	1	1	0	0	0	0
0	0	0	0	1	2	4	2	5	0	2	4	1	3	4	0	2	0	0	0	0	0	0	0	0

AM Peak 0815 - 0915 (17), AM PHF=0.71 PM Peak 1415 - 1515 (15), PM PHF=0.94

*** Wednesday, December 16, 2009 - Total=109 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
0	**0**	**0**	**0**	**2**	**12**	**10**	**12**	**9**	**3**	**11**	**11**	**8**	**10**	**11**	**10**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
0	0	0	0	0	0	0	2	2	1	4	3	2	5	4	3	-	-	-	-	-	-	-	-	-
0	0	0	0	0	6	3	5	3	0	1	3	2	1	4	4	-	-	-	-	-	-	-	-	-
0	0	0	0	0	3	4	3	4	0	2	3	1	4	2	1	-	-	-	-	-	-	-	-	-
0	0	0	0	2	3	3	2	0	2	4	2	3	0	1	2	-	-	-	-	-	-	-	-	-

AM Peak 0630 - 0730 (14), AM PHF=0.70

TDSSW, Inc.
Vehicle Counts

VehicleCount-311 -- English (ENU)

Datasets:

Site:	**[18602] Ribbonwood Road Btwn I-8 E/B Ramps & Old hwy 80**
Direction:	5 - South bound A>B, North bound B>A. **Lane:** 0
Survey Duration:	16:08 Monday, December 14, 2009 => 13:20 Tuesday, December 22, 2009
Zone:	North America
File:	1860222Dec2009.EC0 (Plus)
Identifier:	M278T7ZB MC56-6 [MC55] (c)Microcom 02/03/01
Algorithm:	Factory default (v3.21 - 15275)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**17:00 Monday, December 14, 2009 => 17:00 Wednesday, December 16, 2009**
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range:	0 - 100 mph.
Direction:	North (bound)
Separation:	All - (Headway)
Name:	Default Profile
Scheme:	Vehicle classification (Scheme F99)
Units:	Non metric (ft, mi, ft/s, mph, lb, ton)
In profile:	Vehicles = 1127 / 4671 (24.13%)

*** Monday, December 14, 2009 - Total=81 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**29**	**18**	**12**	**12**	**5**	**2**	**3**	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	2	3	3	0	1	0	2
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	2	2	4	3	0	0	2
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	8	2	1	1	0	1	4
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	6	5	4	1	1	2	2

*** Tuesday, December 15, 2009 - Total=590, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
10	**4**	**6**	**5**	**15**	**31**	**33**	**35**	**41**	**21**	**43**	**43**	**41**	**35**	**39**	**41**	**39**	**23**	**29**	**19**	**13**	**10**	**10**	**4**	
2	1	3	0	1	7	7	17	12	7	10	11	8	12	16	13	9	3	8	7	4	1	5	0	0
2	0	1	3	4	9	6	5	8	5	10	11	9	8	9	9	12	8	5	4	1	4	1	1	0
4	1	1	0	4	2	11	7	9	2	11	9	14	8	5	9	11	5	9	6	3	4	4	2	2
2	2	1	2	6	13	9	6	12	7	12	12	10	7	9	10	7	7	7	2	5	1	0	1	3

AM Peak 1030 - 1130 (45), AM PHF=0.94 PM Peak 1215 - 1315 (45), PM PHF=0.80

*** Wednesday, December 16, 2009 - Total=456 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
5	**3**	**3**	**5**	**24**	**23**	**30**	**44**	**43**	**37**	**24**	**35**	**34**	**24**	**34**	**38**	**50**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
0	1	1	0	6	5	9	15	13	11	9	6	10	3	5	8	12	-	-	-	-	-	-	-	-
0	2	2	1	7	7	4	10	9	9	7	7	6	8	9	11	13	-	-	-	-	-	-	-	-
2	0	0	0	5	5	8	9	10	9	4	10	7	7	12	7	13	-	-	-	-	-	-	-	-
3	0	0	4	6	6	9	10	11	8	4	12	11	6	8	12	12	-	-	-	-	-	-	-	-

AM Peak 0700 - 0800 (44), AM PHF=0.73

590 + 641 = 1231

TDSSW, Inc.
Vehicle Counts

VehicleCount-310 -- English (ENU)

Datasets:

Site:	[18602] Ribbonwood Road Btwn I-8 E/B Ramps & Old hwy 80
Direction:	5 - South bound A>B, North bound B>A. Lane: 0
Survey Duration:	16:08 Monday, December 14, 2009 => 13:20 Tuesday, December 22, 2009
Zone:	North America
File:	1860222Dec2009.EC0 (Plus)
Identifier:	M278T7ZB MC56-6 [MC55] (c)Microcom 02/03/01
Algorithm:	Factory default (v3.21 - 15275)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	17:00 Monday, December 14, 2009 => 17:00 Wednesday, December 16, 2009
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range:	0 - 100 mph.
Direction:	South (bound)
Separation:	All - (Headway)
Name:	Default Profile
Scheme:	Vehicle classification (Scheme F99)
Units:	Non metric (ft, mi, ft/s, mph, lb, ton)
In profile:	Vehicles = 1211 / 4671 (25.93%)

*** Monday, December 14, 2009 - Total=149 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39	35	26	15	13	14	7	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7	10	11	4	2	2	3	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	8	3	5	4	3	1	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	9	4	5	5	4	3	5
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	9	8	8	1	2	5	0	0

*** Tuesday, December 15, 2009 - Total=641, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
9	6	5	6	9	11	17	26	43	38	39	41	40	48	34	46	54	47	38	32	17	19	9	7	
1	3	1	1	1	3	2	5	8	10	14	11	12	9	11	15	14	14	12	8	5	3	5	2	0
3	0	3	0	2	2	3	7	17	11	13	11	5	12	8	11	15	15	13	13	2	5	1	1	2
5	0	1	3	3	3	5	5	12	5	6	12	9	13	7	11	19	7	6	4	3	5	1	4	9
0	3	0	2	3	3	7	9	6	12	6	7	14	14	8	9	6	11	7	7	7	6	2	0	4

AM Peak 0745 - 0845 (46), AM PHF=0.68 PM Peak 1545 - 1645 (57), PM PHF=0.75

*** Wednesday, December 16, 2009 - Total=421 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
15	7	5	3	4	13	20	22	37	26	28	28	30	39	36	42	66	-	-	-	-	-	-	-	
0	3	2	0	1	3	2	0	8	7	6	6	8	10	12	11	13	-	-	-	-	-	-	-	-
2	0	1	1	0	3	4	5	16	7	5	3	5	10	7	13	17	-	-	-	-	-	-	-	-
9	3	0	1	1	5	6	8	5	8	7	9	9	10	9	8	19	-	-	-	-	-	-	-	-
4	1	2	1	2	2	8	9	8	4	10	10	8	9	8	10	17	-	-	-	-	-	-	-	-

AM Peak 0730 - 0830 (41), AM PHF=0.64

TDSSW, Inc.
Vehicle Counts

VehicleCount-313 -- English (ENU)

Datasets:

Site:	[18603] Old Hwy 80 Btwn Ribbonwood Road & Mc Cain Valley Road
Direction:	8 - East bound A>B, West bound B>A. **Lane:** 0
Survey Duration:	16:36 Monday, December 14, 2009 => 13:04 Tuesday, December 22, 2009
Zone:	North America
File:	1860322Dec2009.EC0 (Plus)
Identifier:	M264XG37 MC56-6 [MC55] (c)Microcom 02/03/01
Algorithm:	Factory default (v3.21 - 15275)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	17:00 Monday, December 14, 2009 => 17:00 Wednesday, December 16, 2009
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range:	0 - 100 mph.
Direction:	East (bound)
Separation:	All - (Headway)
Name:	Default Profile
Scheme:	Vehicle classification (Scheme F99)
Units:	Non metric (ft, mi, ft/s, mph, lb, ton)
In profile:	Vehicles = 983 / 3954 (24.86%)

*** Monday, December 14, 2009 - Total=133 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**35**	**40**	**24**	**9**	**8**	**9**	**8**	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	11	11	2	3	1	3	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	13	4	5	3	2	1	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	11	9	1	1	0	3	2	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	7	8	1	2	3	2	0

*** Tuesday, December 15, 2009 - Total=499, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
6	**2**	**5**	**4**	**6**	**3**	**12**	**15**	**35**	**22**	**23**	**38**	**49**	**30**	**31**	**44**	**48**	**30**	**31**	**23**	**15**	**12**	**5**	**10**	
0	1	1	0	2	1	1	3	6	10	7	8	**16**	4	6	8	10	5	8	3	2	0	3	2	1
3	0	4	1	1	2	3	5	4	9	7	12	**12**	5	7	9	**17**	12	12	9	3	1	0	3	0
3	0	0	3	2	0	4	5	22	0	4	9	**11**	10	9	11	**12**	9	7	5	7	3	0	4	7
0	1	0	0	1	0	4	2	3	3	5	**9**	10	11	9	**16**	9	4	4	6	3	8	2	1	5

AM Peak 1145 - 1245 (48), AM PHF=0.75 PM Peak 1545 - 1645 (55), PM PHF=0.81

*** Wednesday, December 16, 2009 - Total=351 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
13	**8**	**5**	**3**	**4**	**5**	**8**	**18**	**37**	**22**	**24**	**29**	**21**	**31**	**32**	**39**	**52**	-	-	-	-	-	-	-	
1	3	1	0	1	1	1	1	**6**	5	6	8	4	7	7	8	10	-	-	-	-	-	-	-	-
0	1	3	1	1	2	1	1	**10**	8	4	6	6	11	5	13	16	-	-	-	-	-	-	-	-
7	2	0	1	0	1	3	5	**10**	6	4	9	8	7	10	9	13	-	-	-	-	-	-	-	-
5	2	1	1	2	1	3	**11**	11	3	10	6	3	6	10	9	13	-	-	-	-	-	-	-	-

AM Peak 0745 - 0845 (37), AM PHF=0.84

499+490

= 989

TDSSW, Inc.
Vehicle Counts

VehicleCount-314 -- English (ENU)

Datasets:

Site: [18603] Old Hwy 80 Btwn Ribbonwood Road & Mc Cain Valley Road
Direction: 8 - East bound A>B, West bound B>A. Lane: 0
Survey Duration: 16:36 Monday, December 14, 2009 => 13:04 Tuesday, December 22, 2009
Zone: North America
File: 1860322Dec2009.EC0 (Plus)
Identifier: M264XG37 MC56-6 [MC55] (c)Microcom 02/03/01
Algorithm: Factory default (v3.21 - 15275)
Data type: Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time: 17:00 Monday, December 14, 2009 => 17:00 Wednesday, December 16, 2009
Included classes: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range: 0 - 100 mph.
Direction: West (bound)
Separation: All - (Headway)
Name: Default Profile
Scheme: Vehicle classification (Scheme F99)
Units: Non metric (ft, mi, ft/s, mph, lb, ton)
In profile: Vehicles = 975 / 3954 (24.66%)

* **Monday, December 14, 2009 - Total=75 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**27**	**17**	**9**	**15**	**4**	**1**	**2**	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	3	3	4	2	1	0	1
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	7	2	3	2	0	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	3	0	5	0	0	1	3
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5	4	4	3	0	0	1	4

* **Tuesday, December 15, 2009 - Total=490, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
8	**3**	**4**	**10**	**4**	**18**	**29**	**37**	**43**	**40**	**19**	**37**	**32**	**32**	**39**	**38**	**33**	**23**	**16**	**7**	**8**	**6**	**1**	**3**	
1	1	3	1	0	3	3	10	11	11	4	9	6	9	13	6	8	7	5	1	1	1	1	1	0
0	0	1	2	1	5	6	9	10	11	5	5	7	9	13	11	9	6	4	1	1	0	0	1	1
3	0	0	3	1	3	8	11	7	10	5	8	11	7	8	10	10	7	0	4	3	3	0	0	2
4	2	0	4	2	7	12	7	15	8	5	15	8	7	5	11	6	3	7	1	3	2	0	1	1

AM Peak 0845 - 0945 (47), AM PHF=0.78 PM Peak 1345 - 1445 (41), PM PHF=0.79

* **Wednesday, December 16, 2009 - Total=410 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
4	**5**	**3**	**5**	**12**	**17**	**31**	**34**	**43**	**40**	**26**	**39**	**30**	**22**	**27**	**29**	**43**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
0	1	0	0	3	2	4	6	6	12	12	10	7	3	4	6	7	-	-	-	-	-	-	-	-
1	1	1	0	2	3	2	12	14	12	6	9	8	6	7	11	9	-	-	-	-	-	-	-	-
2	0	2	2	3	4	12	7	14	7	5	11	11	3	10	5	15	-	-	-	-	-	-	-	-
1	3	0	3	4	8	13	9	9	9	3	9	4	10	6	7	12	-	-	-	-	-	-	-	-

AM Peak 0815 - 0915 (49), AM PHF=0.88

TDSSW, Inc.
Vehicle Counts

VehicleCount-316 -- English (ENU)

Datasets:

Site:	**[18604] Mc Cain Valley Road N/O Old Hwy 80**
Direction:	5 - South bound A>B, North bound B>A. **Lane: 0**
Survey Duration:	16:23 Monday, December 14, 2009 => 13:13 Tuesday, December 22, 2009
Zone:	North America
File:	1860422Dec2009.EC0 (Plus)
Identifier:	M508KRAN MC56-6 [MC55] (c)Microcom 02/03/01
Algorithm:	Factory default (v3.21 - 15275)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**17:00 Monday, December 14, 2009 => 17:00 Wednesday, December 16, 2009**
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range:	0 - 100 mph.
Direction:	North (bound)
Separation:	All - (Headway)
Name:	Default Profile
Scheme:	Vehicle classification (Scheme F99)
Units:	Non metric (ft, mi, ft/s, mph, lb, ton)
In profile:	Vehicles = 124 / 499 (24.85%)

*** Monday, December 14, 2009 - Total=9 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**4**	**1**	**2**	**1**	**0**	**1**	**0**	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	1	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	0	1	0	1	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0	1	0	0	0	0	0

*** Tuesday, December 15, 2009 - Total=55, 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
0	**0**	**2**	**0**	**0**	**0**	**6**	**6**	**4**	**2**	**4**	**9**	**2**	**4**	**3**	**6**	**2**	**2**	**2**	**0**	**0**	**1**	**0**	**0**	
0	0	0	0	0	0	0	0	3	1	2	2	0	1	1	2	0	0	0	0	0	0	0	0	0
0	0	2	0	0	0	4	3	0	1	2	2	1	0	0	0	2	0	1	0	0	0	0	0	0
0	0	0	0	0	0	2	3	1	0	0	5	1	1	0	1	0	1	1	0	0	1	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	3	0	1	0	0	0	0	0	0	0

AM Peak 0715 - 0815 (9), AM PHF=0.75 PM Peak 1500 - 1600 (6), PM PHF=0.50

*** Wednesday, December 16, 2009 - Total=60 (Incomplete) , 15 minute drops**

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
0	**0**	**1**	**1**	**0**	**0**	**4**	**9**	**1**	**4**	**8**	**4**	**2**	**6**	**3**	**12**	**5**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	
0	0	0	0	0	0	0	0	1	0	4	2	0	1	0	3	3	-	-	-	-	-	-	-	-
0	0	1	0	0	0	0	0	0	3	1	0	0	1	0	2	1	-	-	-	-	-	-	-	-
0	0	0	0	0	0	2	2	0	1	0	0	1	1	1	7	0	-	-	-	-	-	-	-	-
0	0	0	1	0	0	2	7	0	0	3	2	1	3	2	0	1	-	-	-	-	-	-	-	-

AM Peak 0715 - 0815 (10), AM PHF=0.36

55+57 = 112

TDSSW, Inc.
Vehicle Counts

VehicleCount-317 -- English (ENU)

Datasets:

Site:	**[18604] Mc Cain Valley Road N/O Old Hwy 80**
Direction:	5 - South bound A>B, North bound B>A. **Lane: 0**
Survey Duration:	16:23 Monday, December 14, 2009 => 13:13 Tuesday, December 22, 2009
Zone:	North America
File:	1860422Dec2009.EC0 (Plus)
Identifier:	M508KRAN MC56-6 [MC55] (c)Microcom 02/03/01
Algorithm:	Factory default (v3.21 - 15275)
Data type:	Axle sensors - Paired (Class/Speed/Count)

Profile:

Filter time:	**17:00 Monday, December 14, 2009 => 17:00 Wednesday, December 16, 2009**
Included classes:	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13
Speed range:	0 - 100 mph.
Direction:	South (bound)
Separation:	All - (Headway)
Name:	Default Profile
Scheme:	Vehicle classification (Scheme F99)
Units:	Non metric (ft, mi, ft/s, mph, lb, ton)
In profile:	Vehicles = 119 / 499 (23.85%)

* Monday, December 14, 2009 - Total=5 (Incomplete) , 15 minute drops

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	0	0	0	0	1	
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	1	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	0	0	0	0	0	0	0
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	0	0	0	0	0	1	1

* Tuesday, December 15, 2009 - Total=57, 15 minute drops

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
1	0	1	0	0	0	1	6	4	1	2	4	5	4	10	5	5	4	0	1	1	0	0	2	
0	0	0	0	0	0	0	0	0	0	0	0	0	1	2	1	1	1	0	0	0	0	0	2	0
0	0	1	0	0	0	1	1	2	1	1	1	1	1	3	1	1	2	0	0	1	0	0	0	0
0	0	0	0	0	0	0	2	0	0	0	2	1	1	2	1	1	1	0	1	0	0	0	0	0
1	0	0	0	0	0	0	3	2	0	1	1	3	1	3	2	2	0	0	0	0	0	0	0	0

AM Peak 0730 - 0830 (7), AM PHF=0.58 PM Peak 1400 - 1500 (10), PM PHF=0.83

* Wednesday, December 16, 2009 - Total=57 (Incomplete) , 15 minute drops

0000	0100	0200	0300	0400	0500	0600	0700	0800	0900	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900	2000	2100	2200	2300	
0	0	0	1	0	0	0	3	7	1	9	7	2	2	8	2	15	-	-	-	-	-	-	-	
0	0	0	0	0	0	0	0	1	0	5	1	0	1	0	1	1	-	-	-	-	-	-	-	-
0	0	0	0	0	0	0	0	4	0	0	2	1	0	2	1	2	-	-	-	-	-	-	-	-
0	0	0	1	0	0	0	0	2	0	1	2	1	0	5	0	7	-	-	-	-	-	-	-	-
0	0	0	0	0	0	0	3	0	1	3	2	0	1	1	0	5	-	-	-	-	-	-	-	-

AM Peak 0745 - 0845 (10), AM PHF=0.63

APPENDIX B

EXISTING INTERSECTION ANALYSIS SHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	10	1	0	21	8	0	0	9	7
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	11	1	0	23	9	0	0	10	8
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	68	68	14	68	72	9	17			9		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	68	68	14	68	72	9	17			9		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	99	100	100	99			100		
cM capacity (veh/h)	913	811	1066	915	807	1073	1600			1611		

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	11	1	32	17
Volume Left	11	0	23	0
Volume Right	0	0	0	8
cSH	915	807	1600	1700
Volume to Capacity	0.01	0.00	0.01	0.01
Queue Length 95th (ft)	1	0	1	0
Control Delay (s)	9.0	9.5	5.3	0.0
Lane LOS	A	A	A	
Approach Delay (s)	9.0		5.3	0.0
Approach LOS	A			

Intersection Summary			
Average Delay	4.5		
Intersection Capacity Utilization	18.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
1: I-8 WB ramps & Ribbonwood Road

1/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	16	2	2	21	11	0	0	6	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	17	2	2	23	12	0	0	7	0
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	67	64	7	64	64	12	7			12		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	67	64	7	64	64	12	7			12		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	98	100	100	99			100		
cM capacity (veh/h)	912	815	1076	920	815	1069	1614			1607		

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	17	4	35	7
Volume Left	17	0	23	0
Volume Right	0	2	0	0
cSH	920	925	1614	1700
Volume to Capacity	0.02	0.00	0.01	0.00
Queue Length 95th (ft)	1	0	1	0
Control Delay (s)	9.0	8.9	4.8	0.0
Lane LOS	A	A	A	
Approach Delay (s)	9.0		4.8	0.0
Approach LOS	A			

Intersection Summary			
Average Delay	5.7		
Intersection Capacity Utilization	18.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱						↱			↰	
Volume (veh/h)	1	1	39	0	0	0	0	33	12	0	14	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	1	42	0	0	0	0	36	13	0	15	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	58	65	16	101	59	42	16			49		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	58	65	16	101	59	42	16			49		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	96	100	100	100	100			100		
cM capacity (veh/h)	938	826	1064	844	832	1028	1601			1558		

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	1	43	49	16
Volume Left	1	0	0	0
Volume Right	0	42	13	1
cSH	938	1056	1700	1558
Volume to Capacity	0.00	0.04	0.03	0.00
Queue Length 95th (ft)	0	3	0	0
Control Delay (s)	8.8	8.6	0.0	0.0
Lane LOS	A	A		
Approach Delay (s)	8.6		0.0	0.0
Approach LOS	A			

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	13.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	3	0	33	0	0	0	0	31	13	0	22	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	3	0	36	0	0	0	0	34	14	0	24	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	65	72	24	101	66	41	25			48		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	65	72	24	101	66	41	25			48		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	97	100	100	100	100			100		
cM capacity (veh/h)	928	818	1052	850	825	1030	1589			1559		

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	3	36	48	25
Volume Left	3	0	0	0
Volume Right	0	36	14	1
cSH	928	1052	1700	1559
Volume to Capacity	0.00	0.03	0.03	0.00
Queue Length 95th (ft)	0	3	0	0
Control Delay (s)	8.9	8.5	0.0	0.0
Lane LOS	A	A		
Approach Delay (s)	8.6		0.0	0.0
Approach LOS	A			

Intersection Summary				
Average Delay	3.0			
Intersection Capacity Utilization	13.3%		ICU Level of Service	A
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	17	26	7	0	35	23	7	6	1	17	3	28
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	28	8	0	38	25	8	7	1	18	3	30
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	63			36			152	132	32	120	123	51
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	63			36			152	132	32	120	123	51
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	99	100	98	100	97
cM capacity (veh/h)	1540			1575			782	750	1042	841	758	1018

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	18	36	63	15	52
Volume Left	18	0	0	8	18
Volume Right	0	8	25	1	30
cSH	1540	1700	1575	781	929
Volume to Capacity	0.01	0.02	0.00	0.02	0.06
Queue Length 95th (ft)	1	0	0	1	4
Control Delay (s)	7.4	0.0	0.0	9.7	9.1
Lane LOS	A			A	A
Approach Delay (s)	2.5		0.0	9.7	9.1
Approach LOS				A	A

Intersection Summary			
Average Delay	4.1		
Intersection Capacity Utilization	17.6%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: SR 94 & Ribbonwood Road

1/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱			✥			✥			✥	
Volume (veh/h)	27	28	7	1	22	16	5	3	1	25	6	22
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	29	30	8	1	24	17	5	3	1	27	7	24
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	41			38			155	136	34	127	132	33
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	41			38			155	136	34	127	132	33
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			99	100	100	97	99	98
cM capacity (veh/h)	1568			1572			776	740	1039	831	744	1041

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	29	38	42	10	58
Volume Left	29	0	1	5	27
Volume Right	0	8	17	1	24
cSH	1568	1700	1572	785	894
Volume to Capacity	0.02	0.02	0.00	0.01	0.06
Queue Length 95th (ft)	1	0	0	1	5
Control Delay (s)	7.3	0.0	0.2	9.6	9.3
Lane LOS	A		A	A	A
Approach Delay (s)	3.2		0.2	9.6	9.3
Approach LOS				A	A

Intersection Summary			
Average Delay	4.8		
Intersection Capacity Utilization	18.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	4	31	36	0	0	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	34	39	0	0	4
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	39				82	39
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	39				82	39
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1571				918	1032

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	38	39	4
Volume Left	4	0	0
Volume Right	0	0	4
cSH	1571	1700	1032
Volume to Capacity	0.00	0.02	0.00
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.9	0.0	8.5
Lane LOS	A		A
Approach Delay (s)	0.9	0.0	8.5
Approach LOS			A

Intersection Summary			
Average Delay	0.9		
Intersection Capacity Utilization	15.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	2	45	28	1	2	3
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	49	30	1	2	3
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	32				84	31
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	32				84	31
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1581				916	1043

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	51	32	5
Volume Left	2	0	2
Volume Right	0	1	3
cSH	1581	1700	988
Volume to Capacity	0.00	0.02	0.01
Queue Length 95th (ft)	0	0	0
Control Delay (s)	0.3	0.0	8.7
Lane LOS	A		A
Approach Delay (s)	0.3	0.0	8.7
Approach LOS			A

Intersection Summary			
Average Delay	0.7		
Intersection Capacity Utilization	14.0%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX C

HCM 2000 UNSIGNALIZED INTERSECTION METHODOLOGY & COUNTY OF SAN DIEGO ROADWAY CLASSIFICATION TABLE

2000 HIGHWAY CAPACITY MANUAL LEVEL OF SERVICE CRITERIA FOR UNSIGNALIZED INTERSECTIONS

In the 2000 Highway Capacity Manual (HCM), Level of Service for unsignalized intersections is determined by the computed or measured control delay and is defined for each minor movement. Level of Service is not defined for the intersection as a whole. Delay is a measure of driver discomfort, frustration, fuel consumption, and lost travel time. The criteria are given in the following the table, and are based on the average control delay for any particular minor movement.

LEVEL OF SERVICE	AVERAGE CONTROL DELAY SEC/VEH			EXPECTED DELAY TO MINOR STREET TRAFFIC
A	0.0	≤	10.0	Little or no delay
B	10.1	to	15.0	Short traffic delays
C	15.1	to	25.0	Average traffic delays
D	25.1	to	35.0	Long traffic delays
E	35.1	to	50.0	Very long traffic delays
F		>	50.0	Severe congestion

Level of Service F exists when there are insufficient gaps of suitable size to allow a side street demand to safely cross through a major street traffic stream. This Level of Service is generally evident from extremely long control delays experienced hy side-street traffic and by queuing on the minor-street approaches. The method, however, is based on a constant critical gap size; that is, the critical gap remains constant no matter how long the side-street motorist waits. LOS F may also appear in the form on side-street vehicles selecting smaller-than-usual gaps. In such cases, safety may be a problem, and some disruption to the major traffic stream may result. It is important to note that LOS F may not always result in long queues but may result in adjustments to normal gap acceptance behavior, which are more difficult to observe in the field than queuing.

In most cases at Two-Way Stop Controlled (TWSC) intersections, the critical movement is the minor-street left-turn movement. As such, the minor-street left-turn movement can generally be considered the primary factor affecting overall intersection performance. The lower threshold for LOS F is set at 50 seconds of delay per vehicle. There are many instances, particularly in urban areas, in which the delay equations will predict delays of 50 seconds (LOS F) or more for minor-street movements under very low volume conditions on the minor street (less than 25 vehicle/hour). Since the first term of the equation is a function only of the capacity, the LOS F threshold of 50 sec/vehicle is reached with a movement capacity of approximately 85 vehicle/hour or less.

This procedure assumes random arrivals on the major street. For a typical four-lane arterial with average daily traffic volumes in the range of 15,000 to 20,000 vehicles per day (peak hour, 1,500 to 2,000 vehicle/hour), the delay equation used in the TWSC capacity analysis procedure will predict 50 seconds of delay or more (LOS F) for many urban TWSC intersections that allow minor-street left-turn movements. **The LOS F threshold will be reached regardless of the volume of minor-street left-turn traffic.** Not-withstanding this fact, most low-volume minor-street approaches would not meet any of the volume or delay warrants for signalization of the *Manual on Uniform Traffic Control Devices* (MUTCD) since the warrants define an asymptote at 100 vehicle/hour on the minor approach. As a result, many public agencies that use the HCM Level of Service thresholds to determine the design adequacy of TWSC intersections may be forced to eliminate the minor-street left-turn movement, even when the movement may not present any operational problem, such as the formation of long queues on the minor street or driveway approach.

County of San Diego
DRAFT

August 11, 1998

TABLE 1

AVERAGE DAILY VEHICLE TRIPS

CIRCULATION ELEMENT ROADS		LEVEL OF SERVICE				
CLASS	**X-SECTION**	**A**	**B**	**C**	**D**	**E**
Expressway	126/146	<36,000	<54,000	<70,000	<86,000	<108,000
Prime Arterial	102/122	<22,200	<37,000	<44,600	<50,000	<57,000
Major Road	78/98	<14,800	<24,700	<29,600	<33,400	<37,000
Collector	64/84	<13,700	<22,800	<27,400	<30,800	<34,200
Town Collector	54/74	<3,000	<6,000	<9,500	<13,500	<19,000
Light Collector	40/60	<1,900	<4,100	<7,100	<10,900	<16,200
Rural Collector	40/84	<1,900	<4,100	<7,100	<10,900	<16,200
Rural Light Collector	40/60	<1,900	<4,100	<7,100	<10,900	<16,200
Recreational Parkway	40/100	<1,900	<4,100	<7,100	<10,900	<16,200
Rural Mountain	40/100	<1,900	<4,100	<7,100	<10,900	<16,200

NON-CIRCULATION ELEMENT ROADS		LEVEL OF SERVICE				
CLASS	**X-SECTION**	**A**	**B**	**C**	**D**	**E**
Residential Collector	40/60	*	*	<4,500	*	*
Residential Road	36/56	*	*	<1,500	*	*
Residential Cul-de-sac or Loop Road	32/52	*	*	< 200	*	*

* Levels of service are not applicable to residential streets since their primary purpose is to serve abutting lots, not carry through traffic. Levels of service normally apply to roads carrying through traffic between major trip generators and attractors.

Adjustment for heavy vehicles in the traffic stream applies to three types of vehicles: trucks, RVs, and buses. No evidence indicates any distinct differences in the performance characteristics of trucks and buses on multilane highways; therefore, buses are considered trucks in this method. Finding the heavy-vehicle adjustment factor requires two steps. First, find an equivalent truck factor (E_T) and RV factor (E_R) for prevailing operating conditions. Second, using E_T and E_R, compute an adjustment factor for all heavy vehicles in the traffic stream.

Extended General Highway Segments

Passenger-car equivalents can be selected for two conditions: extended general highway segments and specific grades. Values of passenger-car equivalents are selected from Exhibits 21-8 through 21-11. For long segments of highway in which no single grade has a significant impact on operations, Exhibit 21-8 is used to select passenger-car equivalents for trucks and buses (E_T) and for RVs (E_R).

EXHIBIT 21-8. PASSENGER-CAR EQUIVALENTS ON EXTENDED GENERAL HIGHWAY SEGMENTS

Factor	Type of Terrain		
	Level	Rolling	Mountainous
E_T (trucks and buses)	1.5	2.5	4.5
E_R (RVs)	1.2	2.0	4.0

A long multilane highway segment can be classified as an extended general highway segment if no grade exceeding 3 percent is longer than 0.5 mi and if grades of 3 percent or less do not exceed 1 mi.

Specific Grade

Any grade of 3 percent or less that is longer than 1 mi or a grade greater than 3 percent that is longer than 0.5 mi should be treated as an isolated, specific grade. In addition, the upgrade and downgrade must be treated separately, because the impact of heavy vehicles differs substantially in each.

Equivalents for Extended General Highway Segments

For an extended general segment analysis, the terrain of the highway must be classified as level, rolling, or mountainous. These three classifications are discussed below.

Level Terrain

Level terrain is any combination of horizontal and vertical alignment that permits heavy vehicles to maintain approximately the same speed as passenger cars. This type of terrain generally includes short grades of no more than 1 to 2 percent.

Rolling Terrain

Rolling terrain is any combination of horizontal and vertical alignment that causes heavy vehicles to reduce their speeds substantially below those of passenger cars. However, the terrain does not cause heavy vehicles to operate at crawl speeds for any significant length of time or at frequent intervals.

Mountainous Terrain

Mountainous terrain is any combination of horizontal and vertical alignment that causes heavy vehicles to operate at crawl speeds for significant distances or at frequent intervals. For these general highway segments, values of E_T and E_R are selected from Exhibit 21-8.

APPENDIX D

EXISTING + PROJECT INTERSECTION ANALYSIS SHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	10	1	0	38	140	0	0	9	75
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	11	1	0	41	152	0	0	10	82
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	286	285	51	285	326	152	91			152		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	286	285	51	285	326	152	91			152		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	98	100	100	97			100		
cM capacity (veh/h)	651	607	1018	653	576	894	1504			1429		

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	11	1	193	91
Volume Left	11	0	41	0
Volume Right	0	0	0	82
cSH	653	576	1504	1700
Volume to Capacity	0.02	0.00	0.03	0.05
Queue Length 95th (ft)	1	0	2	0
Control Delay (s)	10.6	11.3	1.8	0.0
Lane LOS	B	B	A	
Approach Delay (s)	10.7		1.8	0.0
Approach LOS	B			

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	26.1%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	16	2	2	54	79	0	0	6	132
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	17	2	2	59	86	0	0	7	143
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	285	282	78	282	353	86	150			86		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	285	282	78	282	353	86	150			86		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	97	100	100	96			100		
cM capacity (veh/h)	643	601	982	650	548	973	1431			1510		

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	17	4	145	150
Volume Left	17	0	59	0
Volume Right	0	2	0	143
cSH	650	701	1431	1700
Volume to Capacity	0.03	0.01	0.04	0.09
Queue Length 95th (ft)	2	0	3	0
Control Delay (s)	10.7	10.2	3.3	0.0
Lane LOS	B	B	A	
Approach Delay (s)	10.6		3.3	0.0
Approach LOS	B			

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	29.0%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	133	1	72	0	0	0	0	50	12	0	14	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	145	1	78	0	0	0	0	54	13	0	15	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	77	83	16	155	77	61	16			67		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	77	83	16	155	77	61	16			67		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	84	100	93	100	100	100	100			100		
cM capacity (veh/h)	913	807	1064	751	813	1004	1601			1534		

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	145	79	67	16
Volume Left	145	0	0	0
Volume Right	0	78	13	1
cSH	913	1059	1700	1534
Volume to Capacity	0.16	0.07	0.04	0.00
Queue Length 95th (ft)	14	6	0	0
Control Delay (s)	9.7	8.7	0.0	0.0
Lane LOS	A	A		
Approach Delay (s)	9.3		0.0	0.0
Approach LOS	A			

Intersection Summary			
Average Delay	6.8		
Intersection Capacity Utilization	17.4%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	71	0	50	0	0	0	0	64	13	0	22	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	77	0	54	0	0	0	0	70	14	0	24	1
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	101	108	24	155	102	77	25			84		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	101	108	24	155	102	77	25			84		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	91	100	95	100	100	100	100			100		
cM capacity (veh/h)	880	782	1052	769	788	984	1589			1513		

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	77	54	84	25
Volume Left	77	0	0	0
Volume Right	0	54	14	1
cSH	880	1052	1700	1513
Volume to Capacity	0.09	0.05	0.05	0.00
Queue Length 95th (ft)	7	4	0	0
Control Delay (s)	9.5	8.6	0.0	0.0
Lane LOS	A	A		
Approach Delay (s)	9.1		0.0	0.0
Approach LOS	A			

Intersection Summary			
Average Delay	5.0		
Intersection Capacity Utilization	14.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱			✥			✥			✥	
Volume (veh/h)	17	26	7	0	35	40	7	6	1	50	3	28
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	18	28	8	0	38	43	8	7	1	54	3	30
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	82			36			161	151	32	129	133	60
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	82			36			161	151	32	129	133	60
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	99			100			99	99	100	93	100	97
cM capacity (veh/h)	1516			1575			770	732	1042	829	749	1006

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	18	36	82	15	88
Volume Left	18	0	0	8	54
Volume Right	0	8	43	1	30
cSH	1516	1700	1575	767	879
Volume to Capacity	0.01	0.02	0.00	0.02	0.10
Queue Length 95th (ft)	1	0	0	2	8
Control Delay (s)	7.4	0.0	0.0	9.8	9.6
Lane LOS	A			A	A
Approach Delay (s)	2.5		0.0	9.8	9.6
Approach LOS				A	A

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	20.6%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	27	28	7	1	22	49	5	3	1	42	6	22
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	29	30	8	1	24	53	5	3	1	46	7	24
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	77			38			173	172	34	145	149	51
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	77			38			173	172	34	145	149	51
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	98			100			99	100	100	94	99	98
cM capacity (veh/h)	1521			1572			755	706	1039	808	727	1018

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	29	38	78	10	76
Volume Left	29	0	1	5	46
Volume Right	0	8	53	1	24
cSH	1521	1700	1572	760	855
Volume to Capacity	0.02	0.02	0.00	0.01	0.09
Queue Length 95th (ft)	1	0	0	1	7
Control Delay (s)	7.4	0.0	0.1	9.8	9.6
Lane LOS	A		A	A	A
Approach Delay (s)	3.2		0.1	9.8	9.6
Approach LOS				A	A

Intersection Summary			
Average Delay	4.6		
Intersection Capacity Utilization	19.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	37	31	36	0	0	21
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	40	34	39	0	0	23
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	39				153	39
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	39				153	39
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	98
cM capacity (veh/h)	1571				817	1032

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	74	39	23
Volume Left	40	0	0
Volume Right	0	0	23
cSH	1571	1700	1032
Volume to Capacity	0.03	0.02	0.02
Queue Length 95th (ft)	2	0	2
Control Delay (s)	4.1	0.0	8.6
Lane LOS	A		A
Approach Delay (s)	4.1	0.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay	3.7		
Intersection Capacity Utilization	20.3%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	19	45	28	1	2	36
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	21	49	30	1	2	39
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	32				121	31
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	32				121	31
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				100	96
cM capacity (veh/h)	1581				863	1043

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	70	32	41
Volume Left	21	0	2
Volume Right	0	1	39
cSH	1581	1700	1032
Volume to Capacity	0.01	0.02	0.04
Queue Length 95th (ft)	1	0	3
Control Delay (s)	2.2	0.0	8.6
Lane LOS	A		A
Approach Delay (s)	2.2	0.0	8.6
Approach LOS			A

Intersection Summary			
Average Delay	3.6		
Intersection Capacity Utilization	20.1%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX E

CUMULATIVE PROJECTS LIST

OBJECTID	PID	PER_TYPE_D	PER_STAT	PER_COMPL	R_TY	PROP_CODE	PER_NUM	PER_NAME	APN	ADDRESS	PROJECT
1887	551533	TENTATIVE PARCEL MAP	DONE	3/8/2007	3200	TPMLEGACY	20719	GRIZZLE TPM	612-030-18-00	NO ADDRESS	04-14724
1888	551533	TENTATIVE PARCEL MAP	DONE	3/8/2007	3200	TPMLEGACY	20719	GRIZZLE TPM	612-091-13-00	40866 OLD HIGHWAY 80	04-14724
1889	551533	TENTATIVE PARCEL MAP	DONE	3/8/2007	3200	TPMLEGACY	20719	GRIZZLE TPM	613-030-31-00	2125 MC CAIN VALLEY RD	04-14724
7772	558319	TENTATIVE PARCEL MAP	DONE	11/17/2005	3200	TPMLEGACY	20580	FRANKIE SMITH TPM	611-091-07-00	39990 ROADRUNNER LN	04-16754
7773	558319	TENTATIVE PARCEL MAP	DONE	11/17/2005	3200	TPMLEGACY	20580	FRANKIE SMITH TPM	612-030-01-00	NO ADDRESS	04-16754
7774	558319	TENTATIVE PARCEL MAP	DONE	11/17/2005	3200	TPMLEGACY	20580	FRANKIE SMITH TPM	612-030-19-00	NO ADDRESS	04-16754
5845	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	528-220-02-00	NO ADDRESS	05-0060154
5846	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	528-220-03-00	NO ADDRESS	05-0060154
5847	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-060-01-00	NO ADDRESS	05-0060154
5848	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-060-02-00	NO ADDRESS	05-0060154
5849	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-060-03-00	NO ADDRESS	05-0060154
5850	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-090-02-00	NO ADDRESS	05-0060154
5851	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-090-03-00	NO ADDRESS	05-0060154
5852	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-100-01-00	NO ADDRESS	05-0060154
5853	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-100-02-00	NO ADDRESS	05-0060154
5854	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-100-03-00	NO ADDRESS	05-0060154
5855	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-120-01-00	NO ADDRESS	05-0060154
5856	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-120-03-00	NO ADDRESS	05-0060154
5857	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	529-130-01-00	NO ADDRESS	05-0060154
5858	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	611-010-01-00	NO ADDRESS	05-0060154
5859	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	611-010-02-00	NO ADDRESS	05-0060154
5860	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	611-010-03-00	NO ADDRESS	05-0060154
5861	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	611-010-06-00	NO ADDRESS	05-0060154
5862	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	611-020-01-00	NO ADDRESS	05-0060154
5863	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	611-050-04-00	NO ADDRESS	05-0060154
5864	556232	TENTATIVE MAP	DONE	6/22/2006	3100	3TMLEGACY	5133	BIG COUNTRY RANCH	611-050-05-00	NO ADDRESS	05-0060154
5314	555467	TENTATIVE PARCEL MAP	DONE	1/12/2005	3200		20698		612-030-22-00	NO ADDRESS	04-14887
5315	555467	TENTATIVE PARCEL MAP	DONE	1/12/2005	3200		20698		612-030-23-00	NO ADDRESS	04-14887
6605	557090	TENTATIVE PARCEL MAP	DONE	8/24/2009	3200	TPMLEGACY	20645	MAURIS TPM	611-061-01-00	2945 RIBBONWOOD RD	04-15158
6675	557190	TENTATIVE PARCEL MAP	DONE	1/4/2007	3200	TPMLEGACY	20675	DART TPM	612-021-05-00	NO ADDRESS	04-15595
10903	641886	TENTATIVE PARCEL MAP	OPEN		3200	3TPM	20981	ELDER, TPM, 4 LOTS +	612-090-17-00	NO ADDRESS	05-0053947
10904	641886	TENTATIVE PARCEL MAP	OPEN		3200	3TPM	20981	ELDER, TPM, 4 LOTS +	612-090-19-00	NO ADDRESS	05-0053947
10905	641886	TENTATIVE PARCEL MAP	OPEN		3200	3TPM	20981	ELDER, TPM, 4 LOTS +	612-090-59-00	NO ADDRESS	05-0053947
11322	651531	TENTATIVE PARCEL MAP	DONE	5/17/2007	3200	3TPM	21003	40760 OLD HIGHWAY 80	612-030-17-00	40760 OLD HIGHWAY 80	06-0059582
11324	651531	TENTATIVE PARCEL MAP	DONE	5/17/2007	3200	3TPM	21003	40760 OLD HIGHWAY 80	612-091-12-00	40760 OLD HIGHWAY 80	06-0059582

Legend

Denied	
Withdrawn	

APPENDIX F

EXISTING + PROJECT + CUMULATIVE PROJECT INTERSECTION ANALYSIS SHEETS

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	30	11	10	68	150	0	0	29	85
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	33	12	11	74	163	0	0	32	92
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	405	389	78	389	435	163	124			163		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	405	389	78	389	435	163	124			163		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	94	98	99	95			100		
cM capacity (veh/h)	518	519	983	548	489	882	1463			1416		

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	33	23	237	124
Volume Left	33	0	74	0
Volume Right	0	11	0	92
cSH	548	620	1463	1700
Volume to Capacity	0.06	0.04	0.05	0.07
Queue Length 95th (ft)	5	3	4	0
Control Delay (s)	12.0	11.0	2.7	0.0
Lane LOS	B	B	A	
Approach Delay (s)	11.6		2.7	0.0
Approach LOS	B			

Intersection Summary			
Average Delay	3.1		
Intersection Capacity Utilization	28.3%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
1: I-8 WB ramps & Ribbonwood Road

1/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	0	0	0	36	12	12	84	99	0	0	16	142
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	39	13	13	91	108	0	0	17	154
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	404	385	95	385	462	108	172			108		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	404	385	95	385	462	108	172			108		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	93	97	99	94			100		
cM capacity (veh/h)	511	513	962	545	464	946	1405			1483		

Direction, Lane #	WB 1	WB 2	NB 1	SB 1
Volume Total	39	26	199	172
Volume Left	39	0	91	0
Volume Right	0	13	0	154
cSH	545	623	1405	1700
Volume to Capacity	0.07	0.04	0.06	0.10
Queue Length 95th (ft)	6	3	5	0
Control Delay (s)	12.1	11.0	3.8	0.0
Lane LOS	B	B	A	
Approach Delay (s)	11.7		3.8	0.0
Approach LOS	B			

Intersection Summary			
Average Delay	3.5		
Intersection Capacity Utilization	32.8%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↰	↱						↱			↰	
Volume (veh/h)	143	11	122	0	0	0	0	100	32	0	34	11
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	155	12	133	0	0	0	0	109	35	0	37	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	169	186	43	308	175	126	49			143		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	169	186	43	308	175	126	49			143		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	80	98	87	100	100	100	100			100		
cM capacity (veh/h)	795	708	1027	554	718	924	1558			1439		

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	155	145	143	49
Volume Left	155	0	0	0
Volume Right	0	133	35	12
cSH	795	991	1700	1439
Volume to Capacity	0.20	0.15	0.08	0.00
Queue Length 95th (ft)	18	13	0	0
Control Delay (s)	10.6	9.3	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	10.0		0.0	0.0
Approach LOS	A			

Intersection Summary			
Average Delay	6.1		
Intersection Capacity Utilization	22.0%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
2: I-8 EB ramps & Ribbonwood Road

1/12/2010

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	81	10	100	0	0	0	0	104	33	0	52	11
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	88	11	109	0	0	0	0	113	36	0	57	12
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	193	211	62	308	199	131	68			149		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	193	211	62	308	199	131	68			149		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	89	98	89	100	100	100	100			100		
cM capacity (veh/h)	766	686	1002	568	696	919	1533			1433		

Direction, Lane #	EB 1	EB 2	NB 1	SB 1
Volume Total	88	120	149	68
Volume Left	88	0	0	0
Volume Right	0	109	36	12
cSH	766	962	1700	1433
Volume to Capacity	0.11	0.12	0.09	0.00
Queue Length 95th (ft)	10	11	0	0
Control Delay (s)	10.3	9.3	0.0	0.0
Lane LOS	B	A		
Approach Delay (s)	9.7		0.0	0.0
Approach LOS	A			

Intersection Summary			
Average Delay	4.7		
Intersection Capacity Utilization	20.9%	ICU Level of Service	A
Analysis Period (min)	15		

HCM Unsignalized Intersection Capacity Analysis
3: SR 94 & Ribbonwood Road

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	47	66	17	10	85	70	17	16	11	80	13	68
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	51	72	18	11	92	76	18	17	12	87	14	74
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	168			90			416	373	81	347	345	130
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	168			90			416	373	81	347	345	130
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			99			96	97	99	85	97	92
cM capacity (veh/h)	1409			1505			477	533	979	566	553	919

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	51	90	179	48	175
Volume Left	51	0	11	18	87
Volume Right	0	18	76	12	74
cSH	1409	1700	1505	572	674
Volume to Capacity	0.04	0.05	0.01	0.08	0.26
Queue Length 95th (ft)	3	0	1	7	26
Control Delay (s)	7.7	0.0	0.5	11.9	12.2
Lane LOS	A		A	B	B
Approach Delay (s)	2.8		0.5	11.9	12.2
Approach LOS				B	B

Intersection Summary			
Average Delay	5.9		
Intersection Capacity Utilization	37.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	67	68	17	11	52	69	15	13	11	82	16	52
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	73	74	18	12	57	75	16	14	12	89	17	57
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)												
pX, platoon unblocked												
vC, conflicting volume	132			92			412	384	83	357	356	94
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	132			92			412	384	83	357	356	94
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			99			97	97	99	84	97	94
cM capacity (veh/h)	1454			1502			483	518	976	554	537	963

Direction, Lane #	EB 1	EB 2	WB 1	NB 1	SB 1
Volume Total	73	92	143	42	163
Volume Left	73	0	12	16	89
Volume Right	0	18	75	12	57
cSH	1454	1700	1502	578	647
Volume to Capacity	0.05	0.05	0.01	0.07	0.25
Queue Length 95th (ft)	4	0	1	6	25
Control Delay (s)	7.6	0.0	0.7	11.7	12.4
Lane LOS	A		A	B	B
Approach Delay (s)	3.4		0.7	11.7	12.4
Approach LOS				B	B

Intersection Summary			
Average Delay	6.2		
Intersection Capacity Utilization	35.2%	ICU Level of Service	A
Analysis Period (min)	15		

Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	47	71	86	10	0	31
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	51	77	93	11	0	34
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	104				278	99
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	104				278	99
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				100	96
cM capacity (veh/h)	1487				687	957

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	128	104	34
Volume Left	51	0	0
Volume Right	0	11	34
cSH	1487	1700	957
Volume to Capacity	0.03	0.06	0.04
Queue Length 95th (ft)	3	0	3
Control Delay (s)	3.2	0.0	8.9
Lane LOS	A		A
Approach Delay (s)	3.2	0.0	8.9
Approach LOS			A

Intersection Summary			
Average Delay	2.6		
Intersection Capacity Utilization	23.0%	ICU Level of Service	A
Analysis Period (min)	15		

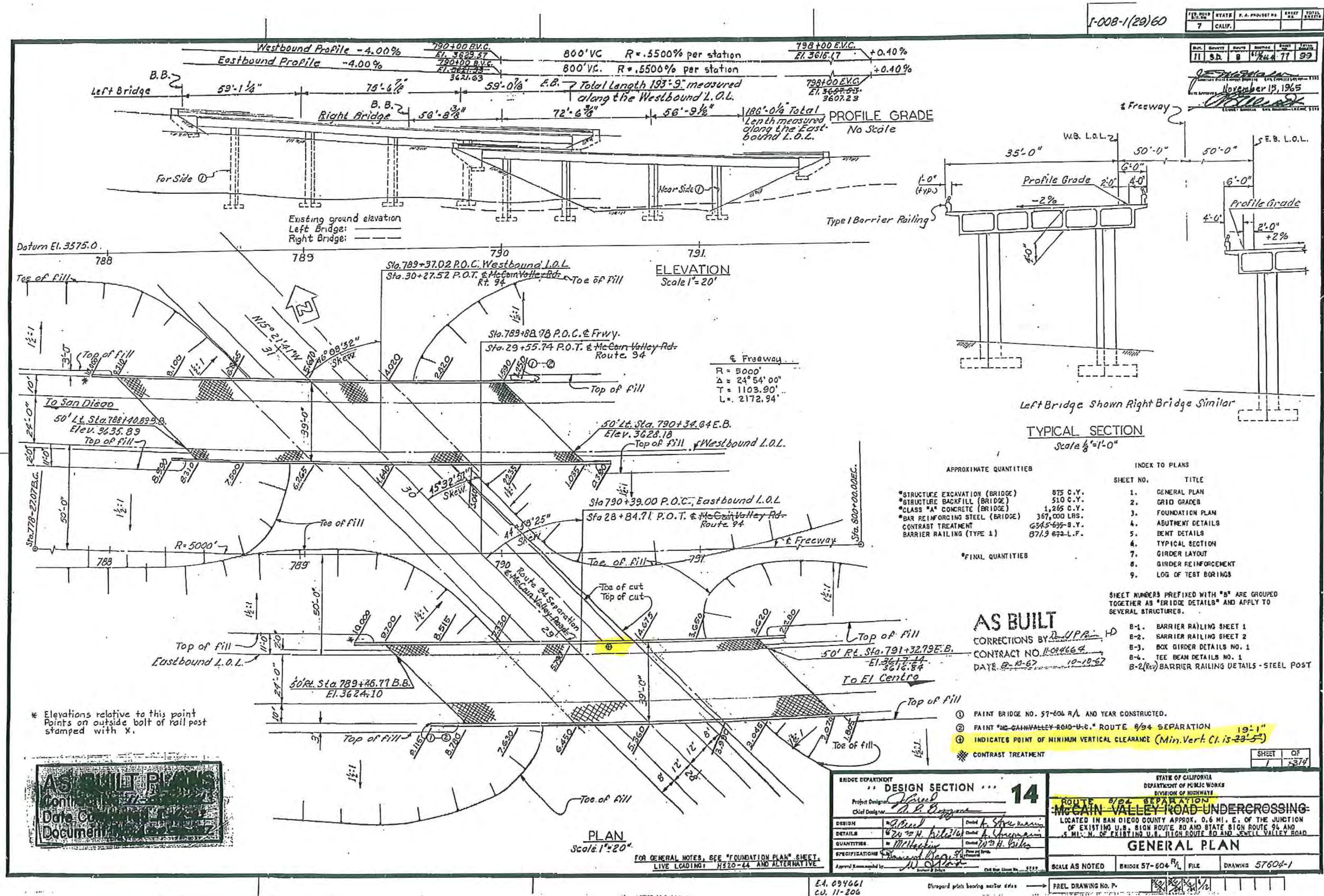
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Volume (veh/h)	29	105	68	11	12	46
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	32	114	74	12	13	50
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (ft)						
pX, platoon unblocked						
vC, conflicting volume	86				257	80
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	86				257	80
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				98	95
cM capacity (veh/h)	1510				716	980

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	146	86	63
Volume Left	32	0	13
Volume Right	0	12	50
cSH	1510	1700	911
Volume to Capacity	0.02	0.05	0.07
Queue Length 95th (ft)	2	0	6
Control Delay (s)	1.7	0.0	9.2
Lane LOS	A		A
Approach Delay (s)	1.7	0.0	9.2
Approach LOS			A

Intersection Summary			
Average Delay	2.8		
Intersection Capacity Utilization	24.0%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX G

VERTICAL CLEARANCE AS-BUILTS


I-008-1(29)60
PROFILE GRADE
No Scale
Westbound Profile -4.00%
Eastbound Profile -4.00%
800' VC R=.5500% per station
Total Length 193'-9" measured along the Westbound L.O.L.
186'-0¼" Total Length measured along the Eastbound L.O.L.
Left Bridge
Right Bridge
Far Side ①
Near Side ①
Existing ground elevation
Left Bridge:
Right Bridge:
Datum El. 3575.0
ELEVATION
Scale 1"=20'
TYPICAL SECTION
Scale ⅛"=1'-0"
Type I Barrier Railing
Profile Grade
Left Bridge Shown Right Bridge Similar
Sta. 789+37.02 P.O.C. Westbound L.O.L.
Sta. 789+82.78 P.O.C. ℄ Frwy.
Sta. 790+39.00 P.O.C. Eastbound L.O.L.
℄ Freeway
R = 5000'
Δ = 24°54'00"
T = 1103.90'
L = 2172.94'
To San Diego
To El Centro
Top of fill
Toe of fill
Westbound L.O.L.
Eastbound L.O.L.
790 Route 8/94 Separation
* Elevations relative to this point. Points on outside bolt of rail post stamped with X.
PLAN
Scale 1"=20'
FOR GENERAL NOTES, SEE "FOUNDATION PLAN" SHEET.
LIVE LOADING: H520-44 AND ALTERNATIVE
APPROXIMATE QUANTITIES
*STRUCTURE EXCAVATION (BRIDGE) 875 C.Y.
*STRUCTURE BACKFILL (BRIDGE) 510 C.Y.
*CLASS "A" CONCRETE (BRIDGE) 1,265 C.Y.
*BAR REINFORCING STEEL (BRIDGE) 367,000 LBS.
CONTRAST TREATMENT 6345 635 S.Y.
BARRIER RAILING (TYPE 1) 871.9 872 L.F.
*FINAL QUANTITIES
INDEX TO PLANS
SHEET NO. TITLE
1. GENERAL PLAN
2. GRID GRADES
3. FOUNDATION PLAN
4. ABUTMENT DETAILS
5. BENT DETAILS
6. TYPICAL SECTION
7. GIRDER LAYOUT
8. GIRDER REINFORCEMENT
9. LOG OF TEST BORINGS
SHEET NUMBERS PREFIXED WITH "B" ARE GROUPED TOGETHER AS "BRIDGE DETAILS" AND APPLY TO SEVERAL STRUCTURES.
B-1. BARRIER RAILING SHEET 1
B-2. BARRIER RAILING SHEET 2
B-3. BOX GIRDER DETAILS NO. 1
B-4. TEE BEAM DETAILS NO. 1
B-2(Rev) BARRIER RAILING DETAILS - STEEL POST
AS BUILT
CORRECTIONS BY
CONTRACT NO. 11-094664
DATE 8-10-67 10-10-67
① PAINT BRIDGE NO. 57-604 R/L AND YEAR CONSTRUCTED.
② PAINT "~~McCAIN VALLEY ROAD U.C.~~" ROUTE 8/94 SEPARATION
⊕ INDICATES POINT OF MINIMUM VERTICAL CLEARANCE (Min. Vert. Cl. is ~~23'-5"~~ 19'-1")
CONTRAST TREATMENT
SHEET 1 OF 374
DESIGN SECTION 14
STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
ROUTE 8/94 SEPARATION
~~McCAIN VALLEY ROAD UNDERCROSSING~~
LOCATED IN SAN DIEGO COUNTY APPROX. 0.6 MI. E. OF THE JUNCTION OF EXISTING U.S. SIGN ROUTE 80 AND STATE SIGN ROUTE 94 AND .5 MI. N. OF EXISTING U.S. SIGN ROUTE 80 AND JEWELL VALLEY ROAD
GENERAL PLAN
SCALE AS NOTED
BRIDGE 57-604 R/L
DRAWING 57604-1
AS BUILT PLANS

77

Recd from Caltrans 12/16

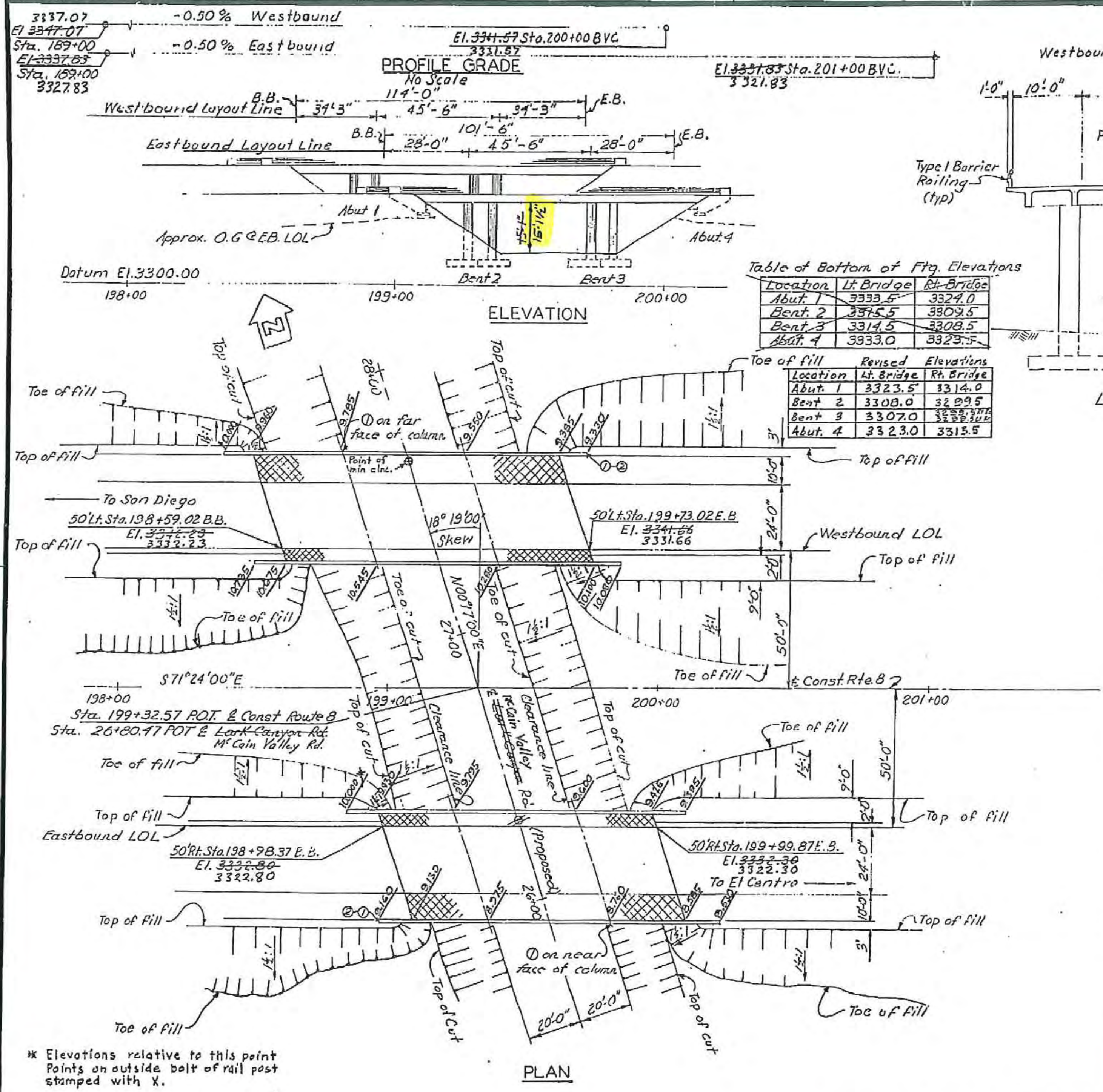


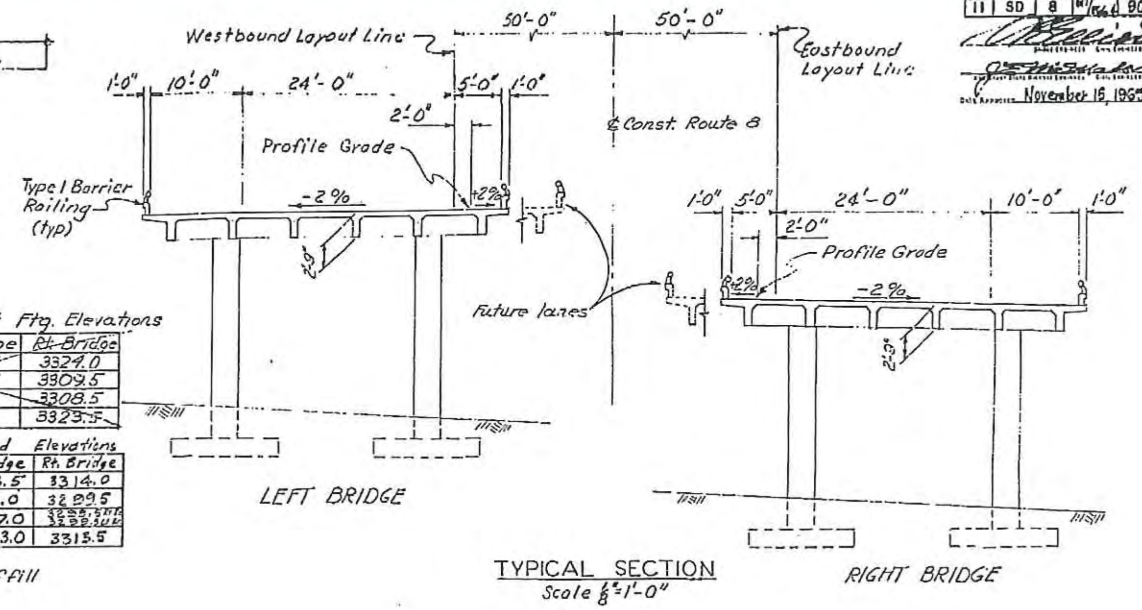
Table of Bottom of Ftg. Elevations

Location	Lt. Bridge	Rt. Bridge
Abut. 1	~~3333.5~~	~~3324.0~~
Bent. 2	~~3315.5~~	~~3309.5~~
Bent 3	~~3314.5~~	~~3308.5~~
Abut. 4	~~3333.0~~	~~3323.5~~

Revised Elevations

Location	Lt. Bridge	Rt. Bridge
Abut. 1	3323.5	3314.0
Bent 2	3308.0	3299.5
Bent 3	3307.0	[illegible]
Abut. 4	3323.0	3315.5

* Elevations relative to this point
Points on outside bolt of rail post stamped with X.



TYPICAL SECTION
Scale 1/8"=1'-0"

I-008-1(29)60

APPROXIMATE QUANTITIES

*STRUCTURE EXCAVATION (BRIDGE)	452 ~~450~~ C.Y.	Changed by CCO#3
*STRUCTURE BACKFILL (BRIDGE)	241 ~~240~~ C.Y.	
*CLASS "A" CONCRETE (BRIDGE)	547 ~~550~~ C.Y.	
*BAR REINFORCING STEEL (BRIDGE)	151,400 ~~152,000~~ LBS.	
CONTRAST TREATMENT	259.2 ~~360~~ S.Y.	
BARRIER RAILING (TYPE 1)	520.6 ~~524~~ L.F.	

*FINAL QUANTITIES

AS BUILT PLANS
Contract No. 11-094664
Date Completed 8-11-67
Document No. 4000087

INDEX TO PLANS

SHEET NO.	TITLE
1.	GENERAL PLAN
2.	FOUNDATION PLAN
3.	ABUTMENT DETAILS
4.	BENT DETAILS
5.	TYPICAL SECTION
6.	GIRDER LAYOUT - RIGHT BRIDGE
7.	GIRDER LAYOUT - LEFT BRIDGE
8.	GIRDER REINFORCEMENT - RIGHT BRIDGE
9.	GIRDER REINFORCEMENT - LEFT BRIDGE
10.	LOG OF TEST BORINGS

SHEET NUMBERS PREFIXED WITH "B" ARE GROUPED TOGETHER AS "BRIDGE DETAILS" WITH ~~MC CAIN VALLEY ROAD U.C.,~~ ROUTE 8/94 SEPARATION BR. NO. 57-604 R/L

B-1. BARRIER RAILING SHEET 1
B-2. BARRIER RAILING SHEET 2
B-4. T-BEAM DETAILS NO. 1

LEGEND

① INDICATES PAINT "BRIDGE NO. 57-589 R/L" AND YEAR CONSTRUCTED.
② INDICATES PAINT "~~LARK CANYON~~ McCAIN VALLEY ROAD UNDERCROSSING"
⊕ INDICATES POINT OF MINIMUM VERTICAL CLEARANCE.
▨ INDICATES CONTRAST TREATMENT

AS BUILT
CORRECTIONS BY Donald P. Pari HD
CONTRACT NO. 11-094664
DATE 8-10-67 10-10-67

SHEET 1 OF 10

BRIDGE DEPARTMENT
... DESIGN SECTION ... 14

DESIGN	M.E. Shue 1-65	Checked ME Conley
DETAILS	Wm. H. Bile 8/64	Checked ME Conley
LAYOUT	Wm. H. Biles 7/64	Checked ME Conley
QUANTITIES	Jerry Smith 4/65	Checked Wm. H. Biles

STATE OF CALIFORNIA
DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS

McCAIN VALLEY ~~LARK CANYON~~ ROAD UNDERCROSSING
LOCATED IN SAN DIEGO COUNTY APPROX. 1.9 MILES EASTERLY OF MC CAIN VALLEY ROAD AND 0.3 MILE NORTHERLY OF EXISTING U.S. SIGN ROUTE 80

GENERAL PLAN

Except as noted SCALE 1"= 20' | BRIDGE 57-589 R/L | Post Mile 66.4 | DRAWING 57589-1

FOR GENERAL NOTES SEE "Foundation Plan" sheet
LIVE LOADING H20-S16-44 AND ALTERNATIVE

11206
094661

Disregard prints bearing earlier revision dates →
P-

90

TULE WIND PROJECT

MAJOR USE PERMIT

STORM WATER MANAGEMENT PLAN

County of San Diego

(MUP 09-019)

Prepared for:

Iberdrola Renewables, Inc.
1125 NW Couch Street, Suite 700
Portland, Oregon

Prepared by:

HDR Engineering, Inc.
8690 Balboa Avenue, Suite 200
San Diego, California 92123
858-712-8400

November 2010

Appendices

Tables

Figures

EXECUTIVE SUMMARY

The purpose of this Storm Water Management Plan (SWMP) is to investigate Best Management Practices (BMPs) for the Tule Wind Project (Project). This report is intended to accompany and support the Major SWMP form from Appendix C of the San Diego County Standard Urban Storm Water Mitigation Plan (SUSMP) in support of a Major Use Permit (MUP) submittal. The following documents and guidelines apply to the water quality for the Project:

- Clean Water Act of 1977 Section 311 and 402, United States Code Title 33 Section 1342, Code of Federal Regulations Title 40 Parts 123-136;
- California Porter-Cologne Water Quality Control Act 1998, California Water Code Section 13000-14957, Division 7;
- California State Water Resources Control Board National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated With Construction and Land Disturbance Activities, Order No. 2009-0009-DWQ (General Construction Permit);
- San Diego County Standard Urban Storm Water Mitigation Plan (SUSMP), March 25, 2010,
- County of San Diego Watershed Protection, Storm Water Management and Discharge Control Ordinance (County Ordinance 9589),
- County of San Diego Stormwater Standards Manual,
- California Regional Water Quality Control Board San Diego Region Order No. R9-2007-0001, NPDES No. CAS0108758.

Project development is outside of the Phase I NPDES permit for the County of San Diego, so General Construction Permit criteria will control analysis and implementation of BMPs. However, since the Project is within the County of San Diego (County) and is required to be reviewed by the County this SWMP will address the County SUSMP requirements. Based on these governing documents the following items are included in the SWMP:

- Project description and vicinity map,
- Site map defining drainage patterns, existing storm drain systems, proposed drainage crossings, soil types, existing land types, and existing and proposed slopes,
- Identification of Pollutants of Concern,
- Identification of Conditions of Concern,
- Identification of Site Design BMP recommendations,
- Preliminary Hydromodification analysis and discussion,
- Identification of Source Control BMPs,
- BMPs for Individual Priority Project Categories,
- Identification of Treatment Control BMP recommendations, and
- Storm Water BMP maintenance discussion.

Water quality investigations completed for the currently applicable regulations identified limited potential impacts to water quality resulting from Project development. Minimal impervious areas are included with Project development and a number of site design and source control BMPs will be implemented to mitigate any potential impacts. Additionally, post construction BMPs will be implemented per the new General Construction Permit to address treatment BMP and hydromodification concerns. A full operation and maintenance plan will be developed during final engineering to identify procedures to maintain performance of the Project BMPs. Mitigation measures will be implemented to the maximum extent practicable and operated and maintained by the developer.

1.0 PROJECT DESCRIPTION

The Tule Wind Project proposes to develop a wind turbine "farm" for power generation, in the County of San Diego in the State of California. Portions of the Project discussed in this report are limited to areas on private property within the County of San Diego. A majority of the overall Project will be developed on Bureau of Land Management (BLM) Federal land, outside the County of San Diego Planning Department jurisdiction. Total Project site area proposed on County of San Diego regulated lands is approximately 1,982 acres, which will permanently impact approximately 77 acres. Total disturbed areas, including temporary construction impacts (widened access roads, trenching, etc), are approximately 127 acres. From a water quality standpoint, all analysis and design addresses permanent impacts only, as additional temporary impacts will be returned to a naturally vegetated state upon completion of the Project. The Project is located just north of Interstate 8 east of Ribbonwood Road, approximately two and half miles northeast of the community of Boulevard, California. Given the rural nature of the Project area, only the western side of the site is bounded by a physical feature, Ribbonwood Road.

Figure 1. Vicinity Map

Under existing conditions the Project site is mainly undeveloped naturally vegetated rocky hills. A number of existing access roads traverse the area, providing service routes to existing utility facilities, commercial facilities, rural houses, agricultural facilities, and a landing strip. Existing topography is fairly steep with some flatter drainage courses at the base of some of the hills and gullies. Naturally occurring native vegetation is predominant throughout the site, with periodic scattered unvegetated rock outcroppings.

Development to be completed on private County of San Diego property will consist of 13 wind turbines, turbine pads, access roads, 5-acre collector substation site, 5-acre operation and maintenance building site, collector power lines, and the associated revegetation and transformer pads. Turbines are approximately 320-feet to 500-feet tall with a 48-foot diameter concrete foundation. Concrete foundations slope away from the centrally located turbine and will be buried greater than half a foot, so that exposed concrete foundations are approximately 6-inches to 8-inches thick and 18-feet to 20-feet in diameter. Turbines also include five-foot by nine-foot concrete pads for transformer foundations. Graded dirt pads around the turbines will be approximately 400-feet in diameter.

Access roads between turbines will be 36-feet wide to accommodate self propelled cranes and supply trucks, while access roads to the turbine strings will only need to be 24-feet wide, as the crane and other assembly equipment can be brought onsite in pieces. Thirty-six foot access roads between turbines are intended to be temporary for construction activities and will be allowed to revegetate to a 24-foot width, pending construction completion. Proposed access road alignments will follow existing access roads to the maximum extent practicable to limit the amount of additional disturbed areas. New access roads will follow existing contours to maximum extent practicable to limit the amount of disturbed areas resulting from grading cuts. Appendix A contains preliminary details for Project features.

Operation and maintenance facility pads and substation pads will be graded to allow for construction of the required facilities and the accompanying access and operation spaces. Impervious areas associated with these facilities will be minimal, limited to the structures themselves. All access and parking areas will be constructed of permeable materials. Additionally, there is the potential for detention basins attached to these graded pads, in order to adequately address water quality concerns. A number of operation and maintenance facility alternative locations were considered in Project development (See Exhibit B for operation and maintenance facility locations). All alternatives are included in analysis to conservatively account for multiple configurations.

Electrical collector lines for the Project will be a combination of overhead and buried, with a majority being buried. Overhead collector lines will supported by single steel or wood poles; typically 60-feet to 80-feet in height. Foundation footprints for collector line poles will be similar to the diameter of the pole itself. Collector line disturbed widths are assumed to be 24-feet to allow construction vehicle access and trenching or pole erection. Natural vegetation surrounding the turbine pads, access roads, and any power poles will be established after construction. Buried collector lines will be completely revegetated after construction.

Analysis of the Project water quality is limited to the permanent impact areas, as temporary impacts will be returned to naturally vegetated conditions after construction. Project development will increase impervious areas by a very small amount. Each turbine pad represents approximately 360 square feet of impermeable area in addition to the footprints of the operation and maintenance pad and substation pads. Overall Project development proposes to increase impervious area by approximately 23,669 square feet (0.7% of the 77 acres of permanently disturbed area) or .003% of the total basin area.

1.1 PROJECT REQUIREMENTS

A Stormwater Intake Form for Development Projects was completed for the Project and is included in Appendix B. Based on the checklist Tule Wind Project is considered a priority project and is required to adhere to Major SWMP requirements. A completed Major SWMP form is included in Appendix C. Priority project criteria are outlined in the SUSMP Priority Development Project matrix as shown in Table 1. Since the Project will develop more than 5,000 square feet of hillside and will create light industrial facilities, development will require site design, source control, priority project BMPs, and treatment control BMPs, to be discussed in Sections 4, 5, 6, and 7, respectively.

Table 1. Priority Development Project Matrix

Yes ☐	No ☑	A	Housing subdivisions of 10 or more dwelling units. Examples: single-family homes, multi-family homes, condominiums, and apartments.
Yes ☑	No ☐	B	Commercial—greater than one acre. Any development other than heavy industry or residential. Examples: hospitals; laboratories and other medical facilities; educational institutions; recreational facilities; municipal facilities; commercial nurseries; multi-apartment buildings; car wash facilities; mini-malls and other business complexes; shopping malls; hotels; office buildings; public warehouses; automotive dealerships; airfields; and other light industrial facilities.
Yes ☐	No ☑	C	Heavy industry—greater than one acre. Examples: manufacturing plants, food processing plants, metal working facilities, printing plants, and fleet storage areas (bus, truck, etc.).
Yes ☐	No ☑	D	Automotive repair shops. A facility categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539.
Yes ☐	No ☑	E	Restaurants. Any facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812), where the land area for development is greater than 5,000 square feet. Restaurants where land development is less than 5,000 square feet shall meet all SUSMP requirements except for structural treatment BMP and numeric sizing criteria requirements and hydromodification requirements.
Yes ☑	No ☐	F	Hillside development greater than 5,000 square feet. Any development that creates 5,000 square feet of impervious surface and is located in an area with known erosive soil conditions, where the development will grade on any natural slope that is twenty-five percent or greater.
Yes ☐	No ☑	G	Environmentally Sensitive Areas (ESAs). All development located within or directly adjacent to or discharging directly to an ESA (where discharges from the development or redevelopment will enter receiving waters within the ESA), which either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition. "Directly adjacent" means situated within 200 feet of the ESA. "Discharging directly to" means outflow from a drainage conveyance system that is composed entirely of flows from the subject development or redevelopment site, and not commingled with flows from adjacent lands.
Yes ☐	No ☑	H	Parking lots 5,000 square feet or more or with 15 or more parking spaces and potentially exposed to urban runoff.
Yes ☐	No ☑	I	Street, roads, highways, and freeways. Any paved surface that is 5,000 square feet or greater used for the transportation of automobiles, trucks, motorcycles, and other vehicles.
Yes ☐	No ☑	J	Retail Gasoline Outlets (RGOs) that are: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.

2.0 POLLUTANTS OF CONCERN

Under existing conditions pollutants generated by the Project site include sediments, oil and grease. Based on the County of San Diego SUSMP anticipated pollutants for hillside developments and commercial developments are sediment, nutrients, organic compounds, oil & grease, trash and debris, oxygen demanding substances, bacteria and viruses, and pesticides. Table 2 outlines the pollutants of concern as shown in the County of San Diego SUSMP. However, based on the minimal amount of development that is proposed anticipated pollutants are more likely sediment from dirt roads and pads, and oil and grease from the roads and turbines.

Table 2. Anticipated and Potential Pollutants Generated by Land Use Type.

Priority Project Categories	General Pollutant Categories								
	Sediments	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P(1)	X
Commercial Development >1 Acre	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Heavy industry/industrial development	X		X	X	X	X	X		
Automotive Repair Shop			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	
Hillside Development >5,000 ft^2	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Retail Gasoline Outlets			X	X	X	X	X		
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

2.1 RECEIVING WATERS

A number of existing streams will convey flows generated by the Project. A majority of the Project drains to Tule Creek via McCain Valley and Lark Canyon. These flows are conveyed into Tule Lake which discharges into Tule Canyon, then Carrizo Wash in Carrizo Gorge. A northern eastern portion of the Project drains into Carrizo Wash through Rodando and Palm Grove. Carrizo Wash continues in a northerly direction to a junction with an unnamed wash that drains the northern most part of the Project. Finally, all flows are conveyed north into Carrizo Creek, into San Felipe Creek, and finally into the Salton Sea. The Salton Sea is a minimum of approximately 45 miles downstream of the Project. See Figure 2 below.

Based on the Project location and the existing conditions, there are no dry weather flows for drainages associated with this Project. There are minimal existing rural developments within the Project drainage basins that would generate flows during dry weather. Frequent site visits during the dry season confirmed that no flows were present in drainages associated with the Project.
All Project areas, Tule Creek, McCain Valley, Lark Canyon, Tule Lake, and Carrizo Creek are located in the McCain hydrologic sub-area in the Jacumba hydrologic area in the Anza Borrego watershed, defined by hydrologic unit number 722.71. Carrizo Creek drains through the Carrizo hydrologic sub-area in the Agua Caliente hydrologic area (722.61) where it confluences with San Felipe Creek in the Ocotillo Lower Felipe hydrologic area (722.20).

Based on the 303(d) list approved by the United States Environmental Protection Agency (USEPA) in 2006, only the Salton Sea is listed for nutrients, salinity, and selenium. Pollutant sources are identified as agricultural, major industrial, point source, or out of state.

Currently there are no Region 9 State Water Resources Control Board special requirements for any water bodies that will be impacted by this Project. Based on the available information there are no High Risk Areas within the Project limits.

Comparison of the anticipated pollutants and the receiving water bodies' impairments indicates there are no primary pollutants of concern. Secondary pollutants of concern are sediment and oil and grease.

HDR
ONE COMPANY | Many Solutions

Receiving Waters

FIGURE 2

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy

3.0 CONDITIONS OF CONCERN

A CEQA Drainage Study dated September 2010 was completed by HDR under a separate cover and discusses the existing and proposed drainage patterns for the Project. A review of this drainage summary is presented below.

3.1 EXISTING DRAINAGE PATTERNS

Project areas are drained by three major drainage basins:

1. Tule Creek Basin – 18,250 acres
2. Southern Unnamed Wash Basin – 486 acres
3. Eastern Unnamed Wash Basin – 734 acres

Tule Creek drains the majority of the Project site to the southeast into Tule Lake. Tule Lake empties into Carrizo Wash, which ultimately discharges into the Salton Sea. Two small northwestern portions of the Project site are drained by two unnamed tributaries to Carrizo Wash. The southern of the two unnamed washes discharges into Carrizo Wash 2.4 miles upstream of the eastern unnamed wash and approximately 10 miles downstream of Tule Lake. Site visits identified existing stream locations and access road crossings. Refer to Exhibit A for an existing conditions drainage map.

All basins have similar drainage patterns. Runoff sheet flows across the ground surface until it encounters rivulets which then discharge into larger streams which ultimately discharge into Tule Creek or Carrizo Wash. Precipitation that falls on typical access roads sheet flows off the side of the roads where it is either collected in swales running parallel to the road or continues to sheet flow across the natural terrain. Swales carry runoff to streams crossing the access road, where they are then conveyed to major drainage features.

There are no major improvements to the drainage features within the basin. However, a number of culverts have been installed on portions of the Tule Creek Basin to facilitate the construction of access roads across the smaller drainage features. An unnamed tributary to Tule Creek along the northeastern edge of the Tule Creek Basin crosses a number of public and private roads via culverts just east of the landing strip. Several access roads utilize a depressed on grade type crossing, where flows are conveyed across the top of the road, rather than constructing culverts to carry flows under the road.

3.2 PROPOSED DRAINAGE PATTERNS

Proposed Project improvements will mimic existing drainage patterns and will minimize redirection of any flows. Improvements include graded pads, access roads, and utility lines, and constructed crossings at each drainage feature.

Tule Creek Basin has an access road running east-west between Ribbonwood Road and McCain Valley Road which will cross approximately six drainages, two of which are larger streams. Drainage of access roads will be completed by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features. Project development within the southern unnamed wash basin does not propose any crossing of existing surface drainage features. Access roads located within the eastern unnamed wash basin will cross approximately nine drainages, one of which is the main drainage channel for the basin.

Precipitation falling on the turbine pads will sheet flow off the proposed features and finished surfaces to brow ditches/swales that will collect runoff. Runoff will then be directed to the existing natural surface drainage features, with flow patterns intended to mimic existing conditions.

Proposed electrical collector lines will be located mainly in the northeastern corner of the Project. Any impacts on drainage patterns from collector lines will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions to the greatest extent practicable. Proposed drainage patterns are illustrated on Exhibit B.

A complete discussion of the Project drainage is completed in the report CEQA Drainage Study, dated September 2010, published under a separate cover by HDR.

3.3 HYDROMODIFICATION

Based on the County of San Diego Major Storm Water Management Plan form this Project is required to complete a Hydromodification Plan (HMP). However, discussions with the County of San Diego Department of Public Works concluded the Project is outside of the Phase I NPDES permit jurisdiction and as such will not be required to complete a hydromodification analysis for the County. General Construction Permit post-construction BMPs are intended to address hydromodification for areas outside of Phase I and Phase II NPDES permits, which will apply to the Project. These post-construction BMP requirements will go into effect September 2012, and are expected to evolve over the upcoming implementation period. As the criteria currently stand, the Project will be required to complete a Water Balance Calculator summary to identify increases in flows of concern. Mitigation measures are included in the Water Balance Calculator and will be used to address any impacts from Project development on the watersheds. Given the preliminary level of planning and the undetermined direction of the General Construction Permit post-construction BMPs, Project design will account for these requirements throughout the planning and permitting process. Revisions to the SWMP during final engineering will clearly identify any needed mitigation features for the Project.

4.0 SITE DESIGN BMPS

LID and site design strategies outlined in the County of San Diego Storm Water Management Plan Form are presented below. Site design BMPs listed below are all those listed on the County of San Diego Storm Water Management Plan Form, however some may not apply given the limited amount of development proposed. Since the Project is in the preliminary stages of planning, site design BMPs could change as planning progresses.

1. Conserve natural areas, soils, and vegetation
   - Preserve well draining soils (Type A or B);
   - Preserve significant trees;
   - Preserve critical (or problematic) areas such as floodplains, steep slopes, wetlands, and areas with erosive or unstable soils.
2. Minimize disturbance to natural drainages
   - Set-back development envelope from drainages;
   - Restrict heavy construction equipment access to planned green/open space areas.
3. Minimize and disconnect impervious surfaces (see 5)
   - Clustered lot design;
   - Items checked in 5.
4. Minimize soil compaction
   - Restrict heavy construction equipment access to planned green/open space areas;
   - Re-till soils compacted by construction vehicles/equipment;
   - Collect and re-use upper soil layers of development site containing organic materials.
5. Drain runoff from impervious surfaces to pervious areas
   - LID Street and Road Design
     - Curb-cuts to landscaping;
     - Rural swales;
     - Concave median;
     - Cul-de-sac landscaping design.
   - LID parking lot design
     - Permeable pavements;
     - Curb cuts to landscaping.
   - LID driveway, sidewalk design
     - Permeable pavements;
     - Pitch pavements toward landscaping.
   - LID building design
     - Cisterns and rain barrels;
     - Downspout to swale;
     - Vegetated roofs.

- LID landscaping design
  - Soil amendments;
  - Reuse of native soils;
  - Smart irrigation systems;
  - Street trees.

6. Minimize erosion from slopes

- Disturb existing slopes only when necessary;
- Minimize cut and fill areas to reduce slope lengths
- Incorporate retaining walls to reduce steepness of slopes or to shorten slopes;
- Provide benches or terraces on high cut and fill slopes to reduce concentration of flows;
- Rounding and shaping slopes to reduce concentrated flow;
- Collect concentrated flows in stabilized drains and channels.

Project development will implement all of number 1, all soils, trees, and critical areas will be conserved during development to the maximum extent practicable.

Disturbance to natural drainages will be limited by restriction of heavy construction equipment access to planned green/open space areas. All heavy equipment will be limited to roads, pads, or construction right of way.

Minimized and disconnected impervious surfaces will be facilitated by LID design features. Proposed streets will not have gutters and will drain directly to parallel rural swales. Road surfaces will also be constructed of a permeable gravel material. Parking lots will be constructed similarly to streets, draining directly to surrounding landscaping or rural swales. All parking lot surfaces will be constructed of permeable gravel type materials. All sidewalks and driveways will be constructed in a similar manner.

Building design impacts will be mitigated by drainage of all runoff from proposed structures into surrounding vegetated swales. Landscaping will reuse existing native soils to the maximum extent practicable.

Soil compaction will be minimized by limiting heavy equipment access to designed roads, pads, and construction right of way. There should be no heavy equipment use outside of the disturbed areas.

Erosion from slopes will be minimized by limiting the amount of disturbance to existing slopes, minimized cut and fill areas thereby reducing slope lengths, providing benches on high cut and fill slopes to reduce concentration of flows, and collections of flows in stabilized drains and channels. Road and pad grading aims to limit elevation differences between proposed and existing grades, which will limit cut and fill heights. Any of the cut or fill slopes that are higher than 30-feet will incorporate benches to break up flow concentrations. Swales and brow ditches will be provided at the bottom of slopes to limit erosion at the bottom of slopes.

Project development aims to maintain the existing natural flow patterns as much as possible and includes limited impervious areas. Limited impervious areas will drain immediately to permeable or vegetated pads or drainage features, eliminating any directly connected impervious areas.

5.0 SOURCE CONTROL BMPS

Source control BMPs outlined in the County of San Diego SWMP form is discussed below. Given the preliminary stage of Project development the following source control BMPs are recommended and will be updated during planning to better reflect utilized source control BMPs. Based on the limited amount of structural development a number of the source control BMPs do not apply to the Project. Site features with source control BMPs identified by the County of San Diego are:

A. On-site storm drain inlets
B. Interior floor drains and elevator shaft sump pumps
C. Interior parking garages
D1. Need for future indoor and structural pest control
D2. Landscape/outdoor pesticide use
E. Pools, spas, ponds, decorative fountains, and other water features
F. Food service
G. Refuse areas
H. Industrial processes
I. Outdoor storage of equipment or materials
J. Vehicle and equipment cleaning
K. Vehicle/Equipment repair and maintenance
L. Fuel dispensing areas
M. Loading docks
N. Fire sprinkler test water
O. Miscellaneous drain or wash water
  - Boiler drain lines;
  - Condensate drain lines;
  - Rooftop equipment;
  - Drainage sumps;
  - Roofing, gutters, and trim
P. Plazas, sidewalks, and parking lots

Current project planning will require source control BMPs for interior floor drains, need for future indoor and structural pest control, landscape/outdoor pesticide use, refuse areas, roofing, gutters, and trim, and sidewalks, and parking lots.

Interior floor drains will be constructed to connect directly to the sanitary sewer for the structure. There will be inspection of the interior drains performed frequently to ensure there is no clogging and no potential for runoff from drain overflow.

Pest control BMPs will include building design features which discourage entry of pests. Integrated pest management information will also be provided to the owners and operators of the facility to ensure proper pest management. Outdoor pesticide use BMPs will consist of preservation of existing native trees, shrubs, and ground cover to the maximum extent practicable. Landscaping will likely not require irrigation, but any minimal irrigation will aim to minimize runoff, promote surface infiltration, and limit the amount of fertilizer and pesticide treated areas serviced which could contribute to runoff. Plants selected for landscaping will be appropriate for the desired land use;

such as, saturated conditions for any low lying sump areas and dry for any high areas. All landscaping will consider pest resistant plants that are appropriate for the site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.

Refuse areas will be located inside of the operation and maintenance facilities and will be located such that no precipitation comes in contact with refuse. All trash disposed of onsite will be located at the operation and maintenance facility, with trash generated at any remote turbine locations immediately removed by the active work crew. In addition, all trash receptacles at the operation and maintenance facility will include signage prohibiting disposal of hazardous materials.

Roofing, gutters, and trip will not be constructed of materials that will leach pollutants into stormwater runoff, typically copper.

Sidewalks and parking lots will mainly be constructed of permeable gravel materials. There potentially could be short distances of concrete sidewalk; however, these will drain immediately to surrounding permeable areas. Due to the gravel construction of the majority of parking lots and sidewalks, sweeping will not be feasible.

6.0 TREATMENT CONTROL BMPS

Discussions with the County of San Diego identified that Project development would not require treatment BMPs, based on the County guidelines, since the Project was located outside of Phase I and Phase II NPDES permits and the Project did not contribute flows to a Municipal Separate Storm Sewer System (MS4). However, based on the Project location, General Construction Permit post-construction BMPs will be required. General Construction Permit post-construction BMPs are intended to reduce the impacts from project development on existing natural drainages. These impacts are typically increased channel erosion or deposition resulting from changes in runoff patterns from the Project site, also known as hydromodification. It has been found that the flows that actually cause the most impact to existing drainages are associated with the high frequency lower volume storms, which is the focus of the General Construction Permit. Project impacts are quantified in the General Construction Permit by a Water Balance Calculator, which identifies the changes in Project runoff and allows for mitigation of these impacts through numerous LID and local detention features. Water Balance Calculator analysis gives mitigation credit to the following Project features:

- Porous pavement,
- Tree planting,
- Downspout disconnection,
- Impervious area disconnection,
- Green roof
- Vegetated swales,
- Rain barrels/cisterns, and
- Soil quality.

Project development proposes to use vegetated swales, downspout disconnection, and potentially several detention basins for the operation and maintenance area and/or substation areas. Additionally, all impervious areas will be disconnected and will be drained via natural features. A comparison of these features with the County of San Diego SUSMP requirements was completed in order to better identify mitigation benefits. Table 3 contains Table 2-3: Treatment Control Selection Matrix, from the County of San Diego SUSMP.

There are no primary pollutants of concern for the Project, and the Project will not contribute pollutants to a 303 (d) listed water body. With no primary pollutants of concern, the County of San Diego SUSMP requires the Project to focus on the secondary pollutants of concern. Secondary pollutants of concern are trash and oil and grease; which represent course sediment and trash as well as pollutants that tend to associate with fine particles during treatment. Table 5 identifies settling basins and LID bioretention facilities as having high removal efficiencies for all pollutants of concern. Based on this, the selection of swales/brow ditches and detention basins for General Construction Permit post-construction BMP requirements, also meets the intent of the County of San Diego SUSMP.

Table 3. Groups of Pollutants and Relative Effectiveness of Treatment Facilities

Pollutant of Concern	Bioretention Facilities (LID)	Settling Basins (Dry Ponds)	Wet Ponds and Wetlands	Infiltration Facilities or Practices (LID)	Media Filters	High-rate Biofilters	High-rate Media Filters	Trash Rack & Hydro-dynamic Devices
Course Sediment and Trash	High	High	High	High	High	High	High	High
Pollutants that tend to associate with fine particles during treatment	High	High	High	High	High	Medium	Medium	Low
Pollutants that tend to be dissolved following treatment	Medium	Low	Medium	High	Low	Low	Low	Low

Further design of these post-construction BMPs will be required during final Project engineering. As the planning process progresses more detail will be available as to the opportunities and locations for these features. Exhibit C includes a BMP Map which defines potential locations for treatment BMPs as well as typical site design and source control BMPs. The BMP Map is only intended to be representative of potential or typical BMP locations and is not intended to exclude additional locations of features. Additional CASQA BMP information is located in Appendix E.

Responsible parties for the capital costs associated with construction of the treatment control BMPs are presented in Table 4.

Table 4. Treatment Control BMP Capital Cost Responsible Party

Treatment Control BMP	Responsible Party
Detention Basins	Iberdrola Renewables
Swales/Brow Ditches	Iberdrola Renewables

7.0 STORM WATER BMP MAINTENANCE

In accordance with Section 5 of the County of San Diego SUSMP the Project BMPs will be classified as First Category. BMPs will largely “maintain themselves” via the natural process of vegetation growth cycles. Vegetated swales/natural drainages and open spaces for impervious area disconnection will be seeded with local naturally occurring plant types, which will be allowed to grow naturally in these facilities. Permeable paving surfaces will be maintained by Iberdrola to provide uniform access roads. Any erosion issues associated with the unvegetated drive surface will be immediately addressed to limit any sediment discharge from the site. Table 5 defines the anticipated BMP responsible parties.

Table 5. BMP Maintenance Responsibility

Treatment Control BMP	Responsible Party
Detention Basins	Iberdrola Renewables
Swales/Brow Ditches	Iberdrola Renewables

All operation and maintenance required by these BMPs will be the responsibility of Iberdrola. More specific operation and maintenance of the BMPs will be established during final Project design and discussed in a Maintenance Plan report.

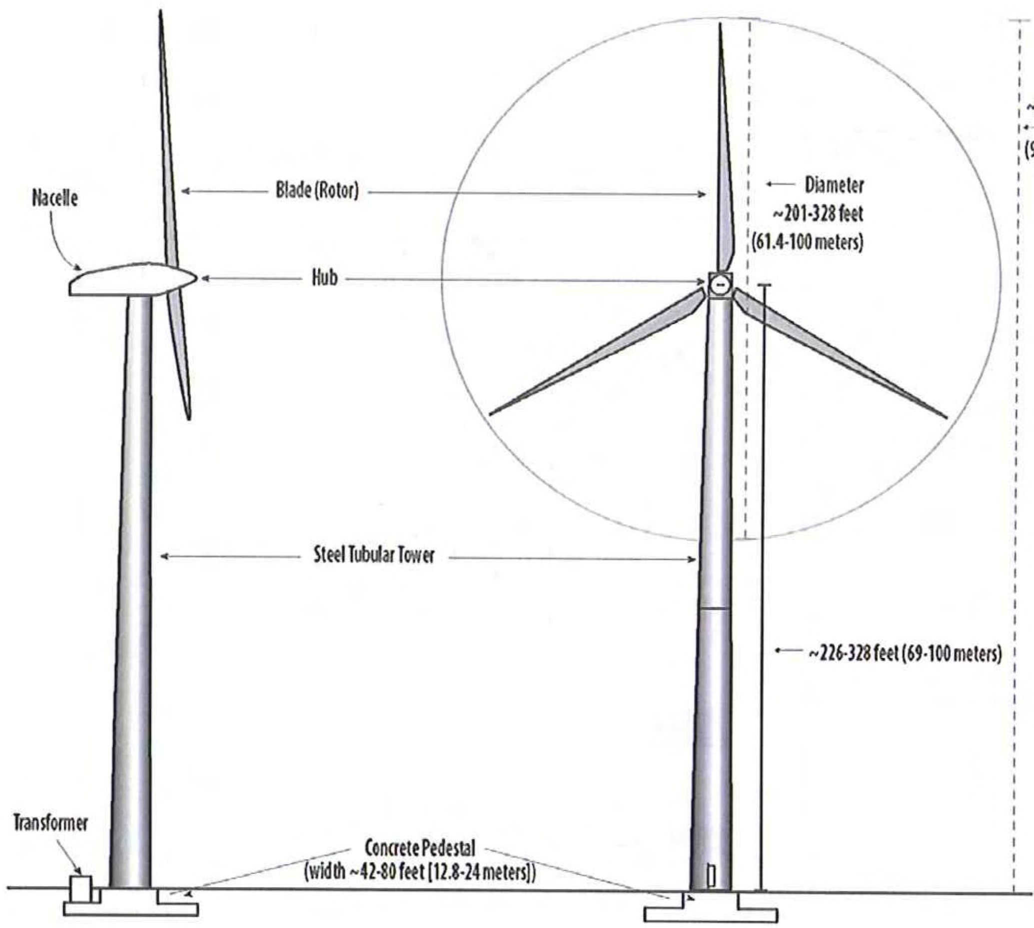
8.0 CONCLUSION

Based on the currently applicable water quality requirements, an analysis of the potential impacts was completed for the Tule Wind Project in support of a MUP submittal to the County of San Diego. This analysis determined that the Project would have low potential for water quality impacts to the surrounding water bodies. Minimal impervious area increases are proposed with Project disturbance placement intended to limit the impacts to surrounding water bodies. Based on the minimal level of impervious surfaces proposed as part of the project and implementation of applicable site design BMPs, source control BMPs, LID features, and storm water BMP maintenance, the project will not substantially degrade water quality. Mitigation measures are implemented to the maximum extent practicable to address the limited numbers of potential impacts. Operation and maintenance of the BMPs should be minimal, due to their natural operation conditions, with responsibility for these features performance over the life of the Project being the developers.

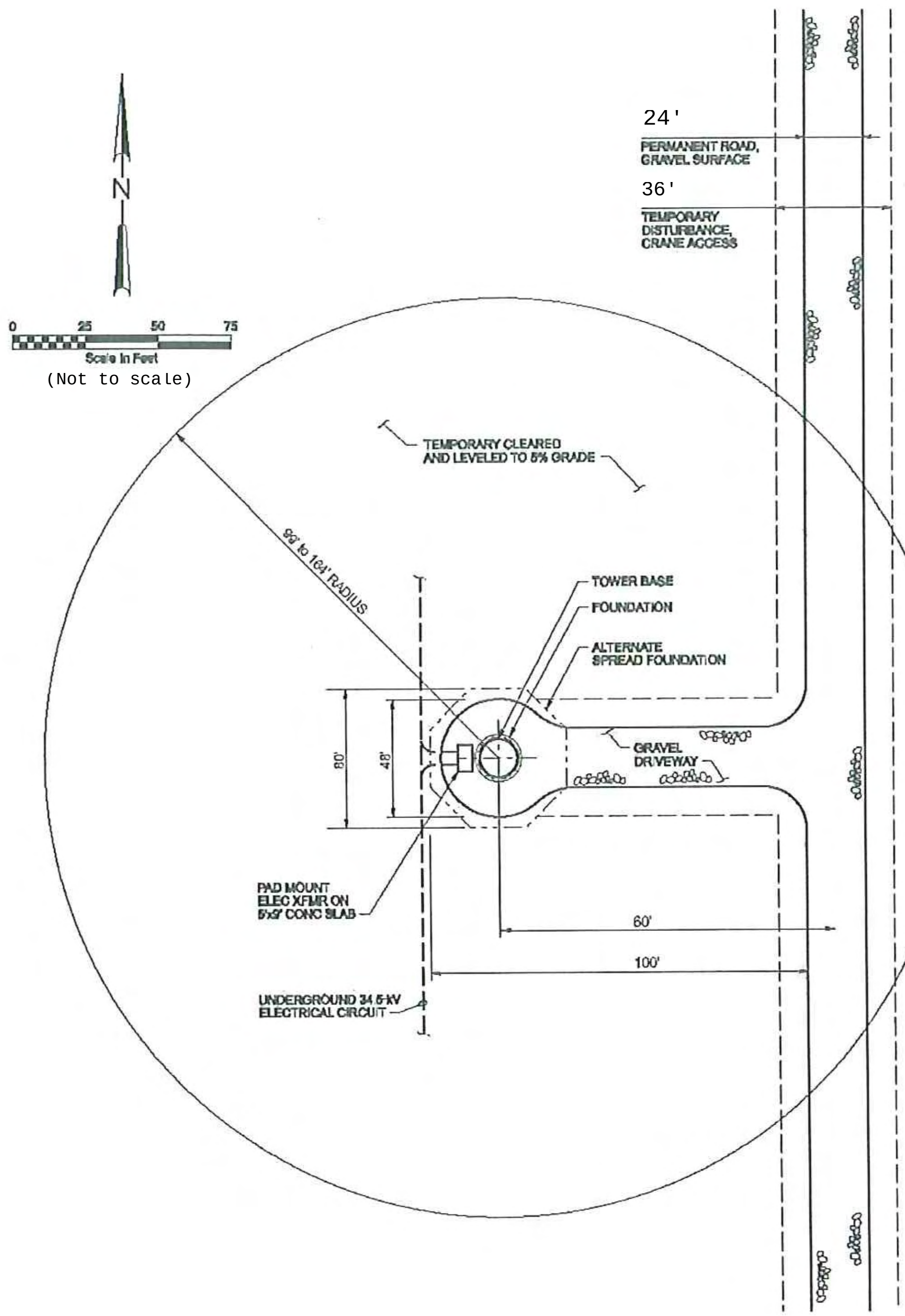
APPENDIX A

Preliminary Project Details

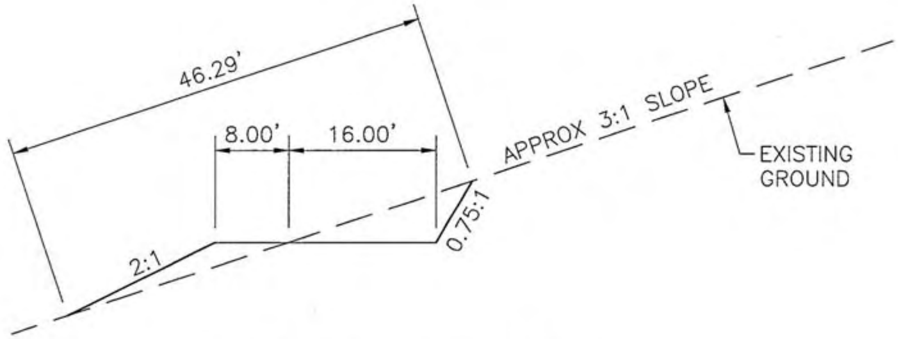
Typical Turbine Schematic
Typical Turbine Site
Typical Access Road Sections
Typical Substation Facility
Typical Operation and Maintenance Facility Site
Typical Operation and Maintenance Facility Elevations
Typical Collector Line Power Pole
Typical Buried Collector Line



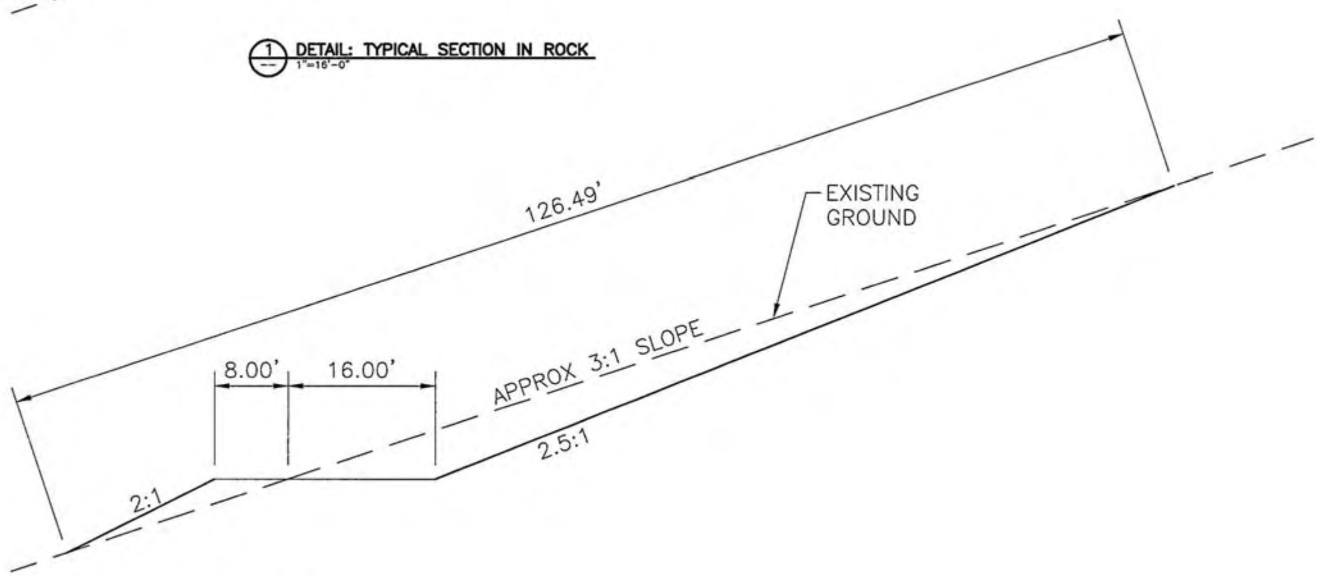
Turbine Schematic



Turbine Site

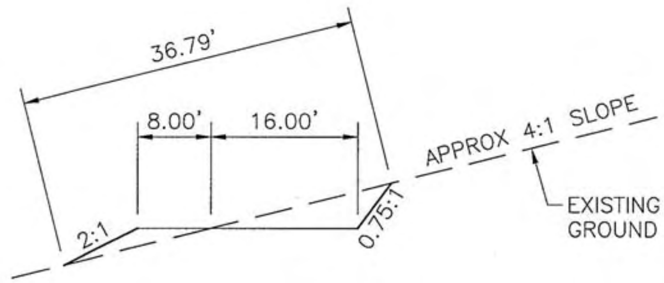


1 DETAIL: TYPICAL SECTION IN ROCK
1"=16'-0"



2 DETAIL: TYPICAL SECTION IN SOIL
1"=16'-0"

Typical Access Road Cross Sections



1 DETAIL: TYPICAL SECTION IN ROCK
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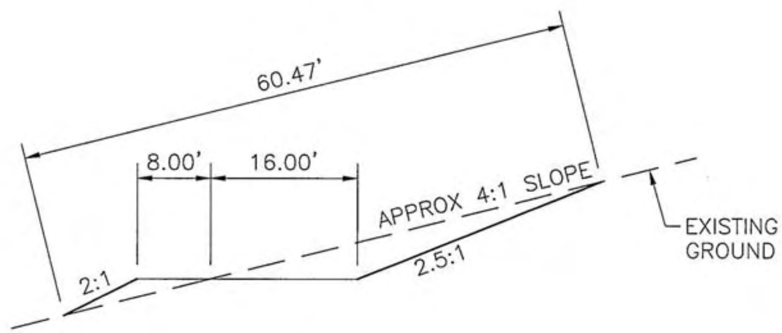
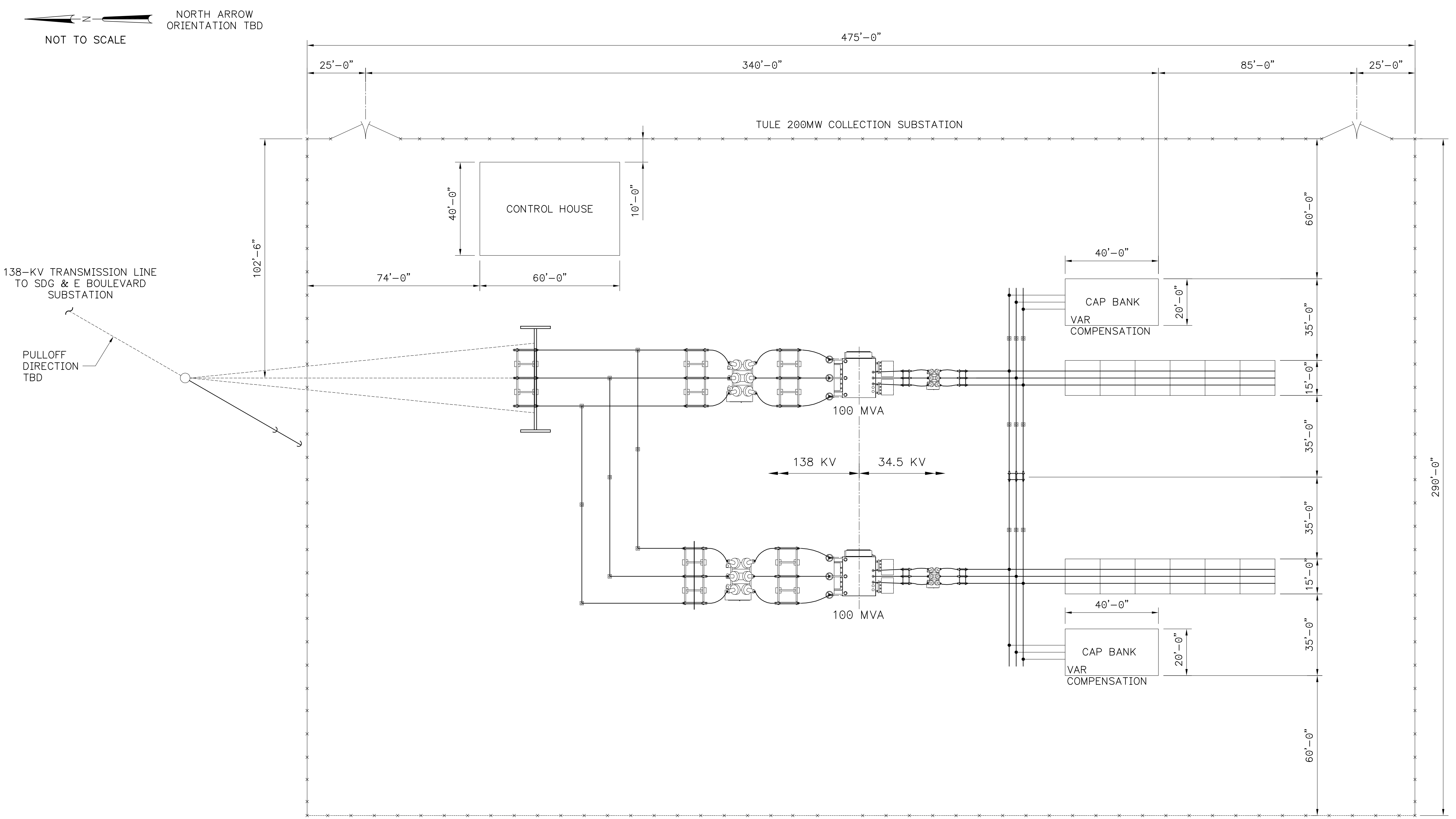


2 DETAIL: TYPICAL SECTION IN SOIL
1"=16'-0"

Typical Access Road Cross Sections

10/20/2009 11:12 AM TWEBSTER Z:\TWW_VAN\IBERDROLA\TULE\2009 ASSISTANCE\DWGS\FIGURE4.DWG



TriAxis Engineering, Inc.

DSGN J KING						
DR FIGURE4.DWG T WEBSTER						
CHK G ORMSBY						
APVD G ORMSBY	NO.	DATE	REVISION	BY	APVD	

REUSE OF DOCUMENTS

THIS DOCUMENT, AND THE IDEAS AND DESIGNS INCORPORATED HEREIN, AS AN INSTRUMENT OF PROFESSIONAL SERVICE, IS THE PROPERTY OF TRIAXIS ENGINEERING, INC. AND IS NOT TO BE USED, IN WHOLE OR IN PART, FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF TRIAXIS ENGINEERING, INC.

VERIFY SCALES

BAR IS ONE HALF INCH ON ORIGINAL DRAWING

0 1/2"

IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.

TULE SUBSTATION
IBERDROLA RENEWABLES

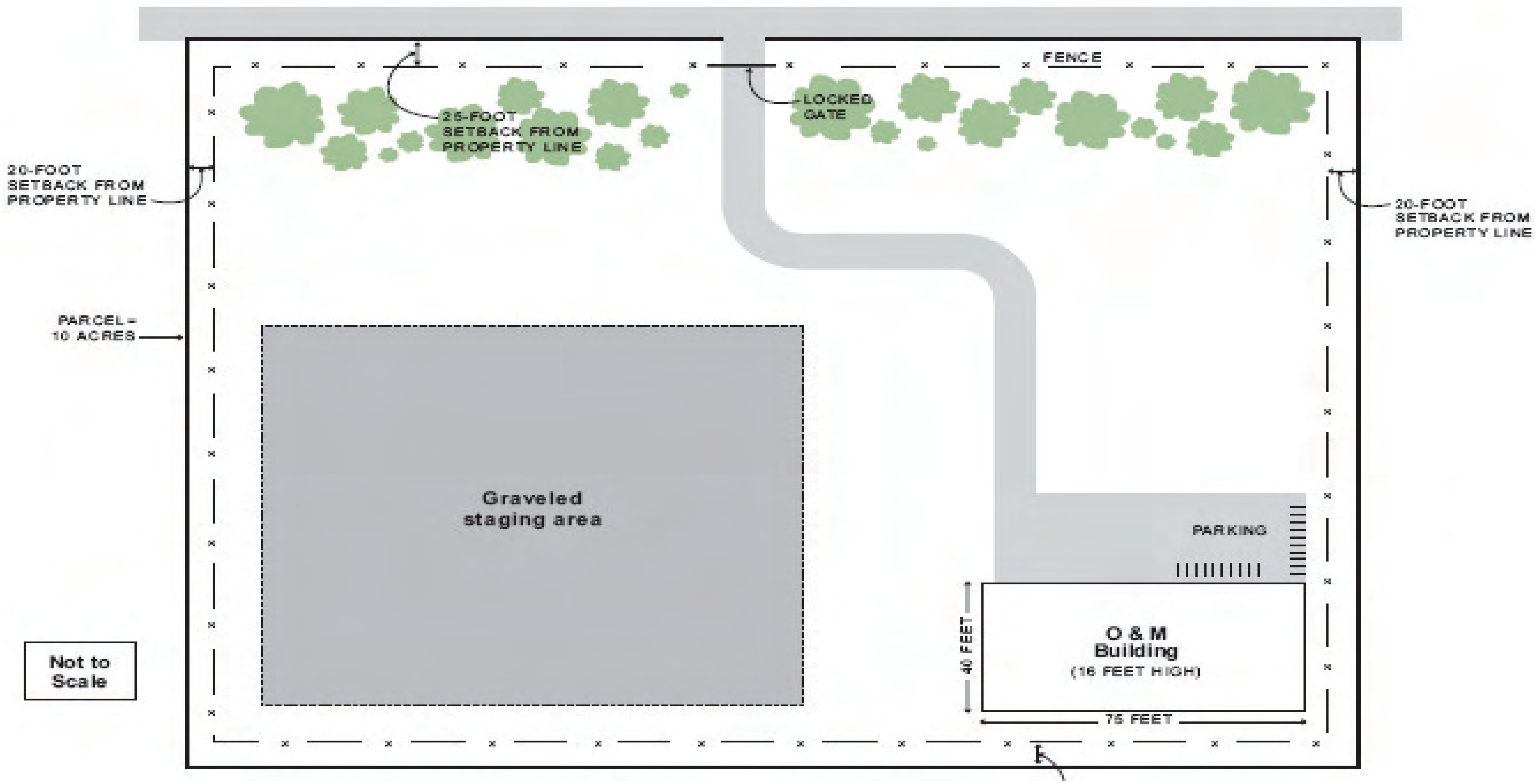
TULE WIND PROJECT

FIGURE 4
200MW COLLECTION SUBSTATION
PLAN VIEW

SHEET
DWG NO. FIGURE4
DATE DEC 2009
PROJ NO. Y8773

PRELIMINARY

Source: Iberdrola, 2009 | G:/Projects\IberdrolaRenew_424914\TuleWindEnergy_115965\14_00_GIS_MODELS\14_02_Graphics\14_02_01_docs\Ltr_Landscp_master.ai | Last Updated : 12-24-2009



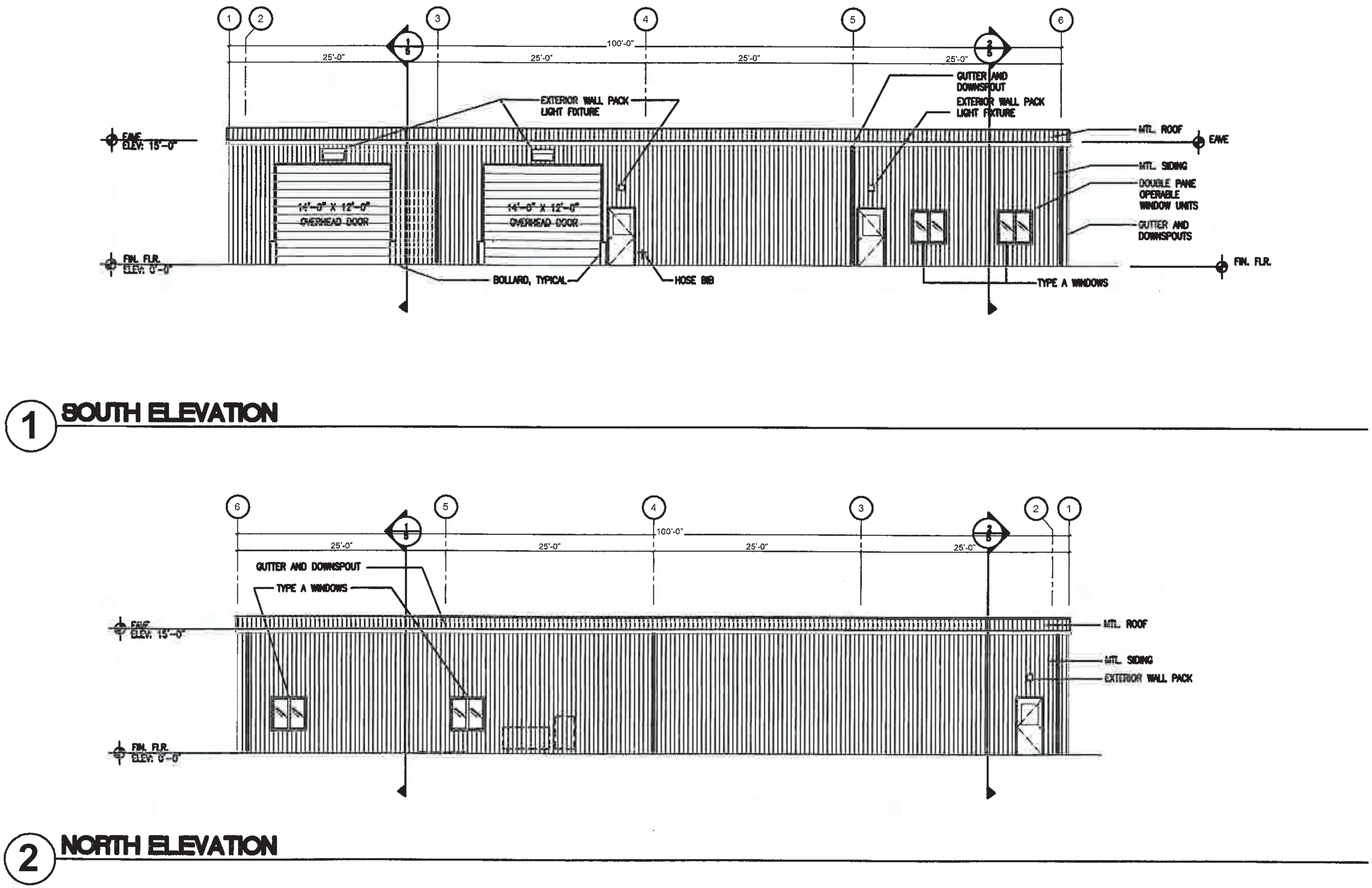
Typical Operations and Maintenance Facility Site

FIGURE 2.0-9a

Iberdrola | Tule Wind Project | Applicant's Environmental Document

HDR ONE COMPANY | *Many Solutions*℠

Source: Iberdrola, 2009 | G:/Projects\IberdrolaRenew_424914\TuleWindEnergy_115965\14_00_GIS_MODELS\14_02_Graphics\14_02_01_docs\Ltr_Landscp_master.ai | Last Updated : 12-24-2009

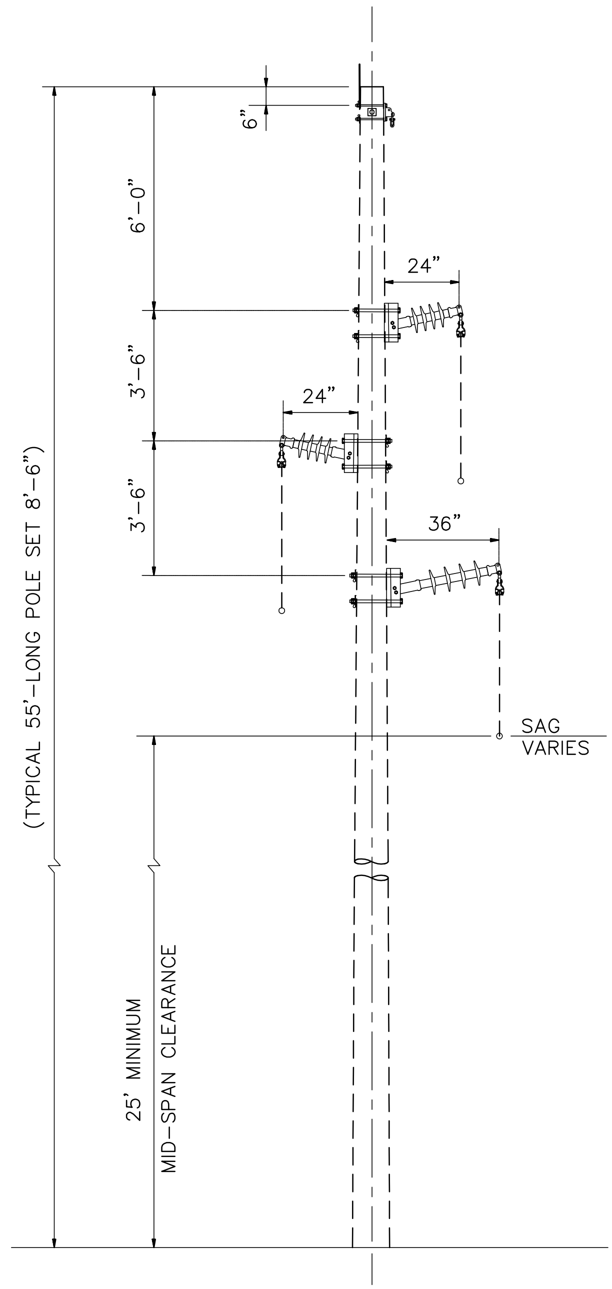


Typical Operations and Maintenance Facility Elevations

FIGURE 2.0-9b

Iberdrola | Tule Wind Project | Applicant's Environmental Document

HDR ONE COMPANY | Many Solutions℠



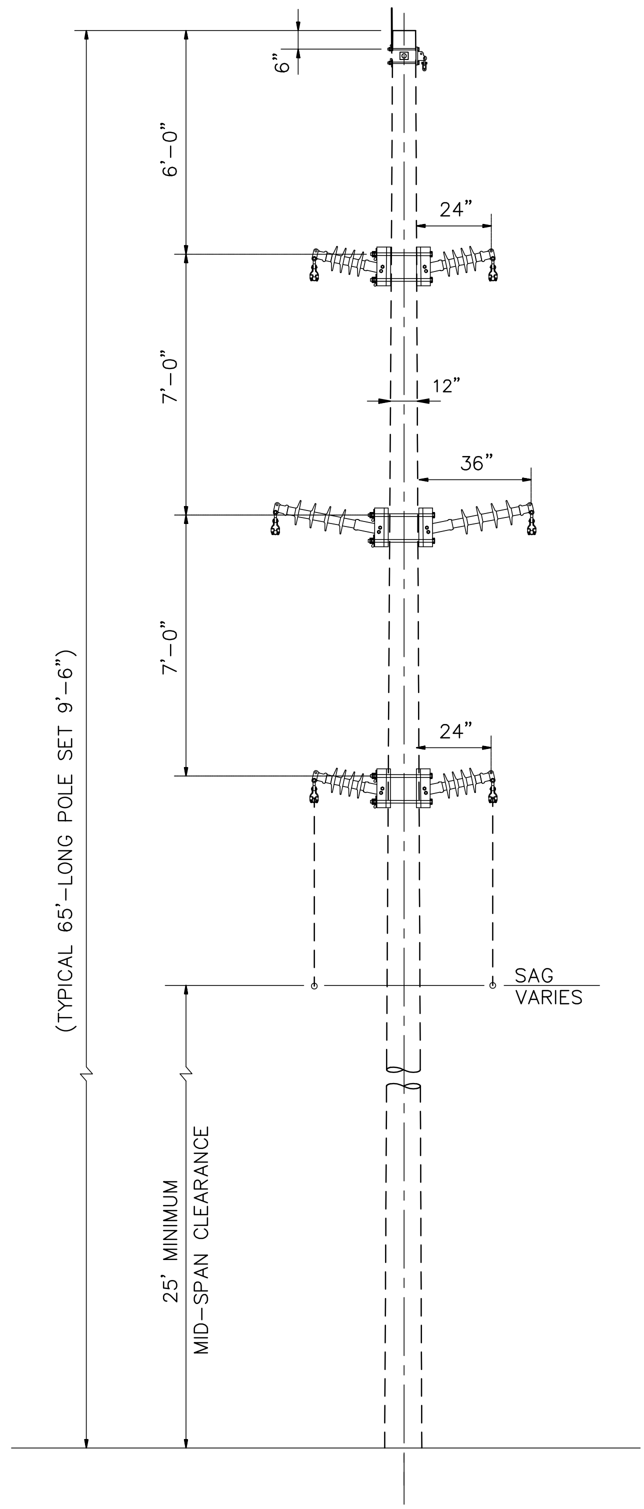
DESIGN ASSUMPTIONS:

- 1590 KCMIL "COREOPSIS" AAC
- 280' MAX SPAN

NOTES:

1. STRUCTURE DIMENSIONS ARE APPROXIMATE. ACTUAL DIMENSIONS MAY VARY.
2. DIMENSIONS ARE TO ATTACHMENT HOLES.
3. DRAWING IS NOT TO EXACT SCALE

IBERDROLA TULE WIND PROJECT	TYPICAL 34.5-KV HORIZONTAL LINE POST TANGENT SINGLE-CIRCUIT CONFIGURATION			
TriAxis Engineering, Inc.	DSGN MCF	DR JHR	DATE FEB 2010	FIG 1



DESIGN ASSUMPTIONS:

- 1590 KCMIL "COREOPSIS" AAC
- 280' MAX SPAN

NOTES:

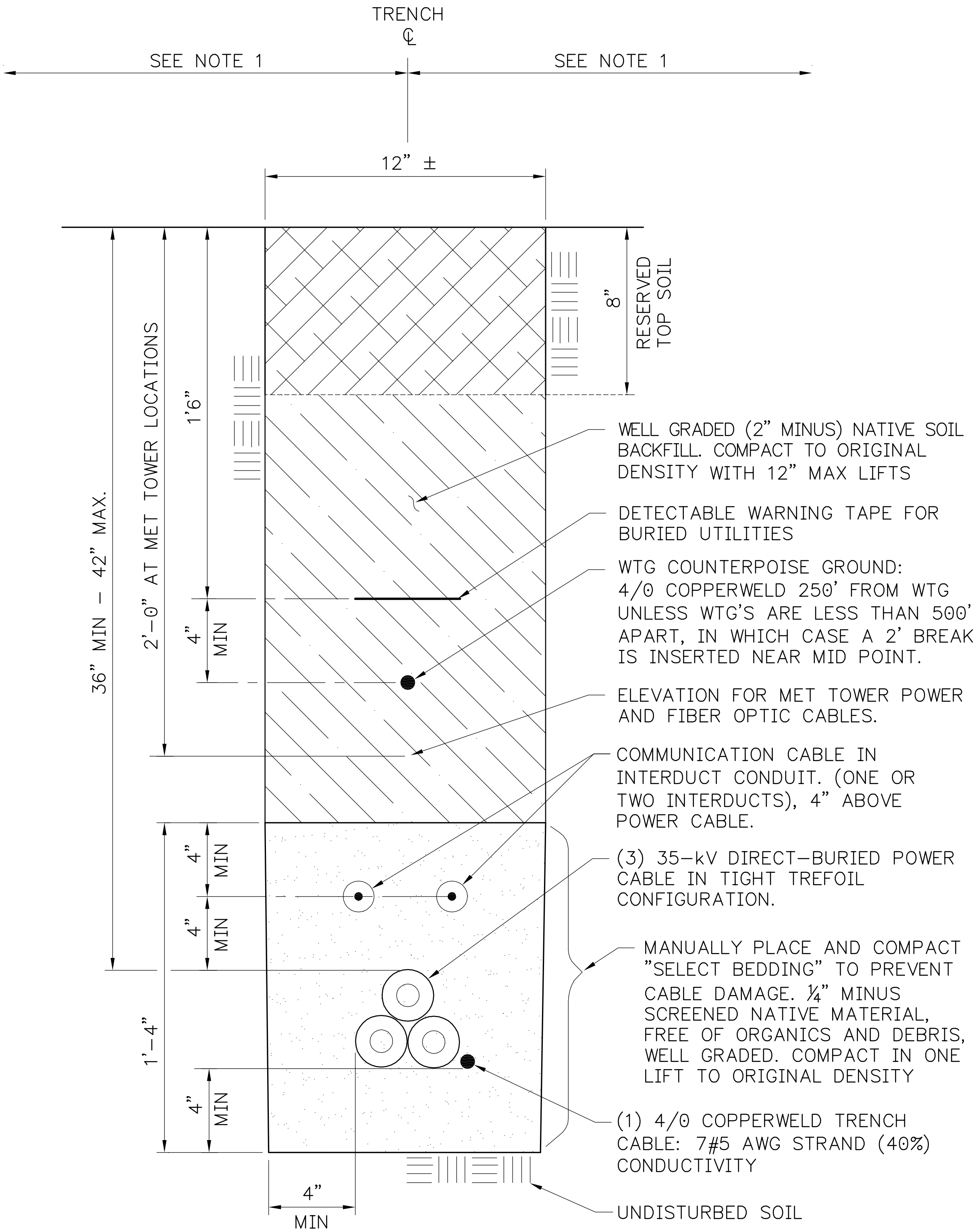
1. STRUCTURE DIMENSIONS ARE APPROXIMATE. ACTUAL DIMENSIONS MAY VARY.
2. DIMENSIONS ARE TO ATTACHMENT HOLES.
3. DRAWING IS NOT TO EXACT SCALE

IBERDROLA
TULE WIND
PROJECT

TriAxis Engineering, Inc.

TYPICAL
34.5-KV HORIZONTAL LINE POST
TANGENT DOUBLE-CIRCUIT CONFIGURATION

DSGN MCF	DR JHR	DATE FEB 2010	FIG 2



NOTES:

1. EACH 3-PHASE CABLE TRENCH SHALL BE SEPARATED FROM ALL OTHER CABLE TRENCHES BY 10'-6" MINIMUM, CENTERLINE-TO-CENTERLINE UNLESS OTHERWISE NOTED ON DRAWINGS.
2. ROCKS SHALL NOT COME IN CONTACT WITH CABLES.

IBERDROLA RENEWABLES TULE WIND PROJECT	FIGURE 2 DIRECT BURIED 34.5-KV UNDERGROUND CABLE TRENCH DETAIL	TriAxis Engineering, Inc.

APPENDIX B

County of San Diego Stormwater Intake Form for Development Projects

County of San Diego Stormwater Intake Form for Development Projects

County of San Diego

STORMWATER INTAKE FORM FOR DEVELOPMENT PROJECTS

This form must be completed in its entirety and accompany applications for any of the discretionary or ministerial permits and approvals referenced in Sections 67.803(c)(1) and 67.803(c)(2) of the County of San Diego Watershed Protection, Stormwater Management and Discharge Control Ordinance (WPO).

STEP 1: IDENTIFY RELEVANT PROJECT INFORMATION

Applicant Name: Andrew Linehan		Contact Information: Jeffrey Durocher
Project Address: Multiple Properties	APN(s): See APN list	Permit Application #:

STEP 2: DETERMINE PRIORITY DEVELOPMENT PROJECT STATUS

WPO Section 67.802(w) defines the criteria for determining whether your project is considered a Priority Development Project (PDP). If you answer "Yes" to any of the questions below, your project is a PDP subject to review and approval of a Major Stormwater Management Plan (SWMP). If you answer "No" to all of the questions below, your project is subject to review and approval of a Minor SWMP.

1. *Residential subdivision of 10 or more dwelling units (Single-family, Multi-family, Condo, or Apartment Complex) ...... Yes No*
2. *Commercial development that includes development of land area greater than one (1) acre .... Yes No*
3. *Industrial development greater than one (1) acre .... Yes No*
4. *Automotive repair shop .... Yes No*
5. *Restaurant or restaurant facilities with an area of development of 5,000 square feet or greater .... Yes No*
6. *On a steep hillside (>25% natural slope) <u>AND</u> proposes 5,000 square feet of impervious surface or more, or includes grading of any natural slope >25%* [(1)] *.................................... Yes No*
7. *Located within 200 feet of an Environmentally Sensitive Area <u>AND</u> creates 2,500 square feet or more of impervious surface or increases the area of imperviousness of a site to more than 10% of its naturally occurring condition* [(1)] [(2)] *...... Yes No*
8. *A parking lot that is 5,000 square feet or greater <u>OR</u> proposes at least 15 new parking stalls .... Yes No*
9. *Streets or roads that create a new paved surface that is 5,000 square feet or greater .... Yes No*
10. *Retail gasoline outlet .... Yes No*

[(1)] In lieu of a Major SWMP, Ministerial Permit Applications for residential dwellings/additions on an existing legal lot answering "Yes" may be able to utilize the Minor Stormwater Management Plan upon approval of a county official. Please note that upon further analysis, staff may determine that a Major SWMP will be required.
[(2)] A County technician will assist you in determining whether your project is located within 200 feet of an Environmentally Sensitive Area.

STOP **If you answered "Yes" to any of the questions, please complete a Major SWMP for your project.**
Instructions and an example of the form can be downloaded from http://www.co.san-diego.ca.us/dpw/watersheds/land_dev/susmp.html

If you answered "NO" to all of the questions above, please complete a Minor SWMP for your project.
Instructions and an example of the form can be downloaded from http://www.sdcounty.ca.gov/dplu/docs/LUEG-SW.pdf

STEP 3: SIGN AND DATE THE CERTIFICATION

<u>APPLICANT CERTIFICATION</u>: I have read and understand that the County of San Diego has adopted minimum requirements for managing urban runoff, including stormwater, from construction and land development activities. I certify that this intake form has been completed to the best of my ability and accurately reflects the project being proposed. I also understand that non-compliance with the County's WPO and Grading Ordinance may result in enforcement by the County, including fines, cease and desist orders, or other actions.

Applicant : *Date:*

APPENDIX C

County of San Diego Storm Water Management Plan for Priority Projects (Major SWMP) Form

County of San Diego Major SWMP Form

Major Stormwater Management Plan
(Major SWMP)
For
Tule Wind Project
MUP 3300-09-019

Preparation/Revision Date: September 2010

Prepared for:

Iberdrola Renewables, Inc.
1125 Northwest Couch, Suite 700
Portland, OR 97209

Prepared by:

Brinton Swift, P.E.
HDR Engineering
8690 Balboa Avenue, Suite 200
San Diego, CA 92123
Telephone: 858-712-8335

The selection, sizing, and preliminary design of stormwater treatment and other control measures in this plan have been prepared under the direction of the following Registered Civil Engineer and meet the requirements of Regional Water Quality Control Board Order R9-2007-0001 and subsequent amendments.

Name, RCE # Date

The Major Stormwater Management Plan (Major SWMP) must be completed in its entirety and accompany applications to the County for a permit or approval associated with certain types of development projects. To determine whether your project is required to submit a Major or Minor SWMP, please reference the County's Stormwater Intake Form for Development Projects.

Project Name:	Tule Wind Project
Project Location:	
Permit Number (Land Development Projects):	MUP 3300-09-019
Work Authorization Number (**CIP only**):	
Applicant:	Iberdrola Renewables, Inc.
Applicant's Address:	Portland,OR
Plan Prepared By (*Leave blank if same as applicant*):	HDR Engineering
Preparer's Address:	San Diego, CA
Date:	May, 2010

The County of San Diego Watershed Protection, Storm Water Management, and Discharge Control Ordinance (WPO) (Ordinance No. 9926) requires all applications for a permit or approval associated with a Land Disturbance Activity to be accompanied by a Storm Water Management Plan (SWMP) (section 67.806.b). The purpose of the SWMP is to describe how the project will minimize the short and long-term impacts on receiving water quality. Projects that meet the criteria for a priority development project are required to prepare a Major SWMP.

Since the SWMP is a living document, revisions may be necessary during various stages of approval by the County. Please provide the approval information requested below.

Project Stages	Does the SWMP need revisions?		If YES, Provide Revision Date
	YES	NO	

Instructions for a Major SWMP can be downloaded at http://www.sdcounty.ca.gov/dpw/watersheds/susmp/susmp.html

Completion of the following checklists and attachments will fulfill the requirements of a Major SWMP for the project listed above.

STEP 1

PRIORITY DEVELOPMENT PROJECT DETERMINATION

TABLE 1: IS THE PROJECT IN ANY OF THESE CATEGORIES?

Yes ❑	No ☑	A	Housing subdivisions of 10 or more dwelling units. Examples: single-family homes, multi-family homes, condominiums, and apartments.
Yes ☑	No ❑	B	Commercial—greater than one acre. Any development other than heavy industry or residential. Examples: hospitals; laboratories and other medical facilities; educational institutions; recreational facilities; municipal facilities; commercial nurseries; multi-apartment buildings; car wash facilities; mini-malls and other business complexes; shopping malls; hotels; office buildings; public warehouses; automotive dealerships; airfields; and other light industrial facilities.
Yes ❑	No ☑	C	Heavy industry—greater than one acre. Examples: manufacturing plants, food processing plants, metal working facilities, printing plants, and fleet storage areas (bus, truck, etc.).
Yes ❑	No ☑	D	Automotive repair shops. A facility categorized in any one of Standard Industrial Classification (SIC) codes 5013, 5014, 5541, 7532-7534, or 7536-7539.
Yes ❑	No ☑	E	Restaurants. Any facility that sells prepared foods and drinks for consumption, including stationary lunch counters and refreshment stands selling prepared foods and drinks for immediate consumption (SIC code 5812), where the land area for development is greater than 5,000 square feet. Restaurants where land development is less than 5,000 square feet shall meet all SUSMP requirements except for structural treatment BMP and numeric sizing criteria requirements and hydromodification requirements.
Yes ☑	No ❑	F	Hillside development greater than 5,000 square feet. Any development that creates 5,000 square feet of impervious surface and is located in an area with known erosive soil conditions, where the development will grade on any natural slope that is twenty-five percent or greater.
Yes ❑	No ☑	G	Environmentally Sensitive Areas (ESAs). All development located within or directly adjacent to or discharging directly to an ESA (where discharges from the development or redevelopment will enter receiving waters within the ESA), which either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition. “Directly adjacent” means situated within 200 feet of the ESA. “Discharging directly to” means outflow from a drainage conveyance system that is composed entirely of flows from the subject development or redevelopment site, and not commingled with flows from adjacent lands.
Yes ❑	No ☑	H	Parking lots 5,000 square feet or more or with 15 or more parking spaces and potentially exposed to urban runoff.
Yes ❑	No ☑	I	Street, roads, highways, and freeways. Any paved surface that is 5,000 square feet or greater used for the transportation of automobiles, trucks, motorcycles, and other vehicles.
Yes ❑	No ☑	J	Retail Gasoline Outlets (RGOs) that are: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.

To use the table, review each definition A through K. If any of the definitions match, the project is a Priority Development Project. Note some thresholds are defined by square footage of impervious area created; others by the total area of the development. Please see special requirements for previously developed sites and project exemptions on page 6 of the County SUSMP.

STEP 2

PROJECT STORMWATER QUALITY DETERMINATION

Total Project Site Area ___1,982_______ (Acres)

Estimated amount of disturbed acreage: ____127____ (Acres)
(If >1 acre, you must also provide a WDID number from the SWRCB) WDID: ________

Complete A through C and the calculations below to determine the amount of impervious surface on your project before and after construction.

A. Total size of project site: ___77_______ (Acres)

B. Total impervious area (including roof tops) before construction ___0__ (Acres or ft^2)

C. Total impervious area (including roof tops) after construction ___0.54____(Acres)

Calculate percent impervious before construction: B/A = ___0_____%
Calculate percent impervious after construction: C/A = ____0.7____%

Please provide detailed descriptions regarding the following questions:

TABLE 2: PROJECT SPECIFIC STORMWATER ANALYSIS

1.	Please provide a brief description of the project.
The Tule Wind Project is a large project that proposes to develop a wind turbine "farm," for power generation, in the County of San Diego in the State of California. Portions of the project discussed in this report are limited to areas within private properties within the County of San Diego. A majority of the overall project will be developed on Bureau of Land Management (BLM) Federal land, outside the County of San Diego Planning Department jurisdiction. Project development proposed on County of San Diego regulated lands is located just north of Interstate 8 off Ribbonwood Road, approximately two and half miles northeast of the community of Boulevard, California. Given the rural nature of the Project area, only the western side of the site is bounded by a physical feature, Ribbonwood Road. Proposed development will include the construction of electrical generating wind turbines, access roads, power transmission lines, maintenance facilities, and all the associated additional appurtenances. See Tule Wind Project Storm Water Management Plan for further discussion of Project.	
2.	Describe the current and proposed zoning and land use designation.
Project areas and surrounding areas are zoned general agricultural and general rural. Existing land use and surrounding land use is in line with the zoning, consisting of agricultural uses, scattered residential, scattered commercial, and open space. Future land use is envisioned to remain consistent with the existing zoning.	
3.	Describe the pre-project and post-project topography of the project. (Show on Plan)
Pre-project topography consists of steep mountainous areas with deep gullies and valleys, which convey stormwater runoff to flatter offsite areas. Existing slopes are primarily less than 15%, however, Project areas to include some slopes over 50%. Post-project topography will closely match pre-project topography. Access roads will be graded to match existing contours and transmission lines will not impact existing contours. Wind turbine pads, maintenance facility pads, and transformer sub-station pads will be the only areas graded flatter than existing slopes. These facilities have small localized footprints.	
4.	Describe the soil classification, permeability, erodibility, and depth to groundwater for LID and Treatment BMP consideration. (Show on Plan) If infiltration BMPs are proposed, a Geotechnical Engineer must certify infiltration BMPs in Attachment E.
All soil types A, B, C, and D are present on the Project. A majority of the site is vegetated with low level ground cover and low level bushes which stabilize the soil. Higher elevation portions of the Project consist of large rock formations. Existing wells in the vicinity of Rough Acres Ranch have the minimum observed depth to groundwater of 11-30 feet. In the event infiltrations BMPs are selected, further review of either existing or planned geotechnical studies will be completed to determine performance characteristics.	
5.	Describe if contaminated or hazardous soils are within the project area. (Show on Plan)
Based on the California Environmental Protection Agency identification program the McCain Valley Adult Conservation Camp located at 2550 McCain Valley Road is identified	

as containing a Leaking Underground Storage Tank (LUST). Storage tank contents were historically diesel. Contamination is listed as potential aquifer and generates hazardous waste. Contaminated soil is likely very small and is below the ground surface, isolated from contact with surface water runoff.	
6.	Describe the existing site drainage and natural hydrologic features. (Show on Plan).
Project areas are drained by three major drainage basins: • Tule Creek Basin – 18,250 acres • Southern Unnamed Wash Basin – 485 acres • Eastern Unnamed Wash Basin – 734 acres Tule Creek drains the majority of the Project site to the southeast into Tule Lake. Tule Lake empties into Carrizo Wash, which ultimately discharges into the Salton Sea. Two small northwestern portions of the Project site are drained by two unnamed tributaries to Carrizo Wash. The southern of the two unnamed washes discharges into Carrizo Wash 2.4 miles upstream of the eastern unnamed wash and approximately 10 miles downstream of Tule Lake. All basins have similar drainage patterns. Runoff sheet flows across the ground surface until it encounters rivulets which then discharge into larger streams which ultimately discharge into Tule Creek or Carrizo Wash. Precipitation that falls on existing access roads sheet flows off the side of the roads where it is either collected in swales running parallel to the road or continues to sheet flow across the natural terrain. Swales carry runoff to streams crossing the access road, where they are then conveyed to major drainage features. There are no major improvements to the drainage features within the basin. However, a number of culverts have been installed on portions of the Tule Creek Basin to facilitate the construction of access roads across the smaller drainage features. An unnamed tributary to Tule Creek along the northeastern edge of the Tule Creek Basin crosses a number of public and private roads via culverts just east of the landing strip. Several access roads utilize a depressed on grade type crossing, where flows are conveyed across the top of the road, rather than constructing culverts to carry flows under the road.	
7.	Describe site features and conditions that constrain, or provide opportunities for stormwater control, such as LID features.
Project development proposed little paved surfaces or impermeable site features. Any impervious area will drain to a surrounding impervious area prior to discharging into existing natural facilities. This provides an excellent opportunity for vegetated swales or buffers around all impervious features. There is also the opportunity to construct extended detention basins for the larger graded pads to address runoff rates and water quality. Some areas of the Project are located over soil type C and soil type D which makes natural infiltration options more difficult. Extensive rock outcropping throughout the Project could make extensive grading required for numerous detention facilities undesirable. Overall there will be excellent opportunities for use of vegetated swales and buffers to create impervious area disconnection and runoff treatment.	
8.	Is this project within the environmentally sensitive areas as defined on the maps in Appendix A of the *County of San Diego Standard Urban Storm Water Mitigation Plan for Land Development and Public Improvement Projects?*
Yes	**No**

9.	Is this an emergency project?
Yes	**No**

CHANNELS & DRAINAGES

Complete the following checklist to determine if the project includes work in channels.

TABLE 3: PROJECT SPECIFIC STORMWATER ANALYSIS

No.	CRITERIA	YES	NO	N/A	COMMENTS
1.	Will the project include work in channels?	X			If YES go to 2 If NO go to 13.
2.	Will the project increase velocity or volume of downstream flow?		X		If YES go to 6.
3.	Will the project discharge to unlined channels?	X			If YES go to. 6.
4.	Will the project increase potential sediment load of downstream flow?			X	If YES go to 6.
5.	Will the project encroach, cross, realign, or cause other hydraulic changes to a stream that may affect downstream channel stability?			X	If YES go to 8.
6.	Review channel lining materials and design for stream bank erosion.			X	Continue to 7.
7.	Consider channel erosion control measures within the project limits as well as downstream. Consider scour velocity.	X			Continue to 8.
8.	Include, where appropriate, energy dissipation devices at culverts.	X			Continue to 9.
9.	Ensure all transitions between culvert outlets/headwalls/wingwalls and channels are smooth to reduce turbulence and scour.	X			Continue to 10.
10.	Include, if appropriate, detention facilities to reduce peak discharges.	X			Continue to 11.
11.	“Hardening“ natural downstream areas to prevent erosion is not an acceptable technique for protecting channel slopes, unless pre-development conditions are determined to be so erosive that hardening would be required even in the absence of the proposed development.			X	Continue to 12.
12.	Provide other design principles that are comparable and equally effective.			X	Continue to 13.

No.	CRITERIA	YES	NO	N/A	COMMENTS
13.	End				

TEMPORARY CONSTRUCTION BMPS

Please check the construction BMPs that may be implemented during construction of the project. The applicant will be responsible for the placement and maintenance of the BMPs incorporated into the final project design.

- ☑ Silt Fence
- ☑ Fiber Rolls
- ☐ Street Sweeping and Vacuuming
- ☐ Storm Drain Inlet Protection
- ☑ Stockpile Management
- ☑ Solid Waste Management
- ☑ Stabilized Construction Entrance/Exit
- ☐ Dewatering Operations
- ☑ Vehicle and Equipment Maintenance
- ☑ Desilting Basin
- ☑ Gravel Bag Berm
- ☑ Sandbag Barrier
- ☑ Material Delivery and Storage
- ☑ Spill Prevention and Control
- ☑ Concrete Waste Management
- ☑ Water Conservation Practices
- ☐ Paving and Grinding Operations
- ☑ Any minor slopes created incidental to construction and not subject to a major or minor grading permit shall be protected by covering with plastic or tarp prior to a rain event, and shall have vegetative cover reestablished within 180 days of completion of the slope and prior to final building approval.

EXCEPTIONAL THREAT TO WATER QUALITY DETERMINATION

Complete the checklist below to determine if a proposed project will pose an "exceptional threat to water quality," and therefore require Advanced Treatment Best Management Practices during the construction phase.

TABLE 4: EXCEPTIONAL THREAT TO WATER QUALITY DETERMINATION

No.	CRITERIA	YES	NO	INFORMATION
1.	Is all or part of the proposed project site within 200 feet of waters named on the Clean Water Act (CWA) Section 303(d) list of Water Quality Limited Segments as impaired for sedimentation and/or turbidity? Current 303d list may be obtained from the following site: http://www.swrcb.ca.gov/tmdl/docs/303dlists2006/approved/r9_06_303d_reqtmdls.pdf		X	If YES, continue to 2. If NO, go to 5.
2.	Will the project disturb more than 5 acres, including all phases of the development?			If YES, continue to 3. If NO, go to 5.
3.	Will the project disturb slopes that are steeper than 4:1 (horizontal: vertical) with at least 10 feet of relief, and that drain toward the 303(d) listed receiving water for sedimentation and/or turbidity?			If YES, continue to 4. If NO, go to 5.
4.	Will the project disturb soils with a predominance of USDA-NRCS Erosion factors k_f greater than or equal to 0.4?			If YES, continue to 6. If NO, go to 5.
5.	Project is not required to use Advanced Treatment BMPs.			Document for Project Files by referencing this checklist.
6.	Project poses an "exceptional threat to water quality" and is required to use Advanced Treatment BMPs.			Advanced Treatment BMPs must be consistent with WPO section 67.811(b)(20)(D) performance criteria

Exemption potentially available for projects that require advanced treatment: Project proponent may perform a Revised Universal Soil Loss Equation, Version 2 (RUSLE 2), Modified Universal Soil Loss Equation (MUSLE), or similar analysis that shows to the County official's satisfaction that advanced treatment is not required

STEP 3

HYDROMODIFICATION DETERMINATION

The following questions provide a guide to collecting information relevant to hydromodification management issues.

TABLE 5: HYDROMODIFICATION DETERMINATION

	QUESTIONS	YES	NO	Information
1.	Will the proposed project disturb 50 or more acres of land? (Including all phases of development)	X		If YES, continue to 2. If NO, go to 6.
2.	Would the project site discharge directly into channels that are concrete-lined or significantly hardened such as with rip-rap, sackcrete, etc, downstream to their outfall into bays or the ocean?		X	If NO, continue to 3. If YES, go to 6.
3.	Would the project site discharge directly into underground storm drains discharging directly to bays or the ocean?		X	If NO, continue to 4. If YES, go to 6.
4.	Would the project site discharge directly to a channel (lined or un-lined) and the combined impervious surfaces downstream from the project site to discharge at the ocean or bay are 70% or greater?		X	If NO, continue to 5. If YES, go to 6.
5.	Project is required to manage hydromodification impacts.		X	Hydromodification Management Required as described in Section 67.812 b(4) of the WPO.
6.	Project is not required to manage hydromodification impacts.	X		Hydromodification Exempt. Keep on file.

An exemption is potentially available for projects that are required (No. 5. in Table 5 above) to manage hydromodification impacts: The project proponent may conduct an independent geomorphic study to determine the project's full hydromodification impact. The study must incorporate sediment transport modeling across the range of geomorphically-significant flows and demonstrate to the County's satisfaction that the project flows and sediment reductions will not detrimentally affect the receiving water to qualify for the exemption.

STEP 4

POLLUTANTS OF CONCERN DETERMINATION

WATERSHED

Please check the watershed(s) for the project.

☐ San Juan 901	☐ Santa Margarita 902	☐ San Luis Rey 903	☐ Carlsbad 904
☐ San Dieguito 905	☐ Penasquitos 906	☐ San Diego 907	☐ Sweetwater 909
☐ Otay 910	☐ Tijuana 911	☐ Whitewater 719	☐ Clark 720
☐ West Salton 721	☑ Anza Borrego 722	☐ Imperial 723	

http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/index.shtml

HYDROLOGIC SUB-AREA NAME AND NUMBER(S)

Number	Name
722.71	Jacumba hydrologic sub area

http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/index.shtml

SURFACE WATERS that each project discharge point proposes to discharge to. List the impairments identified in Table 7.

SURFACE WATERS (river, creek, stream, etc.)	Hydrologic Unit Basin Number	Impairment(s) listed [303(d) listed waters or waters with established TMDLs]	Distance to Project
Tule Creek	722.71	None	0 mi
Carrizo Creek	722.71	None	4.2 mi

http://www.waterboards.ca.gov/water_issues/programs/tmdl/docs/303dlists2006/epa/r9_06_303d_reqtmdls.pdf

GROUND WATERS

Ground Waters	Hydrologic Unit Basin Number	MUN	AGR	IND	PROC	GWR	FRESH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
Anza-Borrego	722.00	X	X	X												

http://www.waterboards.ca.gov/sandiego/water_issues/programs/basin_plan/index.shtml

\+ Excepted from Municipal ● Existing Beneficial Use ○ Potential Beneficial Use

PROJECT ANTICIPATED AND POTENTIAL POLLUTANTS

Using Table 6, identify pollutants that are anticipated to be generated from the proposed priority project categories. Pollutants associated with any hazardous material sites that have been remediated or are not threatened by the proposed project are not considered a pollutant of concern.

TABLE 6: ANTICIPATED AND POTENTIAL POLLUTANTS GENERATED BY LAND USE TYPE

	General Pollutant Categories								
PDP Categories	Sediments	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P	X
Commercial Development 1 acre or greater	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Heavy industry /industrial development	X		X	X	X	X	X		
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	
Hillside Development >5,000 ft²	**X**	**X**			**X**	**X**	**X**		**X**
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Retail Gasoline Outlets			X	X	X	X	X		
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

PROJECT POLLUTANTS OF CONCERN SUMMARY TABLE

Please summarize the identified project pollutant of concern by checking the appropriate boxes in the table below and list any surface water impairments identified. Pollutants anticipated to be generated by the project, which are also causing impairment of receiving waters, shall be considered the primary pollutants of concern. For projects where no primary pollutants of concern exist, those pollutants identified as anticipated shall be considered secondary pollutants of concern.

TABLE 7: PROJECT POLLUTANTS OF CONCERN

Pollutant Category	Anticipated (X)	Potential (P)	Surface Water Impairments
Sediments	X	X	None
Nutrients	X	X	None
Heavy Metals	X	X	None
Organic Compounds		X	None
Trash & Debris	X		None
Oxygen Demanding Substances	X	X	None
Oil & Grease	X		None
Bacteria & Viruses		X	None
Pesticides	X	X	None

STEP 5

LID AND SITE DESIGN STRATEGIES

Each numbered item below is a Low Impact Development (LID) requirement of the WPO. Please check the box(s) under each number that best describes the LID BMP(s) and Site Design Strategies selected for this project.

TABLE 8: LID AND SITE DESIGN

1. Conserve natural Areas, Soils, and Vegetation
☑ Preserve well draining soils (Type A or B)
☑ Preserve Significant Trees
☑ Preserve critical (or problematic) areas such as floodplains, steep slopes, wetlands, and areas with erosive or unstable soil conditions
☐ Other. Description:
2. Minimize Disturbance to Natural Drainages
☐ Set-back development envelope from drainages
☑ Restrict heavy construction equipment access to planned green/open space areas
☐ Other. Description:
3. Minimize and Disconnect Impervious Surfaces (see 5)
☐ Clustered Lot Design
☑ Items checked in 5?
☐ Other. Description:
4. Minimize Soil Compaction
☑ Restrict heavy construction equipment access to planned green/open space areas
☐ Re-till soils compacted by construction vehicles/equipment
☐ Collect & re-use upper soil layers of development site containing organic Materials
☐ Other. Description:
5. Drain Runoff from Impervious Surfaces to Pervious Areas
LID Street & Road Design
☑ Curb-cuts to landscaping
☑ Rural Swales
☐ Concave Median
☐ Cul-de-sac Landscaping Design
☑ Other. Description: Nearly all roads will be gravel
LID Parking Lot Design
☑ Permeable Pavements
☑ Curb-cuts to landscaping

	☐ Other. Description:
	LID Driveway, Sidewalk, Bike-path Design
	☑ Permeable Pavements
	☑ Pitch pavements toward landscaping
	☐ Other. Description:
	LID Building Design
	☐ Cisterns & Rain Barrels
	☑ Downspout to swale
	☐ Vegetated Roofs
	☐ Other. Description:
	LID Landscaping Design
	☐ Soil Amendments
	☑ Reuse of Native Soils
	☐ Smart Irrigation Systems
	☐ Street Trees
	☐ Other. Description:
6. Minimize erosion from slopes	
	☑ Disturb existing slopes only when necessary
	☑ Minimize cut and fill areas to reduce slope lengths
	☐ Incorporate retaining walls to reduce steepness of slopes or to shorten slopes
	☑ Provide benches or terraces on high cut and fill slopes to reduce concentration of flows
	☐ Rounding and shaping slopes to reduce concentrated flow
	☑ Collect concentrated flows in stabilized drains and channels
	☐ Other. Description:

STEP 6

SOURCE CONTROL

Please complete the checklist on the following pages to determine Source Control BMPs. Below is instruction on how to use the checklist. (Also see instructions on page 40 of the *SUSMP)*

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.

2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your Source Control Exhibit in Attachment B.

3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in a table in your Project-Specific SUSMP.

Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternatives.

Project development will incorporate the source control BMPs for indoor and structural pest control, outdoor pesticide use, refuse areas, and roofing, gutter, and trim material selection. Parking areas will be constructed of permeable gravel materials and as such will not be swept as listed in the County of San Diego SUSMP. All materials will be stored inside operation and maintenance facilities. No external storage areas are proposed. All other source control features identified in the County of San Diego SUSMP are considered for Project development. Refer to accompanying SWMP for more details on source control BMPs.

Use the format in Table 9 below to summarize the project Source Control BMPs. Incorporate all identified Source Control BMPs in your Source Control Exhibit in Attachment B.

TABLE 9: PROJECT SOURCE CONTROL BMPS

Potential source of runoff pollutants	*Permanent source control BMPs*	*Operational source control BMPs*
B. Interior floor drains	Interior floor drains will be plumbed to the sanitary sewer	Interior floor drains will be inspected and maintained to prevent blockage and overflow
D1. Need for future indoor and structural pest control	Building design features that discourage entrance of pests	Provide integrated pest management practice information to building owners and operators
D2. Landscape/Outdoor Pesticide Use	Native trees, shrubs, and ground cover will be preserved to the maximum extent practicable. Any landscaping will be designed	Landscaping will be maintained with minimum or no pestecides.

	to minimize runoff, promote surface infiltration, and minimize the use of fertilizers. Where landscaping is used to retain or detain stormwater, plants that are tolerant of saturated conditions will be used. Pest resistant plants will be used to the maximum extent practicable. Plants will be selected that are appropriate for site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions	
G. Refuse areas	Refuse containers will either be contained indoors or will include a covered facility or trash receptacle lids to prevent runon or runoff. Signs will be posted on the receptacles stating “Do Not Dump Hazardous Materials Here” or similar.	The following practices will be implemented : Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post “no hazardous materials” signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site.
O. Roofing, gutters, and trim	Roofing, gutter, and trim will avoid use of copper or other unprotected metals.	
P. Parking lots		Parking lots will be constructed of permeable gravel materials and as such will not be swept.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on Source Control Exhibit, Attachment B	3 Permanent Controls—List in SUSMP Table and Narrative	4 Operational BMPs—Include in SUSMP Table and Narrative
❑ A. **On-site storm drain inlets**	❑ **Locations of inlets.**	❑ **Mark all inlets with the words "No Dumping! Flows to Bay" or similar.**	❑ **Maintain and periodically repaint or replace inlet markings.** ❑ **Provide stormwater pollution prevention information to new site owners, lessees, or operators.** ❑ **See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** ❑ **Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."**
☑ B. **Interior floor drains and elevator shaft sump pumps**		☑ **State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.**	☑ **Inspect and maintain drains to prevent blockages and overflow.**
❑ C. **Interior parking garages**		❑ **State that parking garage floor drains will be plumbed to the sanitary sewer.**	❑ **Inspect and maintain drains to prevent blockages and overflow.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on Source Control Exhibit, Attachment B	3 Permanent Controls—List in SUSMP Table and Narrative	4 Operational BMPs—Include in SUSMP Table and Narrative
☑ D1. **Need for future indoor & structural pest control**		☑ **Note building design features that discourage entry of pests.**	☑ **Provide Integrated Pest Management information to owners, lessees, and operators.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on Source Control Exhibit, Attachment B	3 Permanent Controls—List in SUSMP Table and Narrative	4 Operational BMPs—Include in SUSMP Table and Narrative
☑ D2. **Landscape/ Outdoor Pesticide Use** **<u>Note: Should be consistent with project landscape plan (if applicable).</u>**	☑ **Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained.** ❑ **Show self-retaining landscape areas, if any.** ❑ **Show stormwater treatment facilities.**	**State that final landscape plans will accomplish all of the following:** ☑ **Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.** ☑ **Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.** ☑ **Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.** ☑ **Consider using pest-resistant plants, especially adjacent to hardscape.** ☑ **To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.**	☑ **Maintain landscaping using minimum or no pesticides.** ☑ **See applicable operational BMPs in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at <u>www.cabmphandbooks.com</u>** ❑ **Provide IPM information to new owners, lessees and operators.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on Source Control Exhibit, Attachment B	3 Permanent Controls—List in SUSMP Table and Narrative	4 Operational BMPs—Include in SUSMP Table and Narrative
❑ E. **Pools, spas, ponds, decorative fountains, and other water features.**	❑ **Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet.**	❑ **If the local municipality requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.**	❑ **See applicable operational BMPs in Fact Sheet SC-72, "Fountain and Pool Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**
❑ F. **Food service**	❑ **For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment.** ❑ **On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.**	❑ **Describe the location and features of the designated cleaning area.** ❑ **Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.**	❑

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on Source Control Exhibit, Attachment B	3 Permanent Controls—List in SUSMP Table and Narrative	4 Operational BMPs—Include in SUSMP Table and Narrative
☑ G. **Refuse areas**	☑ **Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas.** ❑ **If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area.** ❑ **Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.**	☑ **State how site refuse will be handled and provide supporting detail to what is shown on plans.** ☑ **State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.**	❑ **State how the following will be implemented:** **Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**
❑ H. **Industrial processes.**	❑ **Show process area.**	❑ **If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."**	❑ **See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR STORMWATER CONTROL PLAN SHOULD INCLUDE THESE SOURCE CONTROL BMPs		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on Source Control Exhibit, Attachment B	3 Permanent Controls—List in SUSMP Table and Narrative	4 Operational BMPs—Include in SUSMP Table and Narrative
❑ I. **Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)**	❑ **Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area.** ❑ **Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults.** ❑ **Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.**	❑ **Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains.** **Where appropriate, reference documentation of compliance with the requirements of local Hazardous Materials Programs for:** ▪ **Hazardous Waste Generation** ▪ **Hazardous Materials Release Response and Inventory** ▪ **California Accidental Release (CalARP)** ▪ **Aboveground Storage Tank** ▪ **Uniform Fire Code Article 80 Section 103(b) & (c) 1991** ▪ **Underground Storage Tank**	❑ **See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

❑ J. Vehicle and Equipment Cleaning	❑ Show on drawings as appropriate: (1) Commercial/industrial facilities having vehicle /equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses. (2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use). (3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer. (4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.	❑ If a car wash area is not provided, describe measures taken to discourage on-site car washing and explain how these will be enforced.	Describe operational measures to implement the following (if applicable): ☑ Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system. ❑ Car dealerships and similar may rinse cars with water only. ❑ See Fact Sheet SC-21, "Vehicle and Equipment Cleaning," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com

❑ K. **Vehicle/Equipment Repair and Maintenance**	☑ **Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater.** ❑ **Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.** ☑ **Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.**	☑ **State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area.** ☑ **State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.** ☑ **State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.**	**In the SUSMP report, note that all of the following restrictions apply to use the site:** ☑ **No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains.** ☑ **No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.** ☑ **No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.**

❑ L. **Fuel Dispensing Areas**	❑ **Fueling areas[1] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.** ❑ **Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.**		❑ **The property owner shall dry sweep the fueling area routinely.** ❑ **See the Business Guide Sheet, "Automotive Service—Service Stations" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

[1] **The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.**

❑ M. **Loading Docks**	❑ **Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas should be drained to the sanitary sewer where feasible. Direct connections to storm drains from depressed loading docks are prohibited.** ❑ **Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.** ❑ **Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.**		❑ **Move loaded and unloaded items indoors as soon as possible.** ❑ **See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**
❑ N. **Fire Sprinkler Test Water**		❑ **Provide a means to drain fire sprinkler test water to the sanitary sewer.**	❑ **See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

O. **Miscellaneous Drain or Wash Water** ❑ **Boiler drain lines** ❑ **Condensate drain lines** ❑ **Rooftop equipment** ❑ **Drainage sumps** ☑ **Roofing, gutters, and trim.**		❑ **Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.** ❑ **Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.** ❑ **Rooftop mounted equipment with potential to produce pollutants shall be roofed and/or have secondary containment.** ❑ **Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.** ☑ **Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.**	
☑ P. **Plazas, sidewalks, and parking lots.**			❑ **Plazas, sidewalks, and parking lots shall be swept regularly to prevent the accumulation of litter and debris. Debris from pressure washing shall be collected to prevent entry into the storm drain system. Washwater containing any cleaning agent or degreaser shall be collected and discharged to the sanitary sewer and not discharged to a storm drain.**

STEP 7

LID AND TREATMENT CONTROL SELECTION

A treatment control BMP and/or LID facility must be selected to treat the project pollutants of concern identified in Table 7 "Project Pollutants of Concern". A treatment control facility with a high or medium pollutant removal efficiency for the project's most significant pollutant of concern shall be selected. It is recommended to use the design procedure in Chapter 4 of the SUSMP to meet NPDES permit LID requirements, treatment requirements, and flow control requirements. If your project does not utilize this approach, the project will need to demonstrate compliance with LID, treatment and flow control requirements. Review Chapter 2 "Selection of Stormwater Treatment Facilities" in the SUSMP to assist in determining the appropriate treatment facility for your project.

Will this project be utilizing the unified LID design procedure as described in Chapter 4 of the Local SUSMP? *(If yes, please document in Attachment D following the steps in Chapter 4 of the County SUSMP)*	
Yes	**No**
If this project is not utilizing the unified LID design procedure, please describe how the alternative treatment facilities will comply with applicable LID criteria, stormwater treatment criteria, and hydromodification management criteria.	
Based on discussions with County of San Diego Department of Public Works staff, the Project is not required to address SUSMP stormwater treatment criteria or hydromodification management criteria. However, Project development does not propose to increase impervious areas by significant amounts, with the majority of improvements being constructed of permeable materials. Every impervious area of the Project will drain to permeable surrounding surfaces prior to discharging to surrounding natural drainage features. There are no connected impervious conveyance facilities proposed for the Project. Stormwater treatement will be achieved through site design and source control as well as post-construction BMPs required by the Water Resources Control Board Order No. 2009-0009-DWQ General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities. Hydromodification will also be addressed at a later time by the State General Construction Permit.	

- Indicate the project pollutants of concern (POCs) from Table 7 in Column 2 below.

TABLE 10: GROUPING OF POTENTIAL POLLUTANTS of Concern (POCs) by fate during stormwater treatment

Pollutant	Check Project Specific POCs	Coarse Sediment and Trash	Pollutants that tend to associate with fine particles during treatment	Pollutants that tend to be dissolved following treatment
Sediment	X	X	X	
Nutrients			X	X
Heavy Metals			X	
Organic Compounds			X	
Trash & Debris	X	X		
Oxygen Demanding			X	
Bacteria			X	
Oil & Grease	X		X	
Pesticides			X	

➢ Indicate the treatment facility(s) chosen for this project in the following table.

TABLE 11: GROUPS OF POLLUTANTS and relative effectiveness of treatment facilities

Pollutants of Concern	Bioretention Facilities (LID)	Settling Basins (Dry Ponds)	Wet Ponds and Constructed Wetlands	Infiltration Facilities or Practices (LID)	Media Filters	Higher-rate biofilters*	Higher-rate media filters*	Trash Racks & Hydro -dynamic Devices	Vegetated Swales
Coarse Sediment and Trash	High	High	High	High	High	High	High	High	High
Pollutants that tend to associate with fine particles during treatment	High	High	High	High	High	Medium	Medium	Low	Medium
Pollutants that tend to be dissolved following treatment	Medium	Low	Medium	High	Low	Low	Low	Low	Low

➢ Please check the box(s) that best describes the Treatment BMP(s) and/or LID BMP selected for this project.

TABLE 12: PROJECT LID AND TC-BMPS

Bioretention Facilites (LID)
☐ Bioretention area
☐ Flow-through Planter
☐ Cistern with Bioretention Facility

Settling Basins (Dry Ponds)
☐ Extended/dry detention basin with grass/vegetated lining
☐ Extended/dry detention basin with impervious lining
Infiltration Facilities or Practices (LID)
☐ Infiltration basin
☐ Dry well
☐ Infiltration trench
Wet Ponds and Constructed Wetlands
☐ Wet pond/basin (permanent pool)
☐ Constructed wetland
Vegetated Swales (LID[1])
☐ Vegetated Swale
Media Filters
☐ Austin Sand Filter
☐ Delaware Sand Filter
☐ Multi-Chambered Treatment Train (MCTT)
Higher-rate Biofilters
☐ Tree-pit-style unit
☐ Other_______________________________________
Higher-rate Media Filters
☐ Vault-based filtration unit with replaceable cartridges
☐ Other_______________________________________
Hydrodynamic Separator Systems
☐ Swirl Concentrator
☐ Cyclone Separator
Trash Racks
☐ Catch Basin Insert
☐ Catch Basin Insert w/ Hydrocarbon boom
☐ Other_______________________________________
Self-Treating or Self-Retaining Areas (LID)
☐ Pervious Pavements
☐ Vegetated Roofs
☐ Other_______________________________________

(1) Must be designed per SUSMP "Vegetated Swales" design criteria for LID credit (p. 65).

For design guidelines and calculations refer to Chapter 4 "Low Impact Development Design Guide" in the SUSMP. Please show all calculations and design sheets for all treatment facilities proposed in Attachment D.

- Create a Construction Plan SWMP Checklist for your project.

Instructions on how to fill out table

1. Number and list each measure or BMP you have specified in your SWMP in Columns 1 and Maintenance Category in Column 3 of the table. Leave Column 2 blank.

2. When you submit construction plans, duplicate the table (by photocopy or electronically). Now fill in Column 2, identifying the plan sheets where the BMPs are shown. List all plan sheets on which the BMP appears. This table must be shown on the front sheet of the grading and improvement plans.

Stormwater Treatment Control and LID BMP's			
Description / Type	Sheet	Maintenance Category	Revisions

* BMP's approved as part of Stormwater Management Plan (SWMP) dated xx/xx/xx on file with DPW. Any changes to the above BMP's will require SWMP revision and Plan Change approvals.

- Please describe why the chosen treatment BMP(s) was selected for this project. For projects utilizing a low performing BMP, please provide a feasibility analysis that demonstrates utilization of a treatment facility with a high or medium removal efficiency ranking is infeasible.

Based on the locations of the project site, drainage patterns, site constraints, treatment efficiencies, maintenance concerns, the recommended treatment control devices are:

Runoff from the Project does not enter a Municipal Separate Storm Sewer System (MS4) and is outside of Phase I and Phase II NPDES permits for the Regional Water Quality Control Board. This Project is therefore not subject to the regulations of Order No. R9-2007-0001, which requires the use of Treatment Control BMPs to reduce pollutants to runoff from priority projects. As such Treatment Control BMPs are not required.

However, the State Water Resources Control Board Order No. 2009-0009-DWQ General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities applies to the Project and requires post-construction BMPs. These BMPs are intended to mitigate hydromodification impacts through a number of different alternatives quantified by a Water Balance Calculator. Project development will meet these requirements through the use of any number of vegetated swales, extended detention basins, or impervious area disconnection designed and discussed in the documentation

required for the State General Construction Permit. Site runoff will still be treated with LID site design and source control BMPs per the County of San Diego SUSMP.

A Treatment BMP must address runoff from developed areas. Please provide the post-construction water quality treatment volume or flow values for the selected project Treatment BMP(s). Guidelines for design calculations are located in Chapter 4 of the County SUSMP. Label outfalls on the BMP map. The Water Quality peak rate of discharge flow (Q_{WQ}) and the Water Quality storage volume (V_{WQ}) is dependent on the type of treatment BMP selected for the project.

Outfall	**Tributary Area (acres)**	**Q_{WQ} (cfs)**	**V_{WQ} (ft^3)**

STEP 8

OPERATION AND MAINTENANCE

➢ Please check the box that best describes the maintenance mechanism(s) for this project.

TABLE 13: PROJECT BMP CATEGORY

CATEGORY	SELECTED		BMP Description
	YES	**NO**	
First		X	
Second[1]		X	
Third[2]		X	
Fourth		X	

Note:

1. A recorded maintenance agreement will be required.
2. Project will be required to establish or be included in a Stormwater Maintenance Assessment District for the long-term maintenance of treatment BMPs.

➢ Please list all individual LID and Treatment Control BMPs (TC-BMPs) incorporated into project. Please ensure the "BMP Identifier" is consistent with the legend in Attachment C "LID and/or TC-BMP Exhibit". Please attach the record plan sheets upon completion of project and amend the Major SWMP where appropriate. For each type of LID or TC-BMP provide an inspection sheet in Attachment F "Maintenance Plan".

TABLE 14: PROJECT SPECIFIC LID AND TC-BMPS

BMP Identifier*	LID or TC-BMP Type	BMP Pollutant of Concern Efficiency (H,M,L) – Table 11	Final Construction Date *(to be completed by County inspector)*	Final Construction Inspector Name *(to be completed by County inspector)*

* For location of BMP's, see approved Record Plan dated _XX/XX/XX_, plan (TYPE) sheet _ (#) _.

- Responsible Party for Long-term Maintenance:

Identify the parties responsible for long-term maintenance of the BMPs identified above and Source Controls specified in Attachment B. Include the appropriate written agreement with the entities responsible for O&M in Attachment F. Please see Chapter 5 "Private Ownership and Maintenance" on page 94 of the County SUSMP for appropriate maintenance mechanisms.

Name:
Company Name: Iberdrola Renewables
Phone Number: 503-796-7781
Street Address: 1125 Northwest Couch Street, Suite 700
City/State/Zip: Portland, OR 97209
Email Address: Jeffrey.durocher@iberdrolausa.com

- Funding Source:

Provide the funding source or sources for long-term operation and maintenance of each BMP identified above. By certifying the Major SWMP the applicant is certifying that the funding responsibilities have been addressed and will be transferred to future owners.

Site design and source control BMPs are mainly self maintaining through normal vegetation cycles or require little to no maintenance. However, Iberdrola will be responsible for operation and maintenance of all BMPs on the Project site.

ATTACHMENTS

Please include the following attachments.

ATTACHMENT		COMPLETED	N/A
A	Project Location Map	X	
B	Source Control Exhibit	X	
C	LID and/or TC-BMP Exhibit	X	
D	Drainage Management Area (DMA) Maps, Sizing Design Calculations and BMP/IMP Design Details		X
E	Geotechnical Certification Sheet		X
F	Maintenance Plan		X
G	Tracking Report		X
H	Addendum		X

Note: Attachments B and C may be combined.

APPENDIX D
Project Exhibits

Exhibit A – Existing Conditions Drainage Map
Exhibit B – Proposed Conditions Drainage Map
Exhibit C – BMP Map

HDR ONE COMPANY | Many Solutions

Existing Conditions Drainage Map

EXHIBIT A

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Water Quality Study

HDR
ONE COMPANY | *Many Solutions*

Proposed Conditions Drainage Map

EXHIBIT B

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Water Quality Study

HDR ONE COMPANY | *Many Solutions*

BMP Map

EXHIBIT C

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Water Quality Study

APPENDIX E
Additional BMP Information

CASQA Site Design and Facility Design
CASQA Site Design and Landscape Planning
CASQA Vegetated Swale
CASQA Extended Detention Basin

Section 3
Site and Facility Design for Water Quality Protection

3.1 Introduction

Site and facility design for stormwater quality protection employs a multi-level strategy. The strategy consists of: 1) reducing or eliminating post-project runoff; 2) controlling sources of pollutants; and 3), if still needed after deploying 1) and 2), treating contaminated stormwater runoff before discharging it to the storm drain system or to receiving waters.

This section describes how elements 1), 2), and 3) of the strategy can be incorporated into the site and facility planning and design process, and by doing so, eliminating or reducing the amount of stormwater runoff that may require treatment at the point where stormwater runoff ultimately leaves the site. Elements 1) and 2) may be referred to as "source controls" because they emphasize reducing or eliminating pollutants in stormwater runoff at their source through runoff reduction and by keeping pollutants and stormwater segregated. Section 4 provides detailed descriptions of the BMPs related to elements 1) and 2) of the strategy. Element 3) of the strategy is referred to as "treatment control" because it utilizes treatment mechanisms to remove pollutants that have entered stormwater runoff. Section 5 provides detailed descriptions of BMPs related to element 3) of the strategy. Treatment controls integrated into and throughout the site usually provide enhanced benefits over the same or similar controls deployed only at the "end of the pipe" where runoff leaves the project site.

3.2 Integration of BMPs into Common Site Features

Many common site features can achieve stormwater management goals by incorporating one or more basic elements, either alone or in combination, depending on site and other conditions. The basic elements include infiltration, retention/detention, biofilters, and structural controls. This section first describes these basic elements, and then describes how these elements can be incorporated into common site features.

Infiltration

Infiltration is the process where water enters the ground and moves downward through the unsaturated soil zone. Infiltration is ideal for management and conservation of runoff because it filters pollutants through the soil and restores natural flows to groundwater and downstream water bodies. See Figure 3-1.

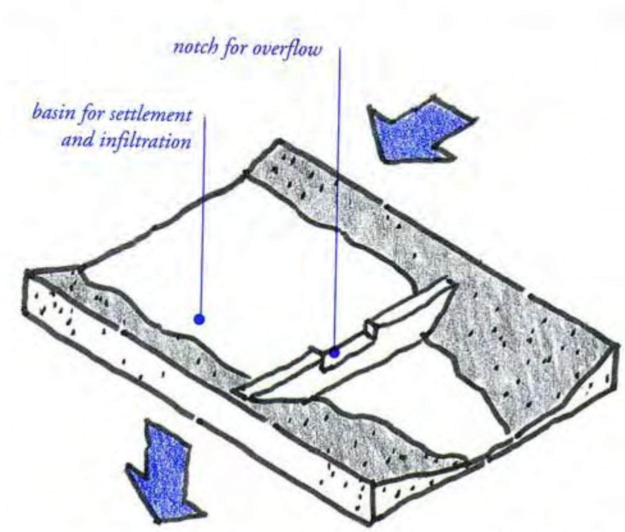


Figure 3-1
Infiltration Basin

The infiltration approach to stormwater management seeks to "preserve and restore the hydrologic cycle." An infiltration stormwater system seeks to infiltrate runoff into the soil by allowing it to flow slowly over permeable surfaces. The slow flow of runoff allows pollutants to settle into the soil where they are naturally mitigated. The reduced volume of runoff that remains takes a long time to reach the outfall, and when it empties into a natural water body or storm sewer, its pollutant load is greatly reduced.

Infiltration basins can be either open or closed. Open infiltration basins, include ponds, swales and other landscape features, are usually vegetated to maintain the porosity of the soil structure and to reduce erosion. Closed infiltration basins can be constructed under the land surface with open graded crushed stone, leaving the surface to be used for parking or other uses. Subsurface closed basins are generally more difficult to maintain and more expensive than open filtration systems, and are used primarily where high land costs demand that the land surface be reclaimed for economic use.

Infiltration systems are often designed to capture the "first flush" storm event and used in combination with a detention basin to control peak hydraulic flows. They effectively remove suspended solids, particulates, bacteria, organics and soluble metals and nutrients through the vehicle of filtration, absorption and microbial decomposition. Groundwater contamination should be considered as a potential adverse effect and should be considered where shallow groundwater is a source of drinking water. In cases where groundwater sources are deep, there is a very low chance of contamination from normal concentrations of typical urban runoff.

Retention and Detention

Retention and detention systems differ from infiltration systems primarily in intent. Detention systems are designed to capture and retain runoff temporarily and release it to receiving waters at predevelopment flow rates. Permanent pools of water are not held between storm events. Pollutants settle out and are removed from the water column through physical processes. See Figure 3-2.

Retention systems capture runoff and retain it between storms as shown in Figure 3-3. Water held in the system is displaced by the next significant rainfall event. Pollutants settle out and are thereby removed from the water column. Because the water remains in the system for a period of time, retention systems benefit from biological and biochemical removal mechanisms provided by aquatic plants and microorganisms. See Figure 3-3.

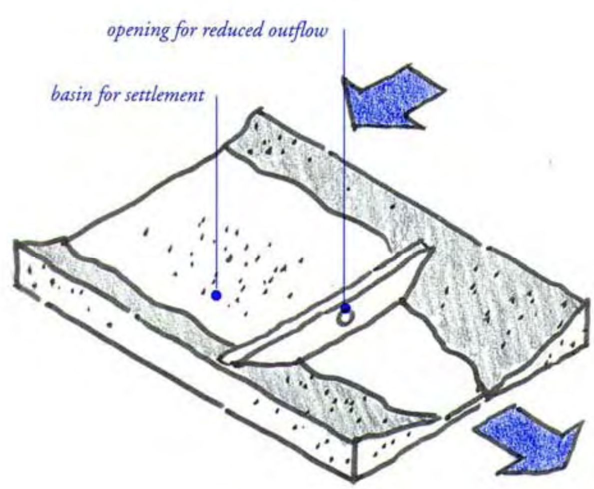


Figure 3-2
Simple Detention System

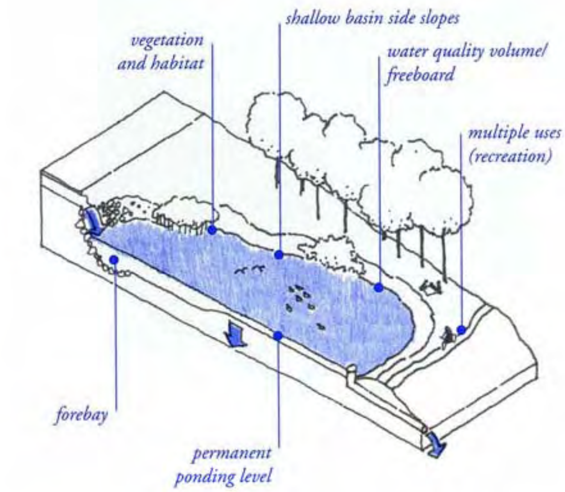


Figure 3-3
Retention System

Retention/detention systems may release runoff slowly enough to reduce downstream peak flows to their pre-development levels, allow fine sediments to settle, and uptake dissolved nutrients in the runoff where wetland vegetation is included.

Bioretention facilities have the added benefit of aesthetic appeal. These systems can be placed in parking lot islands, landscaped areas surrounding buildings, perimeter parking lots, and other open space sections. Placing bioretention facilities on land that city regulations require developers to devote to open space efficiently uses the land. An experienced landscape architect can choose plant species and planting materials that are easy to maintain, aesthetically pleasing, and capable of effectively reducing pollutants in runoff from the site.

Constructed wetland systems retain and release stormwater in a manner that is similar to retention or detention basins. The design mimics natural ecological functions and uses wetland vegetation to filter pollutants. The system needs a permanent water source to function properly and must be engineered to remove coarse sediment, especially construction related sediments, from entering the pond. Stormwater has the potential to negatively affect natural wetland functions and constructed wetlands can be used to buffer sensitive resources.

Biofilters

Biofilters, also known as vegetated swales and filter strips, are vegetated slopes and channels designed and maintained to transport shallow depths of runoff slowly over vegetation. Biofilters are effective if flows are slow and depths are shallow (3% slope max.). The slow movement of runoff through the vegetation provides an opportunity for sediments and particulates to be filtered and degraded through biological activity. In most soils, the biofilter also provides an opportunity for stormwater infiltration, which further removes pollutants and reduces runoff volumes. See Figure 3-4.

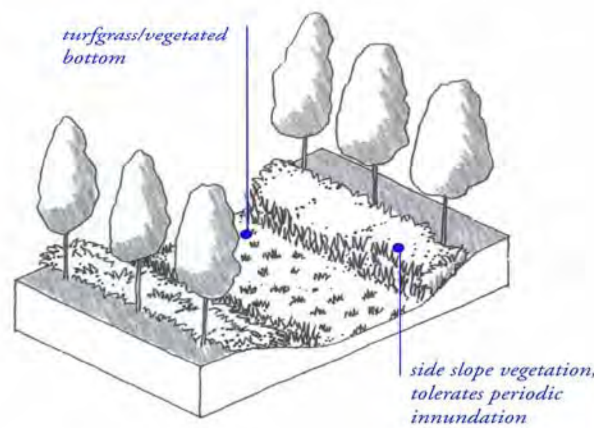


Figure 3-4
Vegetated Swale

Swales intercept both sheet and concentrated flows and convey these flows in a concentrated, vegetation-lined channel. Grass filter strips intercept sheet runoff from the impervious network of streets, parking lots, and rooftops and divert stormwater to a uniformly graded meadow, buffer zone, or small forest. Typically, the vegetated swale and grass strip-planting palette can comprise a wide range of possibilities from dense vegetation to turf grass. Grass strips and vegetated swales can function as pretreatment systems for water entering bioretention systems or other BMPs. If biofilters are to succeed in filtering pollutants from the water column, the planting design must consider the hydrology, soils, and maintenance requirements of the site.

Appropriate plantings not only improve water quality, they provide habitat and aesthetic benefits. Selected plant materials must be able to adapt to variable moisture regimes. Turf grass is acceptable if it can be watered in the dry season, and if it is not inundated for long periods. Species such as willows, dogwoods, sedge, rush, lilies, and bulrush tolerate varying degrees of soil moisture and can provide an attractive plant palette year round.

Structural Controls

Structural controls in the context of this section include a range of measures that prevent pollutants from coming into contact with stormwater. In this context, these measures may be referred to as "structural source controls" meaning that they utilize structural features to prevent pollutant sources and stormwater from coming into contact with one another, thus reducing the opportunity for stormwater to become contaminated. Examples of structural source controls include covers, impermeable surfaces, secondary containment facilities, runoff diversion berms, and diversions to wastewater treatment plants.

3.2.1 Streets

More than any other single element, street design has a powerful impact on stormwater quality. Street and other transportation-related structures typically can comprise between 60 and 70% of the total impervious coverage in urban areas and, unlike rooftops, streets are almost always directly connected to an underground stormwater system.

Recognizing that street design can be the greatest factor in development's impact on stormwater quality, it is important that designers, municipalities and developers employ street standards that reduce impervious land coverage. Directing runoff to biofilters or swales rather than underground storm drains produces a street system that conveys stormwater efficiently while providing both water quality and aesthetic benefits.

On streets where a more urban character is desired, or where a rigid pavement edge is required, curb and gutter systems can be designed to empty into drainage swales. These swales can run parallel to the street, in the parkway between the curb and the sidewalk, or can intersect the street at cross-angles, and run between residences, depending on topography or site planning. Runoff travels along the gutter, but instead of being emptied into a catch basin and underground pipe, multiple openings in the curb direct runoff into surface swales or infiltration/detention basins.

In recent years, new street standards have been gaining acceptance that meets the access requirements of local residential streets while reducing impervious land coverage. These standards create a new class of street that is narrower and more interconnected than the current local street standard, called an "access" street. An access street is at the lowest end of the street hierarchy and is intended only to provide access to a limited number of residences.

Street design is usually mandated by local municipal standards. Officials must consider the scale of the land use as they select stormwater and water quality design solutions. Traffic volume and speeds, bicycle lane design criteria, and residential and business densities influence the willingness of decision makers to permit the narrow streets that include curbless design alternatives.

Emergency service providers often raise objections to reduced street widths. Street designs illustrated here meet national Fire Code standards for emergency access. An interconnected grid system of narrow streets also allows emergency service providers with multiple access routes to compensate for the unlikely possibility that a street may be blocked.

Many municipal street standards mandate 80 to 100% impervious land coverage in the public right-of-way, and are a principal contributor to the environmental degradation caused by development.

A street standard that allows an interconnected system of narrow access streets for residential neighborhoods has the potential to achieve several complimentary environmental and social benefits. A hierarchy of streets sized according to average daily traffic volumes yields a wide variety of benefits: improved safety from lower speeds and volumes, improved aesthetics from street trees and green parkways, reduced impervious land coverage, less heat island effect, and lower development costs. If the reduction in street width is accompanied by a drainage system that allows for infiltration of runoff, the impact of streets on stormwater quality can be greatly mitigated.

There are many examples of narrow streets, from both newly constructed and older communities, which demonstrate the impact of street design on neighborhood character and environmental quality. See Table 3-1.

Table 3-1 Adopted Narrow Street Standards (Typ. Cross-Sections, two-way traffic)

City of Santa Rosa	30 ft wide with parking permitted both sides, <1000 Average Daily Traffic (ADT) 26 – 28 ft with parking permitted one side 20 ft - no parking permitted 20 ft neck downs at intersections
City of Palmdale	28 ft wide with parking permitted both sides
City of San Jose	30 ft wide with parking permitted both sides, <21 Dwelling Units (DU) 34 ft wide with parking permitted both sides, <121 DU
City of Novato	24 ft wide with parking permitted both sides, 2-4 DU 28 ft with parking permitted both sides, 5-15 DU
County of San Mateo	19 ft wide rural pavement cross-section with parking permitted on adjacent gravel shoulders

A comparison of street cross-sections is shown in Figure 3-5.

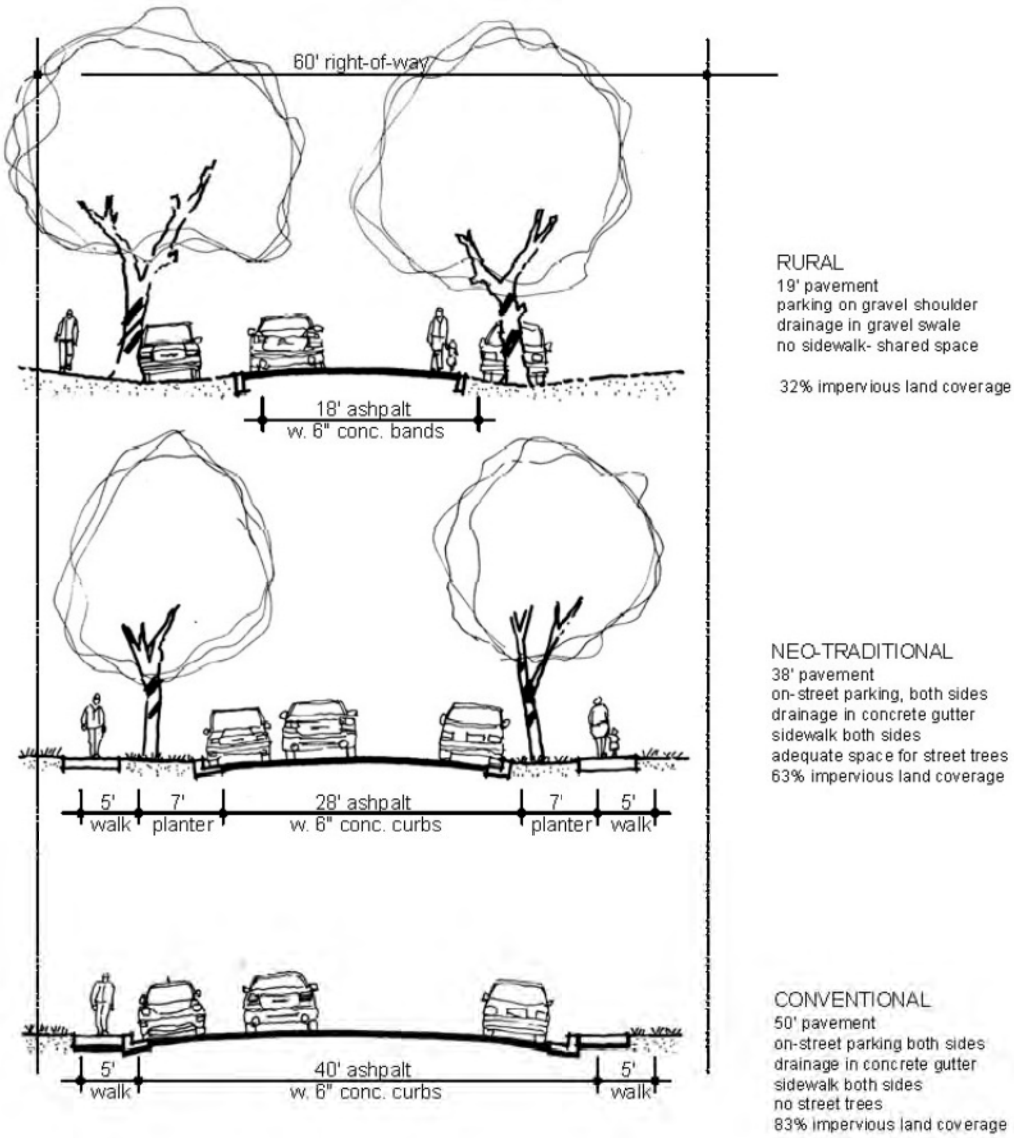


Figure 3-5
Comparison of Street Cross-Sections (two-way traffic, residential access streets)

3.2.2 Parking Lots

In any development, storage space for stationary vehicles can consume many acres of land area, often greater than the area covered by streets or rooftops. In a neighborhood of single-family homes, this parking area is generally located on private driveways or along the street. In higher density residential developments, parking is often consolidated in parking lots.

The space for storage of the automobile, the standard parking stall, occupies only 160 ft^2, but when combined with aisles, driveways, curbs, overhang space, and median islands, a parking lot can require up to 400 ft^2 per vehicle, or nearly one acre per 100 cars. Since parking is usually accommodated on an asphalt or concrete surface with conventional underground storm drain systems, parking lots typically generate a great deal of DCIA.

There are many ways to both reduce the impervious land coverage of parking areas and to filter runoff before it reaches the storm drain system.

Hybrid Parking Lot

Hybrid lots work on the principle that pavement use differs between aisles and stalls. Aisles must be designed for speeds between 10 and 20 mph, and durable enough to support the concentrated traffic of all vehicles using the lot. The stalls, on the other hand, need only be designed for the 2 or 3 mph speed of vehicles maneuvering into place. Most of the time the stalls are in use, vehicles are stationary. Hybrid lots reduce impervious surface coverage in parking areas by differentiating the paving between aisles and stalls, and combining impervious aisles with permeable stalls, as shown in Figure 3-6.

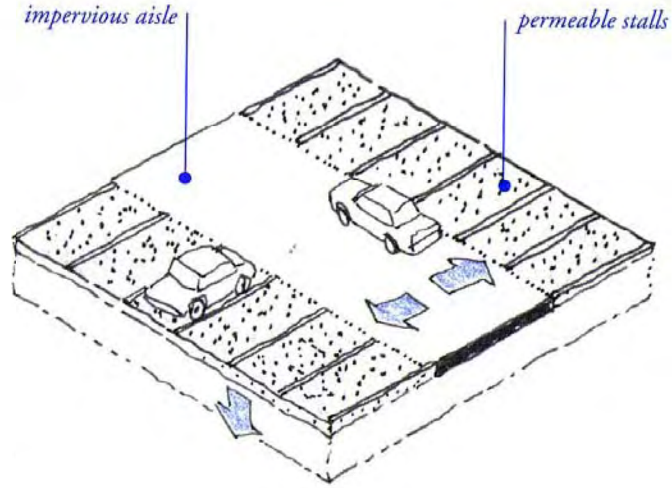


Figure 3-6
Hybrid Parking Lot

If aisles are constructed of a more conventional, impermeable material suitable for heavier vehicle use, such as asphalt, stalls can be constructed of permeable pavement. This can reduce the overall impervious surface coverage of a typical double loaded parking lot by 60% and avoid the need for an underground drainage system.

Permeable stalls can be constructed of a number of materials including pervious concrete, unit pavers such as brick or stone spaced to expose a permeable joint and set on a permeable base, crushed aggregate, porous asphalt, turf block, and cobbles in low traffic areas. Turf blocks and permeable joints are shown in Figures 3-7 and 3-8.

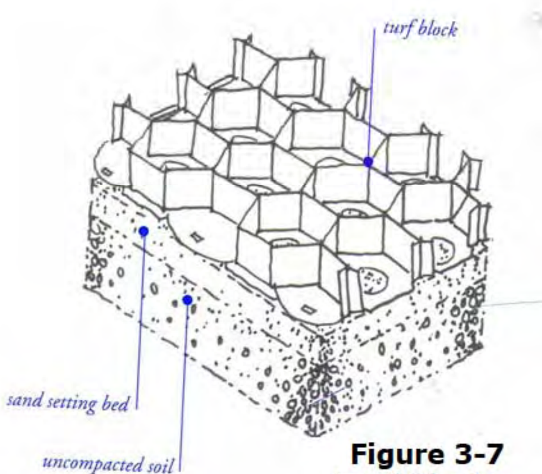


Figure 3-7
Turf Blocks

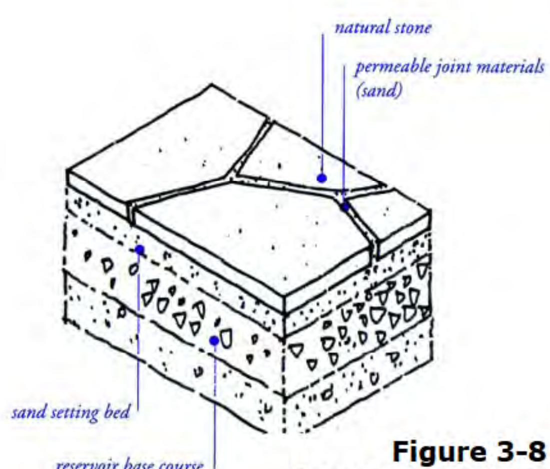


Figure 3-8
Permeable Joints

Parking Grove

A variation on the permeable stall design, a grid of trees and bollards can be used to delineate parking stalls and create a "parking grove." If the bollard and tree grids are spaced approximately 19 ft apart, two vehicles can park between each row of the grid. This 9.5 ft stall spacing is slightly more generous than the standard 8.5 to 9 ft stall, and allows for the added width of the tree trucks and bollards. A benefit of this design is that the parking grove not only shades parked cars, but also presents an attractive open space when cars are absent. Examples of parking groves are shown in Figures 3-9 and 3-10.

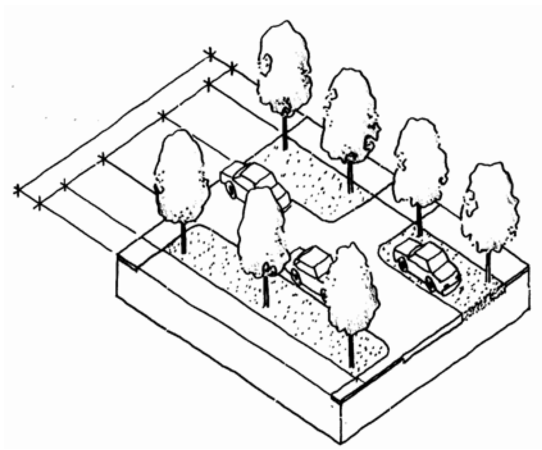


Figure 3-9
Parking Grove

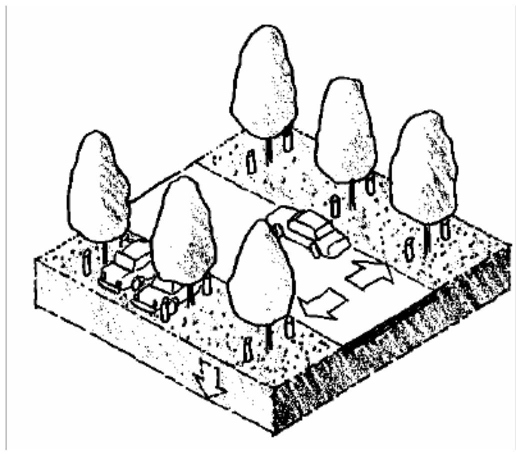


Figure 3-10
Parking Grove

Overflow Parking

Parking lot design is often required to accommodatepeak demand, generating a high proportion of impervious land coverage of very limited usefulness. An alternative is to differentiate between regular and peak parking demands, and to construct the peak parking stalls of a different, more permeable, material. This "overflow parking" area can be made of a turf block, which appears as a green lawn when not occupied by vehicles, or crushed stone or other materials. See Figure 3-11. The same concept can be applied to areas with temporary parking needs, such as emergency access routes, or in residential applications, RV, or trailer parking.

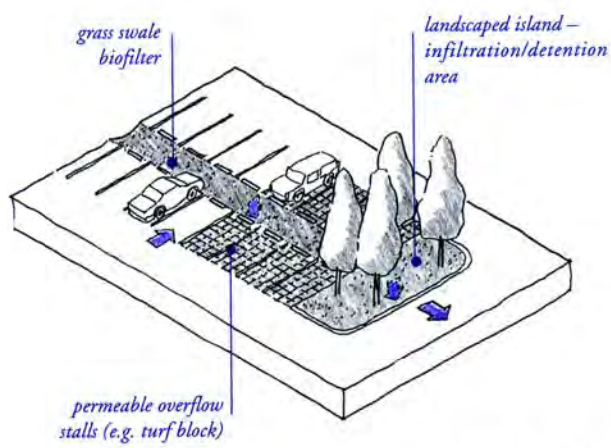


Figure 3-11
Overflows Parking

Porous Pavement Recharge Bed

In some cases, parking lots can be designed to perform more complex stormwater management functions. Constructing a stone-filled reservoir below the pavement surface and directing runoff underground by means of perforated distribution pipes can achieve subsurface stormwater storage and infiltration as shown in Figure 3-12. Subsurface infiltration basins eliminate the possibilities of mud, mosquitoes and safety hazards sometimes perceived to be associated with ephemeral surface drainage. They also can provide for storage of large volumes of runoff, and can be incorporated with roof runoff collection systems.

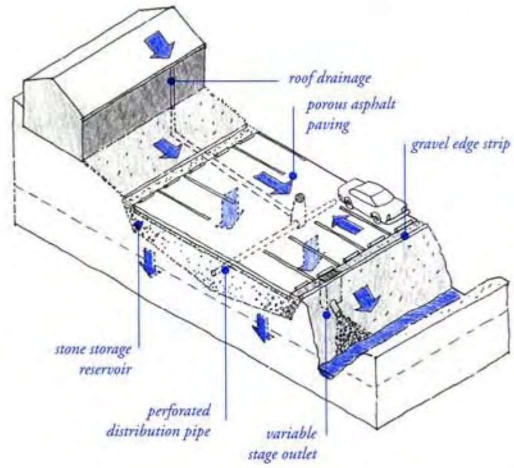


Figure 3-12
Porous Pavement Recharge Bed

3.2.3 Driveways

Driveways can comprise up to 40% of the total transportation network in a conventional development, with streets, turn-arounds, and sidewalks comprising the remaining 60%.

Driveway length is generally determined by garage setback requirements, and width is usually mandated by municipal codes and ordinances. If garages are setback from the street, long driveways are required, unless a rear alley system is included to provide garage access. If parking for two vehicles side by side is required, a 20 ft minimum width is required. Thus, if a 20 ft setback and a two-car-wide driveway are required, a minimum of 400 ft^2 of driveway will result, or 4% of a typical 10,000 ft^2 residential lot. If the house itself is compact, and the driveway is long, wide, and paved with an impervious material such as asphalt or concrete, it can become the largest component of impervious land coverage on the lot.

Municipalities can reduce the area dedicated to driveways by allowing for tandem parking (one vehicle in front of another on a narrow driveway). In addition, if shared driveways are permitted, then two or more garages can be accessed by a single driveway, further reducing required land area. Rear alley access to the garage can reduce driveway length, but overall impervious surface coverage may not be reduced if the alleys are paved with impervious materials and the access streets remain designed to conventional municipal standards.

Alternative solutions that work to reduce the impact of water quality problems associated with impervious land coverage on city streets also work on driveways. Sloping the driveway so that it drains onto an adjacent turf or groundcover area prevents driveways from draining directly to storm drain systems. This concept is shown in Figures 3-13 and 3-14. Use of turf-block or unit pavers on sand creates attractive, low maintenance, permeable driveways that filter stormwater. See Figure 3-15. Crushed aggregate can serve as a relatively smooth pavement with minimal maintenance as shown in Figure 3-16. Paving only under wheels (Figure 3-17) is a viable, inexpensive design if the driveway is straight between the garage and the street, and repaving temporary parking areas with permeable unit pavers such as brick or stone can significantly reduce the percentage of impervious area devoted to the driveway.

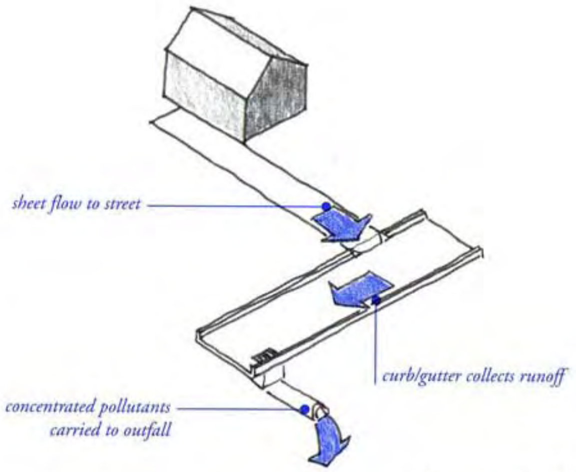


Figure 3-13
Traditional Design
Drains Flow Directly to Storm Drain

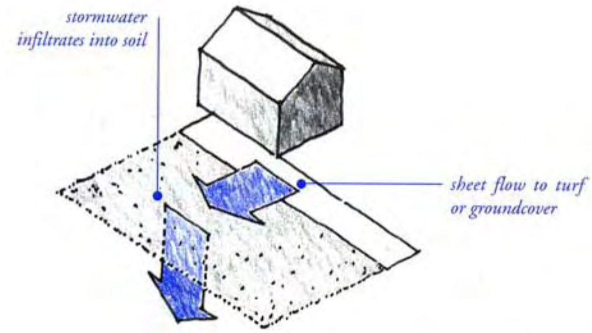


Figure 3-14
Alternative Solution
Slopes Flow to Groundcover

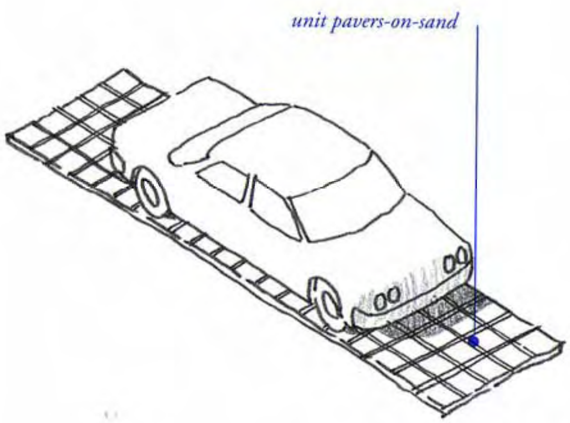


Figure 3-15
Unit Pavers

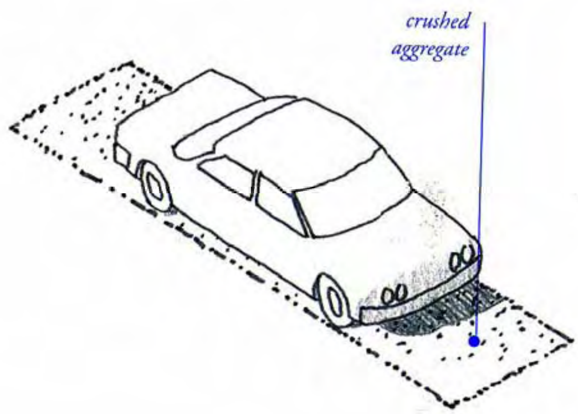


Figure 3-16
Crushed Aggregate

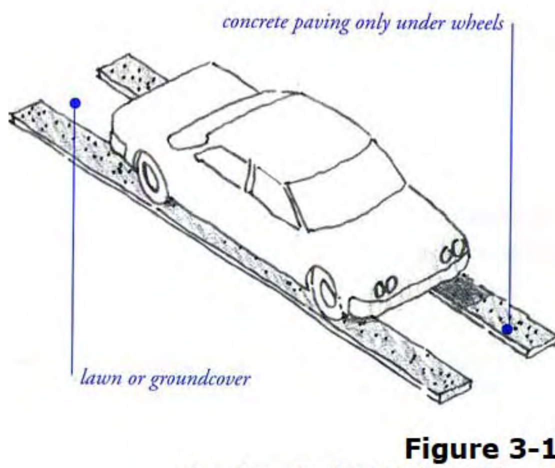


Figure 3-17
Paving Only Under Wheels

3.2.4 Landscape and Open Space

In the natural landscape, most soils infiltrate a high percentage of rainwater through a complex web of organic and biological activities that build soil porosity and permeability. Roots reach into the soil and separate particles of clay, insects excavate voids in the soil mass, roots decay leaving networks of macro pores, leaves fall and form a mulch over the soil surface, and earthworms burrow and ingest organic detritus to create richer, more porous soil. These are just a few examples of the natural processes that occur within the soil.

Maintenance of a healthy soil structure through the practice of retaining or restoring native soils where possible and using soil amendments where appropriate can improve the land's ability to filter and slowly release stormwater into drainage networks. Construction practices such as decreasing soil compaction, storing topsoil on-site for use after construction, and chipping wood for mulch as it is cleared for the land can improve soil quality and help maintain healthy watersheds. Practices that reduce erosion and help retain water on-site include incorporating organic amendments into disturbed soils after construction, retaining native vegetation, and covering soil during revegetation.

Subtle changes in grading can also improve infiltration. Landscape surfaces are conventionally graded to have a slight convex slope. This causes water to run off a central high point into a surrounding drainage system, creating increased runoff. If a landscape surface is graded to have a slightly concave slope, it will hold water. The infiltration value of concave vegetated surfaces is greater in permeable soils. Soils of heavy clay or underlain with hardpan provide less infiltration value. In these cases, concave vegetated surfaces must be designed as retention/detention basins, with proper outlets or under drains to an interconnected system.

Multiple Small Basins

Biofilters, infiltration, retention/detention basins are the basic elements of a landscape designed for stormwater management. The challenge for designers is to integrate these elements creatively and attractively in the landscape – either within a conventional landscape aesthetic or by presenting a different landscape image that emphasizes the role of water and drainage.

Multiple small basins can provide a great deal of water storage and infiltration capacity. These small basins can fit into the parkway planting strip or shoulders of street rights-of-way. If connected by culverts under walks and driveways, they can create a continuous linear infiltration system. Infiltration and retention/detention basins can be placed under wood decks, in parking lot planter islands, and at roof downspouts. Outdoor patios or seating areas can be sunken a few steps, paved with a permeable pavement such as flagstone or gravel, and designed to hold a few inches of water collected from surrounding rooftops or paved areas for a few hours after a rain.

All of these are examples of small basins that can store water for a brief period, allowing it to infiltrate into the soil, slowing its release into the drainage network, and filtering pollutants. An ordinary lawn can be designed to hold a few inches of water for a few hours after a storm, attracting birds and creating a landscape of diversity. Grass/vegetated swales can be integrated with landscaping, providing an attractive, low maintenance, linear biofilter. Extended detention (dry ponds) store water during storms, holding runoff to predevelopment levels. Pollutants settle and are removed from the water column before discharging to streams. Wet ponds serve a similar purpose and can increase property values by providing a significant aesthetic, and passive recreation opportunity.

Plant species selection is critical for proper functioning of infiltration areas. Proper selection of plant materials can improve the infiltration potential of landscape areas. Deep-rooted plants help to build soil porosity. Plant leaf-surface area helps to collect rainwater before it lands on the soil, especially in light rains, increasing the overall water-holding potential of the landscape.

A large number of plant species will survive moist soils or periodic inundation. These plants provide a wide range of choices for planted infiltration/detention basins and drainage swales. Most inundated plants have a higher survival potential on well-drained alluvial soils than on fine textured shallow soils or clays.

Maintenance Needs for Stormwater Systems

All landscape treatments require maintenance. Landscapes designed to perform stormwater management functions are not necessarily more maintenance intensive than highly manicured conventional landscapes. A concave lawn requires the same mowing, fertilizing, and weeding as a convex one and often less irrigation because more rain is filtered into the underlying soil. Sometimes infiltration basins may require a different kind of maintenance than conventionally practiced.

Typical maintenance activities include periodic inspection of surface drainage systems to ensure clear flow lines, repair of eroded surfaces, adjustment or repair of drainage structures, soil cultivation or aeration, care of plant materials, replacement of dead plants, replenishment of mulch cover, irrigation, fertilizing, pruning and mowing. In addition, dead or stressed vegetation may indicate chemical dumping. Careful observation should be made of these areas to determine if such a problem exists.

Landscape maintenance can have a significant impact on soil permeability and its ability to support plant growth. Most plants concentrate the majority of their small absorbing roots in the upper 6 in. of the soil surface if a mulch or forest litter protects the surface. If the soil is exposed or bare, it can become so hot that surface roots will not grow in the upper 8 to 10 in. The common practice of removing all leaf litter and detritus with leaf blowers creates a hard-crusted soil surface of low permeability and high heat conduction. Proper mulching of the soil surface improves water retention and infiltration, while protecting the surface root zone from temperature extremes.

In addition to impacting permeability, landscape maintenance practices can have adverse effects on water quality. Because commonly used fertilizers and herbicides are a source of organic compounds, it is important to keep these practices to a minimum, and prevent overwatering.

When well maintained and designed, landscaped concave surfaces, infiltration basins, swales and bioretention areas can add aesthetic value while providing the framework for environmentally sound, comprehensive stormwater management systems.

Street Trees

Trees improve water quality by intercepting and storing rainfall on leaves and branch surfaces, thereby reducing runoff volumes and delaying the onset of peak flows. A single street tree can have a total leaf surface area of several hundred to several thousand ft^2, depending on species and size. This aboveground surface area created by trees and other plants greatly contributes to the water holding capacity of the land. They attenuate conveyance by increasing the soil's capacity to filter rainwater and reduce overland flow rates. By diminishing the impact of raindrops on un-vegetated soil, trees reduce soil erosion. Street trees also have the ability to reduce ambient temperature of stormwater runoff and absorb surface water pollutants.

When using street trees to achieve stormwater management goals, it is important to use tree species with wide canopies. Street tree design criteria should specify species expected to attain 20 to 30 ft canopies at maturity. Planter strips with adequate width and depth of soil volume are necessary to ensure tree vitality and reduce future maintenance. Structural soils also provide rooting space for large trees and can be specified along narrow planter strips and underneath sidewalks to enable continuous belowground soil and root connections.

3.2.5 Outdoor Work Areas

The site design and landscape details listed in previous sections are appropriate for uses where low concentrations of pollutants can be mitigated through infiltration, retention, and detention. Often in commercial and industrial sites, there are outdoor work areas in which a higher concentration of pollutants exists, and thus a higher potential of pollutants infiltrating the soil. These work areas often involve automobiles, equipment machinery, or other commercial and industrial uses, and require special consideration.

Outdoor work areas are usually isolated elements in a larger development. Infiltration and detention strategies are still appropriate for and can be applied to other areas of the site, such as parking lots, landscape areas, employee use areas, and bicycle path. It is only the outdoor work area within the development – such as the loading dock, fueling area, or equipment wash area – that requires a different drainage approach. This drainage approach is often precisely the opposite from the infiltration/detention strategy – in other words, collect and convey.

In these outdoor work areas, infiltration is discouraged and runoff is often routed directly to the sanitary sewer, not the storm drain. Because this runoff is being added to the loads normally received by the water treatment plants (publicly owned treatment works – POTWs), it raises several concerns that must be addressed in the planning and design stage. These include:

- Higher flows that could exceed the sewer system capacity
- Catastrophic spills that may cause harm to POTW operation
- A potential increase in pollutants

These concerns can be addressed at policy, management, and site planning levels.

Policy
Piping runoff and process water from outdoor work areas directly to the sanitary sewer for treatment by a downstream POTW displaces the problem of reducing stormwater pollution. Municipal stormwater programs and/or private developers can work with the local POTW to develop solutions that minimize effects on the treatment facility. It should be noted that many POTWs have traditionally prohibited the discharge of stormwater to their systems. However, these prohibitions are being reviewed in light of the benefits possible from such diversions.

Management
Commercial and industrial sites that host special activities need to implement a pollution prevention program minimizing hazardous material use and waste. For example, if restaurant grease traps are directly connected to the sanitary sewer, proper management programs can mitigate the amount of grease that escapes from the trap, clogging sewer systems and causing overflows or damage to downstream systems.

Site Planning
Outdoor work areas can be designed in particular ways to reduce their impacts on both stormwater quality and sewage treatment plants.

- Create an impermeable surface such as concrete or asphalt, or a prefabricated metal drip pan, depending on the use.

- Cover the area with a roof. This prevents rain from falling on the work area and becoming polluted runoff.

- Berm or mound around the perimeter of the area to prevent water from adjacent areas to flow on to the surface of the work area.

- Directly connect runoff. Unlike other areas, runoff from these work areas is directly connected to the sanitary sewer or other specialized containment systems. This allows the more highly concentrated pollutants from these areas to receive special treatment that removes particular constituents. Approval for this connection must be obtained from the appropriate sanitary sewer agency.

- Locate the work area away from storm drains or catch basins. If the work area is adjacent to, or directly upstream from a storm drain or landscape drainage feature (e.g., bioswales), debris or liquids from the work area can migrate into the stormwater system.

- Plan the work area to prevent run-on. This can be accomplished by raising the work area or by diverting run-on around the work area.

These design elements are general considerations for work areas. In designing any outdoor work area, evaluate local ordinances affecting the type of work area, as many local jurisdictions have specific requirements.

Some activities are common to many commercial and industrial sites. These include garbage and recycling, maintenance and storage, and loading. These activities can have a significant negative impact on stormwater quality, and require special attention to the siting and design of the activity area.

3.2.6 Maintenance and Storage Areas

To reduce the possibility of contact with stormwater runoff, maintenance and storage areas can be sited away from drainage paths and waterways, and covered. Implementing a regular maintenance plan for sweeping, litter control, and spill cleanup also helps prevent stormwater pollution.

Specifying impermeable surfaces for vehicle and equipment maintenance areas will reduce the chance of pollutant infiltration. A concrete surface will usually last much longer than an asphalt one, as vehicle fluids can either dissolve asphalt or be absorbed by the asphalt and released later. See Figure 3-18.

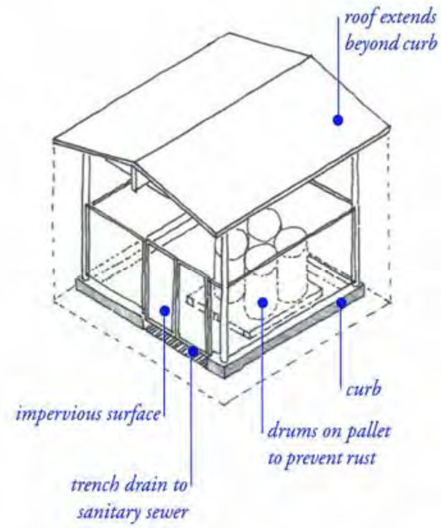


Figure 3-18
Material Storage

3.2.7 Vehicle and Equipment Washing Areas

It is generally advisable to cover areas used for regular washing of vehicles, trucks, or equipment, surround them with a perimeter berm, and clearly mark them as a designated washing area. Sumps or drain lines can be installed to collect wash water, which may be treated for reuse or recycling, or for discharge to the sanitary sewer. The POTW may require some form of pretreatment, such as a trap, for these areas.

Fueling and maintenance activities must be isolated from the vehicle washing facilities. These activities have specific requirements, described later in this section.

Storage of bulk materials, fuels, oils, solvents, other chemicals, and process equipment should be accommodated on an impervious surface covered with a roof. To reduce the chances of corrosion, materials should not be stored directly on the ground, but supported by a wire mesh or other flooring above the impervious pavement. In uncovered areas, drums or other containers can be stored at a slight angle to prevent ponding of rainwater from rusting the lids. Liquid containers should be stored in a designated impervious area that is roofed, fenced within a berm, to prevent spills from flowing into the storm drain.

If hazardous materials are being used or stored, additional specific local, state, or federal requirements may apply.

3.2.8 Loading Area

Loading areas and docks can be designed with a roof or overhang, and a surrounding curb or berm. See Figure 3-19. The area should be graded to direct flow toward an inlet with a shutoff valve or dead-end sump. The sump must be designed with enough capacity to hold a spill while the valve is closed. If the sump has a valve, it must be kept in the closed position and require an action to open it. All sumps must have a sealed bottom so they cannot infiltrate water. Contaminated accumulated waste and liquid must not be discharged to a storm drain and may be discharged to the sanitary sewer only with the POTW's permission. If the waste is not approved for discharge to the sanitary sewer, it must be conveyed to a hazardous waste (or other offsite disposal) facility, and may require pretreatment. Some specific uses have unique requirements.

3.2.9 Trash Storage Areas

Areas designated for trash storage can be covered to protect containers from rainfall. Where covering the trash storage area is not feasible, the area can be protected from run on using grading and berms, and connected to the sanitary sewer to prevent leaks from leaving the designated trash storage area enclosure.

3.2.10 Wash Areas

Areas designated for washing of floor mats, containers, exhaust filters, and similar items can be covered and enclosed to protect the area from rainfall and from overspray leaving the area. These areas can also be connected to the sanitary sewer to prevent wash waters from leaving the designated enclosures. A benefit of covering and enclosing these areas is that vectors may be reduced and aesthetics of the area improved.

3.2.11 Fueling Areas

In all vehicle and equipment fueling areas, plans must be developed for cleaning near fuel dispensers, emergency spill cleanup, and routine inspections to prevent leaks and ensure properly functioning equipment.

If the fueling activities are minor, fueling can be performed in a designated, covered, and bermed area that will not allow run-on of stormwater or runoff of spills.

Retail gasoline outlets and vehicle fueling areas have specific design guidelines. These are described in a Best Management Practice Guide for retail gasoline outlets developed by the California Stormwater Quality Task Force, in cooperation with major gasoline corporations. The practice guide addresses standards for existing, new, or substantially remodeled facilities. In addition, some municipal stormwater permits require RGOs to provide appropriate runoff treatment.

Fuel dispensing areas are defined as extending 6.5 ft from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus 1 ft, whichever is less. These areas must be paved with smooth impervious surfaces, such as Portland cement concrete, with a 2-4% slope to prevent ponding, and must be covered. The cover must not drain onto the work area. The rest of the site must separate the fuel dispensing area by a grade break that prevents run-on of stormwater.

Within the gas station, the outdoor trash receptacle area (garbage and recycling), and the air/water supply area must be paved and graded to prevent stormwater run-on. Trash receptacles should be covered.

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- ☑ Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description

Each project site possesses unique topographic, hydrologic, and vegetative features, some of which are more suitable for development than others. Integrating and incorporating appropriate landscape planning methodologies into the project design is the most effective action that can be done to minimize surface and groundwater contamination from stormwater.

Approach

Landscape planning should couple consideration of land suitability for urban uses with consideration of community goals and projected growth. Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for site design and landscapes planning should conform to applicable standards and specifications of agencies with jurisdiction and be consistent with applicable General Plan and Local Area Plan policies.

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Designing New Installations

Begin the development of a plan for the landscape unit with attention to the following general principles:

- Formulate the plan on the basis of clearly articulated community goals. Carefully identify conflicts and choices between retaining and protecting desired resources and community growth.

- Map and assess land suitability for urban uses. Include the following landscape features in the assessment: wooded land, open unwooded land, steep slopes, erosion-prone soils, foundation suitability, soil suitability for waste disposal, aquifers, aquifer recharge areas, wetlands, floodplains, surface waters, agricultural lands, and various categories of urban land use. When appropriate, the assessment can highlight outstanding local or regional resources that the community determines should be protected (e.g., a scenic area, recreational area, threatened species habitat, farmland, fish run). Mapping and assessment should recognize not only these resources but also additional areas needed for their sustenance.

Project plan designs should conserve natural areas to the extent possible, maximize natural water storage and infiltration opportunities, and protect slopes and channels.

Conserve Natural Areas during Landscape Planning

If applicable, the following items are required and must be implemented in the site layout during the subdivision design and approval process, consistent with applicable General Plan and Local Area Plan policies:

- Cluster development on least-sensitive portions of a site while leaving the remaining land in a natural undisturbed condition.

- Limit clearing and grading of native vegetation at a site to the minimum amount needed to build lots, allow access, and provide fire protection.

- Maximize trees and other vegetation at each site by planting additional vegetation, clustering tree areas, and promoting the use of native and/or drought tolerant plants.

- Promote natural vegetation by using parking lot islands and other landscaped areas.

- Preserve riparian areas and wetlands.

Maximize Natural Water Storage and Infiltration Opportunities Within the Landscape Unit

- Promote the conservation of forest cover. Building on land that is already deforested affects basin hydrology to a lesser extent than converting forested land. Loss of forest cover reduces interception storage, detention in the organic forest floor layer, and water losses by evapotranspiration, resulting in large peak runoff increases and either their negative effects or the expense of countering them with structural solutions.

- Maintain natural storage reservoirs and drainage corridors, including depressions, areas of permeable soils, swales, and intermittent streams. Develop and implement policies and regulations to discourage the clearing, filling, and channelization of these features. Utilize them in drainage networks in preference to pipes, culverts, and engineered ditches.

- Evaluating infiltration opportunities by referring to the stormwater management manual for the jurisdiction and pay particular attention to the selection criteria for avoiding groundwater contamination, poor soils, and hydrogeological conditions that cause these facilities to fail. If necessary, locate developments with large amounts of impervious surfaces or a potential to produce relatively contaminated runoff away from groundwater recharge areas.

Protection of Slopes and Channels during Landscape Design

- Convey runoff safely from the tops of slopes.
- Avoid disturbing steep or unstable slopes.
- Avoid disturbing natural channels.
- Stabilize disturbed slopes as quickly as possible.
- Vegetate slopes with native or drought tolerant vegetation.
- Control and treat flows in landscaping and/or other controls prior to reaching existing natural drainage systems.
- Stabilize temporary and permanent channel crossings as quickly as possible, and ensure that increases in run-off velocity and frequency caused by the project do not erode the channel.
- Install energy dissipaters, such as riprap, at the outlets of new storm drains, culverts, conduits, or channels that enter unlined channels in accordance with applicable specifications to minimize erosion. Energy dissipaters shall be installed in such a way as to minimize impacts to receiving waters.
- Line on-site conveyance channels where appropriate, to reduce erosion caused by increased flow velocity due to increases in tributary impervious area. The first choice for linings should be grass or some other vegetative surface, since these materials not only reduce runoff velocities, but also provide water quality benefits from filtration and infiltration. If velocities in the channel are high enough to erode grass or other vegetative linings, riprap, concrete, soil cement, or geo-grid stabilization are other alternatives.
- Consider other design principles that are comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define “redevelopment” in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of “ redevelopment” must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under “designing new installations” above should be followed.

Redevelopment may present significant opportunity to add features which had not previously been implemented. Examples include incorporation of depressions, areas of permeable soils, and swales in newly redeveloped areas. While some site constraints may exist due to the status of already existing infrastructure, opportunities should not be missed to maximize infiltration, slow runoff, reduce impervious areas, disconnect directly connected impervious areas.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Stormwater Management Manual for Western Washington, Washington State Department of Ecology, August 2001.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Design Considerations

- Tributary Area
- Area Required
- Slope
- Water Availability

Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems.

Targeted Constituents

☑	Sediment	▲
☑	Nutrients	●
☑	Trash	●
☑	Metals	▲
☑	Bacteria	●
☑	Oil and Grease	▲
☑	Organics	▲

Legend ***(Removal Effectiveness)***

● Low ■ High

▲ Medium

California Experience

Caltrans constructed and monitored six vegetated swales in southern California. These swales were generally effective in reducing the volume and mass of pollutants in runoff. Even in the areas where the annual rainfall was only about 10 inches/yr, the vegetation did not require additional irrigation. One factor that strongly affected performance was the presence of large numbers of gophers at most of the sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- If properly designed, vegetated, and operated, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant collateral water quality benefits.

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- Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible.

Limitations

- Can be difficult to avoid channelization.
- May not be appropriate for industrial sites or locations where spills may occur
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.
- Swales are mores susceptible to failure if not properly maintained than other treatment BMPs.

Design and Sizing Guidelines

- Flow rate based design determined by local requirements or sized so that 85% of the annual runoff volume is discharged at less than the design rainfall intensity.
- Swale should be designed so that the water level does not exceed 2/3rds the height of the grass or 4 inches, which ever is less, at the design treatment rate.
- Longitudinal slopes should not exceed 2.5%
- Trapezoidal channels are normally recommended but other configurations, such as parabolic, can also provide substantial water quality improvement and may be easier to mow than designs with sharp breaks in slope.
- Swales constructed in cut are preferred, or in fill areas that are far enough from an adjacent slope to minimize the potential for gopher damage. Do not use side slopes constructed of fill, which are prone to structural damage by gophers and other burrowing animals.
- A diverse selection of low growing, plants that thrive under the specific site, climatic, and watering conditions should be specified. Vegetation whose growing season corresponds to the wet season are preferred. Drought tolerant vegetation should be considered especially for swales that are not part of a regularly irrigated landscaped area.
- The width of the swale should be determined using Manning's Equation using a value of 0.25 for Manning's n.

Construction/Inspection Considerations

- Include directions in the specifications for use of appropriate fertilizer and soil amendments based on soil properties determined through testing and compared to the needs of the vegetation requirements.
- Install swales at the time of the year when there is a reasonable chance of successful establishment without irrigation; however, it is recognized that rainfall in a given year may not be sufficient and temporary irrigation may be used.
- If sod tiles must be used, they should be placed so that there are no gaps between the tiles; stagger the ends of the tiles to prevent the formation of channels along the swale or strip.
- Use a roller on the sod to ensure that no air pockets form between the sod and the soil.
- Where seeds are used, erosion controls will be necessary to protect seeds for at least 75 days after the first rainfall of the season.

Performance

The literature suggests that vegetated swales represent a practical and potentially effective technique for controlling urban runoff quality. While limited quantitative performance data exists for vegetated swales, it is known that check dams, slight slopes, permeable soils, dense grass cover, increased contact time, and small storm events all contribute to successful pollutant removal by the swale system. Factors decreasing the effectiveness of swales include compacted soils, short runoff contact time, large storm events, frozen ground, short grass heights, steep slopes, and high runoff velocities and discharge rates.

Conventional vegetated swale designs have achieved mixed results in removing particulate pollutants. A study performed by the Nationwide Urban Runoff Program (NURP) monitored three grass swales in the Washington, D.C., area and found no significant improvement in urban runoff quality for the pollutants analyzed. However, the weak performance of these swales was attributed to the high flow velocities in the swales, soil compaction, steep slopes, and short grass height.

Another project in Durham, NC, monitored the performance of a carefully designed artificial swale that received runoff from a commercial parking lot. The project tracked 11 storms and concluded that particulate concentrations of heavy metals (Cu, Pb, Zn, and Cd) were reduced by approximately 50 percent. However, the swale proved largely ineffective for removing soluble nutrients.

The effectiveness of vegetated swales can be enhanced by adding check dams at approximately 17 meter (50 foot) increments along their length (See Figure 1). These dams maximize the retention time within the swale, decrease flow velocities, and promote particulate settling. Finally, the incorporation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.

Only 9 studies have been conducted on all grassed channels designed for water quality (Table 1). The data suggest relatively high removal rates for some pollutants, but negative removals for some bacteria, and fair performance for phosphorus.

Table 1 Grassed swale pollutant removal efficiency data							
Removal Efficiencies (% Removal)							
Study	TSS	TP	TN	NO_3	Metals	Bacteria	Type
Caltrans 2002	77	8	67	66	83-90	-33	dry swales
Goldberg 1993	67.8	4.5	-	31.4	42–62	-100	grassed channel
Seattle Metro and Washington Department of Ecology 1992	60	45	-	-25	2–16	-25	grassed channel
Seattle Metro and Washington Department of Ecology, 1992	83	29	-	-25	46–73	-25	grassed channel
Wang et al., 1981	80	-	-	-	70–80	-	dry swale
Dorman et al., 1989	98	18	-	45	37–81	-	dry swale
Harper, 1988	87	83	84	80	88–90	-	dry swale
Kercher et al., 1983	99	99	99	99	99	-	dry swale
Harper, 1988.	81	17	40	52	37–69	-	wet swale
Koon, 1995	67	39	-	9	-35 to 6	-	wet swale

While it is difficult to distinguish between different designs based on the small amount of available data, grassed channels generally have poorer removal rates than wet and dry swales, although some swales appear to export soluble phosphorus (Harper, 1988; Koon, 1995). It is not clear why swales export bacteria. One explanation is that bacteria thrive in the warm swale soils.

Siting Criteria

The suitability of a swale at a site will depend on land use, size of the area serviced, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the swale system (Schueler et al., 1992). In general, swales can be used to serve areas of less than 10 acres, with slopes no greater than 5 %. Use of natural topographic lows is encouraged and natural drainage courses should be regarded as significant local resources to be kept in use (Young et al., 1996).

Selection Criteria (NCTCOG, 1993)

- Comparable performance to wet basins
- Limited to treating a few acres
- Availability of water during dry periods to maintain vegetation
- Sufficient available land area

Research in the Austin area indicates that vegetated controls are effective at removing pollutants even when dormant. Therefore, irrigation is not required to maintain growth during dry periods, but may be necessary only to prevent the vegetation from dying.

The topography of the site should permit the design of a channel with appropriate slope and cross-sectional area. Site topography may also dictate a need for additional structural controls. Recommendations for longitudinal slopes range between 2 and 6 percent. Flatter slopes can be used, if sufficient to provide adequate conveyance. Steep slopes increase flow velocity, decrease detention time, and may require energy dissipating and grade check. Steep slopes also can be managed using a series of check dams to terrace the swale and reduce the slope to within acceptable limits. The use of check dams with swales also promotes infiltration.

Additional Design Guidelines

Most of the design guidelines adopted for swale design specify a minimum hydraulic residence time of 9 minutes. This criterion is based on the results of a single study conducted in Seattle, Washington (Seattle Metro and Washington Department of Ecology, 1992), and is not well supported. Analysis of the data collected in that study indicates that pollutant removal at a residence time of 5 minutes was not significantly different, although there is more variability in that data. Therefore, additional research in the design criteria for swales is needed. Substantial pollutant removal has also been observed for vegetated controls designed solely for conveyance (Barrett et al, 1998); consequently, some flexibility in the design is warranted.

Many design guidelines recommend that grass be frequently mowed to maintain dense coverage near the ground surface. Recent research (Colwell et al., 2000) has shown mowing frequency or grass height has little or no effect on pollutant removal.

Summary of Design Recommendations

1) The swale should have a length that provides a minimum hydraulic residence time of at least 10 minutes. The maximum bottom width should not exceed 10 feet unless a dividing berm is provided. The depth of flow should not exceed 2/3rds the height of the grass at the peak of the water quality design storm intensity. The channel slope should not exceed 2.5%.

2) A design grass height of 6 inches is recommended.

3) Regardless of the recommended detention time, the swale should be not less than 100 feet in length.

4) The width of the swale should be determined using Manning's Equation, at the peak of the design storm, using a Manning's n of 0.25.

5) The swale can be sized as both a treatment facility for the design storm and as a conveyance system to pass the peak hydraulic flows of the 100-year storm if it is located "on-line." The side slopes should be no steeper than 3:1 (H:V).

6) Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible. If flow is to be introduced through curb cuts, place pavement slightly above the elevation of the vegetated areas. Curb cuts should be at least 12 inches wide to prevent clogging.

7) Swales must be vegetated in order to provide adequate treatment of runoff. It is important to maximize water contact with vegetation and the soil surface. For general purposes, select fine, close-growing, water-resistant grasses. If possible, divert runoff (other than necessary irrigation) during the period of vegetation

establishment. Where runoff diversion is not possible, cover graded and seeded areas with suitable erosion control materials.

Maintenance

The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely. The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover.

Maintenance activities should include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Cuttings should be removed from the channel and disposed in a local composting facility. Accumulated sediment should also be removed manually to avoid concentrated flows in the swale. The application of fertilizers and pesticides should be minimal.

Another aspect of a good maintenance plan is repairing damaged areas within a channel. For example, if the channel develops ruts or holes, it should be repaired utilizing a suitable soil that is properly tamped and seeded. The grass cover should be thick; if it is not, reseed as necessary. Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Residuals (e.g., silt, grass cuttings) must be disposed in accordance with local or State requirements. Maintenance of grassed swales mostly involves maintenance of the grass or wetland plant cover. Typical maintenance activities are summarized below:

- Inspect swales at least twice annually for erosion, damage to vegetation, and sediment and debris accumulation preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the swale is ready for winter. However, additional inspection after periods of heavy runoff is desirable. The swale should be checked for debris and litter, and areas of sediment accumulation.

- Grass height and mowing frequency may not have a large impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.

- Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.

- Sediment accumulating near culverts and in channels should be removed when it builds up to 75 mm (3 in.) at any spot, or covers vegetation.

- Regularly inspect swales for pools of standing water. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g. debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained.

Cost

Construction Cost

Little data is available to estimate the difference in cost between various swale designs. One study (SWRPC, 1991) estimated the construction cost of grassed channels at approximately \$0.25 per ft^2. This price does not include design costs or contingencies. Brown and Schueler (1997) estimate these costs at approximately 32 percent of construction costs for most stormwater management practices. For swales, however, these costs would probably be significantly higher since the construction costs are so low compared with other practices. A more realistic estimate would be a total cost of approximately \$0.50 per ft^2, which compares favorably with other stormwater management practices.

Table 2 Swale Cost Estimate (SEWRPC, 1991)

Component	Unit	Extent	Unit Cost			Total Cost		
			Low	Moderate	High	Low	Moderate	High
Mobilization / Demobilization-Light	Swale	1	$107	$274	$441	$107	$274	$441
Site Preparation								
Clearing[b]........	Acre	0.5	$2,200	$3,800	$5,400	$1,100	$1,900	$2,700
Grubbing[c]........	Acre	0.25	$3,800	$5,200	$6,600	$950	$1,300	$1,650
General Excavation[d]........	Yd^3	372	$2.10	$3.70	$5.30	$781	$1,376	$1,972
Level and Till[e]........	Yd^2	1,210	$0.20	$0.35	$0.50	$242	$424	$605
Sites Development								
Salvaged Topsoil Seed, and Mulch[f]..	Yd^2	1,210	$0.40	$1.00	$1.60	$484	$1,210	$1,936
Sod[g]........	Yd^2	1,210	$1.20	$2.40	$3.60	$1,452	$2,904	$4,356
Subtotal	--	--	--	--	--	$5,116	$9,388	$13,660
Contingencies	Swale	1	25%	25%	25%	$1,279	$2,347	$3,415
Total	--	--	--	--	--	$6,395	$11,735	$17,075

Source: (SEWRPC, 1991)

Note: Mobilization/demobilization refers to the organization and planning involved in establishing a vegetative swale.

[a] Swale has a bottom width of 1.0 foot, a top width of 10 feet with 1:3 side slopes, and a 1,000-foot length.

[b] Area cleared = (top width + 10 feet) x swale length.

[c] Area grubbed = (top width x swale length).

[d] Volume excavated = (0.67 x top width x swale depth) x swale length (parabolic cross-section).

[e] Area tilled = $\left(\text{top width} + \frac{8(\text{swale depth}^2)}{3(\text{top width})}\right)$ x swale length (parabolic cross-section).

[f] Area seeded = area cleared x 0.5.

[g] Area sodded = area cleared x 0.5.

Table 3 Estimated Maintenance Costs (SEWRPC. 1991)

Component	Unit Cost	Swale Size (Depth and Top Width)		Comment
		1.5 Foot Depth, One-Foot Bottom Width, 10-Foot Top Width	3-Foot Depth, 3-Foot Bottom Width, 21-Foot Top Width	
Lawn Mowing	$0.85 / 1,000 ft^2/ mowing	$0.14 / linear foot	$0.21 / linear foot	Lawn maintenance area=(top width + 10 feet) x length. Mow eight times per year
General Lawn Care	$9.00 / 1,000 ft^2/ year	$0.18 / linear foot	$0.28 / linear foot	Lawn maintenance area = (top width + 10 feet) x length
Swale Debris and Litter Removal	$0.10 / linear foot / year	$0.10 / linear foot	$0.10 / linear foot	–
Grass Reseeding with Mulch and Fertilizer	$0.30 / yd^2	$0.01 / linear foot	$0.01 / linear foot	Area revegetated equals 1% of lawn maintenance area per year
Program Administration and Swale Inspection	$0.15 / linear foot / year, plus $25 / inspection	$0.15 / linear foot	$0.15 / linear foot	Inspect four times per year
Total	--	**$0.58 / linear foot**	**$ 0.75 / linear foot**	--

Maintenance Cost

Caltrans (2002) estimated the expected annual maintenance cost for a swale with a tributary area of approximately 2 ha at approximately $2,700. Since almost all maintenance consists of mowing, the cost is fundamentally a function of the mowing frequency. Unit costs developed by SEWRPC are shown in Table 3. In many cases vegetated channels would be used to convey runoff and would require periodic mowing as well, so there may be little additional cost for the water quality component. Since essentially all the activities are related to vegetation management, no special training is required for maintenance personnel.

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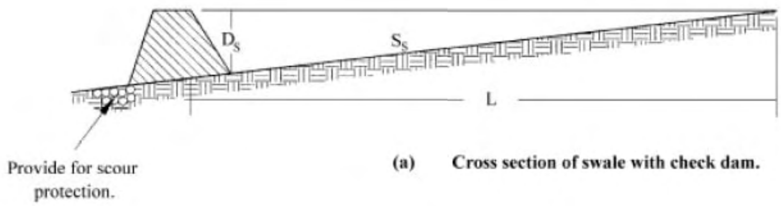
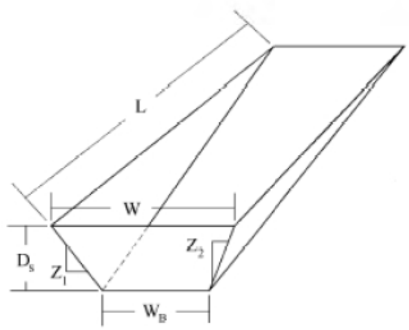


(a) Cross section of swale with check dam.



(b) Dimensional view of swale impoundment area.

Notation:

L = Length of swale impoundment area per check dam (ft)
D_S = Depth of check dam (ft)
S_S = Bottom slpe of swale (ft/ft)
W = Top width of check dam (ft)
W_B = Bottom width of check dam (ft)
$Z_{1\&2}$ = Ratio of horizontal to vertical change in swale side slope (ft/ft)

Design Considerations

- Tributary Area
- Area Required
- Hydraulic Head

Description

Dry extended detention ponds (a.k.a. dry ponds, extended detention basins, detention ponds, extended detention ponds) are basins whose outlets have been designed to detain the stormwater runoff from a water quality design storm for some minimum time (e.g., 48 hours) to allow particles and associated pollutants to settle. Unlike wet ponds, these facilities do not have a large permanent pool. They can also be used to provide flood control by including additional flood detention storage.

California Experience

Caltrans constructed and monitored 5 extended detention basins in southern California with design drain times of 72 hours. Four of the basins were earthen, less costly and had substantially better load reduction because of infiltration that occurred, than the concrete basin. The Caltrans study reaffirmed the flexibility and performance of this conventional technology. The small headloss and few siting constraints suggest that these devices are one of the most applicable technologies for stormwater treatment.

Advantages

- Due to the simplicity of design, extended detention basins are relatively easy and inexpensive to construct and operate.
- Extended detention basins can provide substantial capture of sediment and the toxics fraction associated with particulates.
- Widespread application with sufficient capture volume can provide significant control of channel erosion and enlargement caused by changes to flow frequency

Targeted Constituents

☑	Sediment	▲
☑	Nutrients	●
☑	Trash	■
☑	Metals	▲
☑	Bacteria	▲
☑	Oil and Grease	▲
☑	Organics	▲

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

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relationships resulting from the increase of impervious cover in a watershed.

Limitations

- Limitation of the diameter of the orifice may not allow use of extended detention in watersheds of less than 5 acres (would require an orifice with a diameter of less than 0.5 inches that would be prone to clogging).

- Dry extended detention ponds have only moderate pollutant removal when compared to some other structural stormwater practices, and they are relatively ineffective at removing soluble pollutants.

- Although wet ponds can increase property values, dry ponds can actually detract from the value of a home due to the adverse aesthetics of dry, bare areas and inlet and outlet structures.

Design and Sizing Guidelines

- Capture volume determined by local requirements or sized to treat 85% of the annual runoff volume.

- Outlet designed to discharge the capture volume over a period of hours.

- Length to width ratio of at least 1.5:1 where feasible.

- Basin depths optimally range from 2 to 5 feet.

- Include energy dissipation in the inlet design to reduce resuspension of accumulated sediment.

- A maintenance ramp and perimeter access should be included in the design to facilitate access to the basin for maintenance activities and for vector surveillance and control.

- Use a draw down time of 48 hours in most areas of California. Draw down times in excess of 48 hours may result in vector breeding, and should be used only after coordination with local vector control authorities. Draw down times of less than 48 hours should be limited to BMP drainage areas with coarse soils that readily settle and to watersheds where warming may be determined to downstream fisheries.

Construction/Inspection Considerations

- Inspect facility after first large to storm to determine whether the desired residence time has been achieved.

- When constructed with small tributary area, orifice sizing is critical and inspection should verify that flow through additional openings such as bolt holes does not occur.

Performance

One objective of stormwater management practices can be to reduce the flood hazard associated with large storm events by reducing the peak flow associated with these storms. Dry extended detention basins can easily be designed for flood control, and this is actually the primary purpose of most detention ponds.

Dry extended detention basins provide moderate pollutant removal, provided that the recommended design features are incorporated. Although they can be effective at removing some pollutants through settling, they are less effective at removing soluble pollutants because of the absence of a permanent pool. Several studies are available on the effectiveness of dry extended detention ponds including one recently concluded by Caltrans (2002).

The load reduction is greater than the concentration reduction because of the substantial infiltration that occurs. Although the infiltration of stormwater is clearly beneficial to surface receiving waters, there is the potential for groundwater contamination. Previous research on the effects of incidental infiltration on groundwater quality indicated that the risk of contamination is minimal.

There were substantial differences in the amount of infiltration that were observed in the earthen basins during the Caltrans study. On average, approximately 40 percent of the runoff entering the unlined basins infiltrated and was not discharged. The percentage ranged from a high of about 60 percent to a low of only about 8 percent for the different facilities. Climatic conditions and local water table elevation are likely the principal causes of this difference. The least infiltration occurred at a site located on the coast where humidity is higher and the basin invert is within a few meters of sea level. Conversely, the most infiltration occurred at a facility located well inland in Los Angeles County where the climate is much warmer and the humidity is less, resulting in lower soil moisture content in the basin floor at the beginning of storms.

Vegetated detention basins appear to have greater pollutant removal than concrete basins. In the Caltrans study, the concrete basin exported sediment and associated pollutants during a number of storms. Export was not as common in the earthen basins, where the vegetation appeared to help stabilize the retained sediment.

Siting Criteria

Dry extended detention ponds are among the most widely applicable stormwater management practices and are especially useful in retrofit situations where their low hydraulic head requirements allow them to be sited within the constraints of the existing storm drain system. In addition, many communities have detention basins designed for flood control. It is possible to modify these facilities to incorporate features that provide water quality treatment and/or channel protection. Although dry extended detention ponds can be applied rather broadly, designers need to ensure that they are feasible at the site in question. This section provides basic guidelines for siting dry extended detention ponds.

In general, dry extended detention ponds should be used on sites with a minimum area of 5 acres. With this size catchment area, the orifice size can be on the order of 0.5 inches. On smaller sites, it can be challenging to provide channel or water quality control because the orifice diameter at the outlet needed to control relatively small storms becomes very small and thus prone to clogging. In addition, it is generally more cost-effective to control larger drainage areas due to the economies of scale.

Extended detention basins can be used with almost all soils and geology, with minor design adjustments for regions of rapidly percolating soils such as sand. In these areas, extended detention ponds may need an impermeable liner to prevent ground water contamination.

The base of the extended detention facility should not intersect the water table. A permanently wet bottom may become a mosquito breeding ground. Research in Southwest Florida (Santana et al., 1994) demonstrated that intermittently flooded systems, such as dry extended detention ponds, produce more mosquitoes than other pond systems, particularly when the facilities remained wet for more than 3 days following heavy rainfall.

A study in Prince George's County, Maryland, found that stormwater management practices can increase stream temperatures (Galli, 1990). Overall, dry extended detention ponds increased temperature by about 5°F. In cold water streams, dry ponds should be designed to detain stormwater for a relatively short time (i.e., 24 hours) to minimize the amount of warming that occurs in the basin.

Additional Design Guidelines

In order to enhance the effectiveness of extended detention basins, the dimensions of the basin must be sized appropriately. Merely providing the required storage volume will not ensure maximum constituent removal. By effectively configuring the basin, the designer will create a long flow path, promote the establishment of low velocities, and avoid having stagnant areas of the basin. To promote settling and to attain an appealing environment, the design of the basin should consider the length to width ratio, cross-sectional areas, basin slopes and pond configuration, and aesthetics (Young et al., 1996).

Energy dissipation structures should be included for the basin inlet to prevent resuspension of accumulated sediment. The use of stilling basins for this purpose should be avoided because the standing water provides a breeding area for mosquitoes.

Extended detention facilities should be sized to completely capture the water quality volume. A micropool is often recommended for inclusion in the design and one is shown in the schematic diagram. These small permanent pools greatly increase the potential for mosquito breeding and complicate maintenance activities; consequently, they are not recommended for use in California.

A large aspect ratio may improve the performance of detention basins; consequently, the outlets should be placed to maximize the flowpath through the facility. The ratio of flowpath length to width from the inlet to the outlet should be at least 1.5:1 (L:W) where feasible. Basin depths optimally range from 2 to 5 feet.

The facility's drawdown time should be regulated by an orifice or weir. In general, the outflow structure should have a trash rack or other acceptable means of preventing clogging at the entrance to the outflow pipes. The outlet design implemented by Caltrans in the facilities constructed in San Diego County used an outlet riser with orifices

Figure 1
Example of Extended Detention Outlet Structure

sized to discharge the water quality volume, and the riser overflow height was set to the design storm elevation. A stainless steel screen was placed around the outlet riser to ensure that the orifices would not become clogged with debris. Sites either used a separate riser or broad crested weir for overflow of runoff for the 25 and greater year storms. A picture of a typical outlet is presented in Figure 1.

The outflow structure should be sized to allow for complete drawdown of the water quality volume in 72 hours. No more than 50% of the water quality volume should drain from the facility within the first 24 hours. The outflow structure can be fitted with a valve so that discharge from the basin can be halted in case of an accidental spill in the watershed.

Summary of Design Recommendations

(1) Facility Sizing - The required water quality volume is determined by local regulations or the basin should be sized to capture and treat 85% of the annual runoff volume. See Section 5.5.1 of the handbook for a discussion of volume-based design.

Basin Configuration – A high aspect ratio may improve the performance of detention basins; consequently, the outlets should be placed to maximize the flowpath through the facility. The ratio of flowpath length to width from the inlet to the outlet should be at least 1.5:1 (L:W). The flowpath length is defined as the distance from the inlet to the outlet as measured at the surface. The width is defined as the mean width of the basin. Basin depths optimally range from 2 to 5 feet. The basin may include a sediment forebay to provide the opportunity for larger particles to settle out.

A micropool should not be incorporated in the design because of vector concerns. For online facilities, the principal and emergency spillways must be sized to provide 1.0 foot of freeboard during the 25-year event and to safely pass the flow from 100-year storm.

(2) Pond Side Slopes - Side slopes of the pond should be 3:1 (H:V) or flatter for grass stabilized slopes. Slopes steeper than 3:1 (H:V) must be stabilized with an appropriate slope stabilization practice.

(3) Basin Lining – Basins must be constructed to prevent possible contamination of groundwater below the facility.

(4) Basin Inlet – Energy dissipation is required at the basin inlet to reduce resuspension of accumulated sediment and to reduce the tendency for short-circuiting.

(5) Outflow Structure - The facility's drawdown time should be regulated by a gate valve or orifice plate. In general, the outflow structure should have a trash rack or other acceptable means of preventing clogging at the entrance to the outflow pipes.

The outflow structure should be sized to allow for complete drawdown of the water quality volume in 72 hours. No more than 50% of the water quality volume should drain from the facility within the first 24 hours. The outflow structure should be fitted with a valve so that discharge from the basin can be halted in case of an accidental spill in the watershed. This same valve also can be used to regulate the rate of discharge from the basin.

The discharge through a control orifice is calculated from:

$$Q = CA(2g(H-H_0))^{0.5}$$

where: Q = discharge (ft^3/s)
C = orifice coefficient
A = area of the orifice (ft^2)
g = gravitational constant (32.2)
H = water surface elevation (ft)
H_0= orifice elevation (ft)

Recommended values for C are 0.66 for thin materials and 0.80 when the material is thicker than the orifice diameter. This equation can be implemented in spreadsheet form with the pond stage/volume relationship to calculate drain time. To do this, use the initial height of the water above the orifice for the water quality volume. Calculate the discharge and assume that it remains constant for approximately 10 minutes. Based on that discharge, estimate the total discharge during that interval and the new elevation based on the stage volume relationship. Continue to iterate until H is approximately equal to H_0. When using multiple orifices the discharge from each is summed.

(6) Splitter Box - When the pond is designed as an offline facility, a splitter structure is used to isolate the water quality volume. The splitter box, or other flow diverting approach, should be designed to convey the 25-year storm event while providing at least 1.0 foot of freeboard along pond side slopes.

(7) Erosion Protection at the Outfall - For online facilities, special consideration should be given to the facility's outfall location. Flared pipe end sections that discharge at or near the stream invert are preferred. The channel immediately below the pond outfall should be modified to conform to natural dimensions, and lined with large stone riprap placed over filter cloth. Energy dissipation may be required to reduce flow velocities from the primary spillway to non-erosive velocities.

(8) Safety Considerations - Safety is provided either by fencing of the facility or by managing the contours of the pond to eliminate dropoffs and other hazards. Earthen side slopes should not exceed 3:1 (H:V) and should terminate on a flat safety bench area. Landscaping can be used to impede access to the facility. The primary spillway opening must not permit access by small children. Outfall pipes above 48 inches in diameter should be fenced.

Maintenance

Routine maintenance activity is often thought to consist mostly of sediment and trash and debris removal; however, these activities often constitute only a small fraction of the maintenance hours. During a recent study by Caltrans, 72 hours of maintenance was performed annually, but only a little over 7 hours was spent on sediment and trash removal. The largest recurring activity was vegetation management, routine mowing. The largest absolute number of hours was associated with vector control because of mosquito breeding that occurred in the stilling basins (example of standing water to be avoided) installed as energy dissipaters. In most cases, basic housekeeping practices such as removal of debris accumulations and vegetation management to ensure that the basin dewaters completely in 48-72 hours is sufficient to prevent creating mosquito and other vector habitats.

Consequently, maintenance costs should be estimated based primarily on the mowing frequency and the time required. Mowing should be done at least annually to avoid establishment of woody vegetation, but may need to be performed much more frequently if aesthetics are an important consideration.

Typical activities and frequencies include:

- Schedule semiannual inspection for the beginning and end of the wet season for standing water, slope stability, sediment accumulation, trash and debris, and presence of burrows.
- Remove accumulated trash and debris in the basin and around the riser pipe during the semiannual inspections. The frequency of this activity may be altered to meet specific site conditions.
- Trim vegetation at the beginning and end of the wet season and inspect monthly to prevent establishment of woody vegetation and for aesthetic and vector reasons.
- Remove accumulated sediment and re-grade about every 10 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Inspect the basin each year for accumulated sediment volume.

Cost

Construction Cost

The construction costs associated with extended detention basins vary considerably. One recent study evaluated the cost of all pond systems (Brown and Schueler, 1997). Adjusting for inflation, the cost of dry extended detention ponds can be estimated with the equation:

$$C = 12.4V^{0.760}$$

where: C = Construction, design, and permitting cost, and
V = Volume (ft^3).

Using this equation, typical construction costs are:

$ 41,600 for a 1 acre-foot pond

$ 239,000 for a 10 acre-foot pond

$ 1,380,000 for a 100 acre-foot pond

Interestingly, these costs are generally slightly higher than the predicted cost of wet ponds (according to Brown and Schueler, 1997) on a cost per total volume basis, which highlights the difficulty of developing reasonably accurate construction estimates. In addition, a typical facility constructed by Caltrans cost about $160,000 with a capture volume of only 0.3 ac-ft.

An economic concern associated with dry ponds is that they might detract slightly from the value of adjacent properties. One study found that dry ponds can actually detract from the perceived value of homes adjacent to a dry pond by between 3 and 10 percent (Emmerling-Dinovo, 1995).

Maintenance Cost

For ponds, the annual cost of routine maintenance is typically estimated at about 3 to 5 percent of the construction cost (EPA website). Alternatively, a community can estimate the cost of the maintenance activities outlined in the maintenance section. Table 1 presents the maintenance costs estimated by Caltrans based on their experience with five basins located in southern California. Again, it should be emphasized that the vast majority of hours are related to vegetation management (mowing).

Table 1 Estimated Average Annual Maintenance Effort

Activity	Labor Hours	Equipment & Material ($)	Cost
Inspections	4	7	183
Maintenance	49	126	2282
Vector Control	0	0	0
Administration	3	0	132
Materials	-	535	535
Total	56	$668	$3,132

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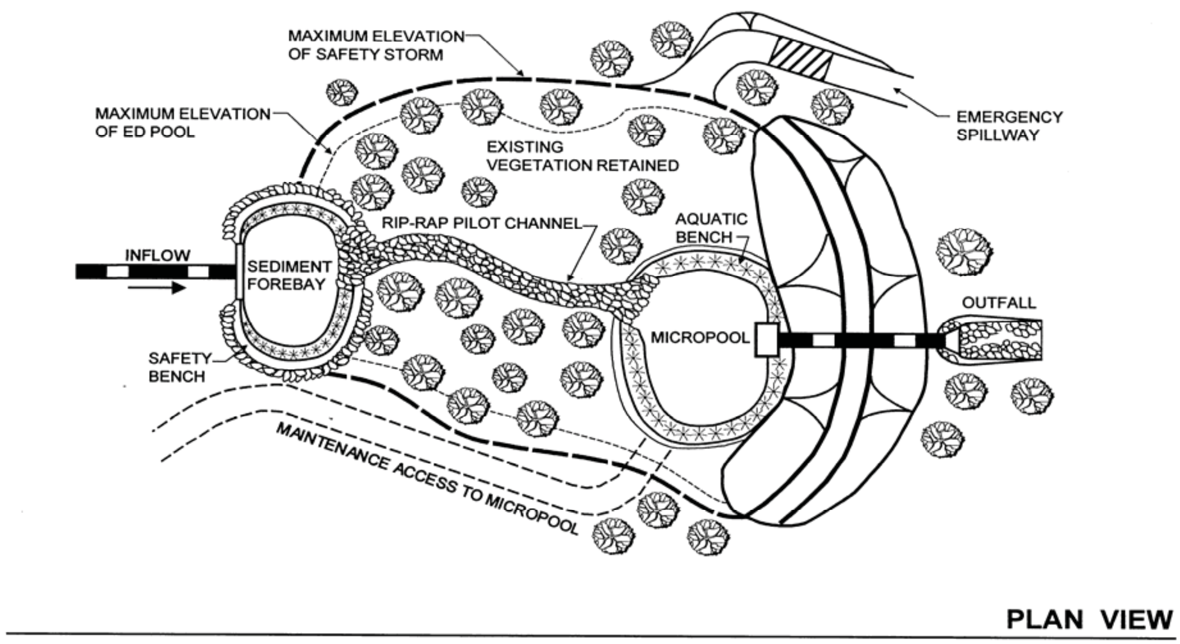

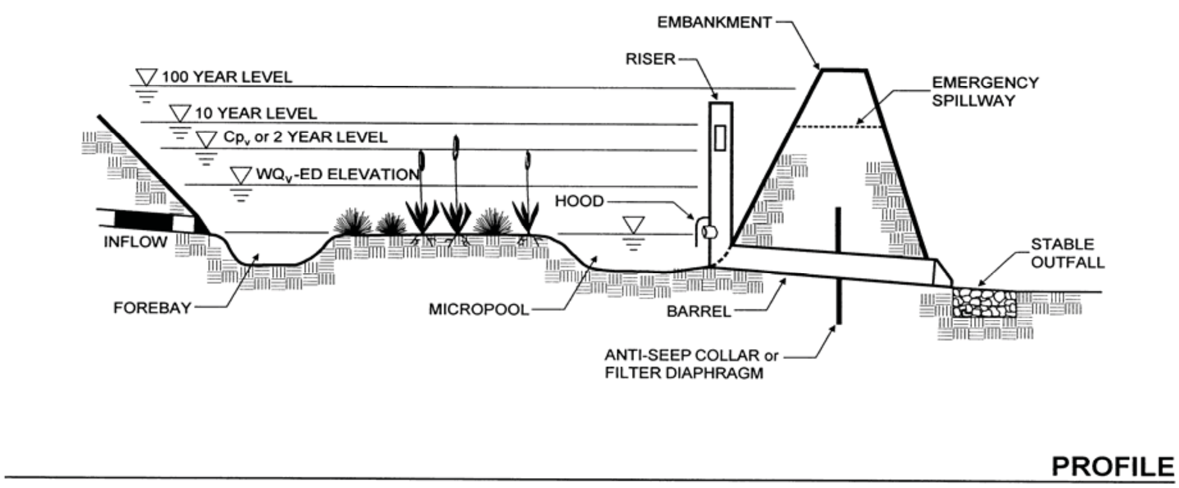

Schematic of an Extended Detention Basin (MDE, 2000)

Tule Wind Project

Major Use Permit

CEQA Drainage Study

County of San Diego

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APPENDICES

TABLES

FIGURES

EXHIBITS

EXECUTIVE SUMMARY

The purpose of this drainage study is to investigate the hydrologic and hydraulic impacts of developing approximately 77 acres in eastern San Diego County. Results from hydrologic analysis will be included in the Tule Wind Major Use Permit (MUP) application to the County of San Diego. Analysis detail is appropriate for an MUP level hydrology study.

This report discusses the methodology and assumptions for the hydrologic and hydraulic analysis performed for the Project. Discussion and comparison of existing and proposed hydrologic conditions identifies qualitative and quantitative Project impacts on local hydrologic conditions.

The hydrologic analysis was completed per the June 2003 San Diego County Hydrology Manual. Existing conditions hydrologic modeling was completed. Proposed conditions were determined to be identical within the accuracy of hydrology calculations; therefore, no impacts were identified.

Hydrologic analysis and hydraulic computations were conducted on proposed road crossing locations in order to appropriately size at-grade crossings and to identify upstream limits of inundation. Hydraulic calculations were complete in accordance with the July 2005 San Diego County Drainage Design Manual.

Report analyses conclude that there are no impacts from local development on watershed runoff. Hydraulic analyses demonstrate drainage crossings will be constructed to meet the County of San Diego standards. Overall site development should have less than significant impact on the drainage patterns of the overall system and will be designed to meet all County of San Diego criteria.

1.0 PROJECT DESCRIPTION

The Tule Wind Project (Project) proposes to develop a wind turbine “farm” for power generation, in the County of San Diego, in the State of California. The Project area is located in the eastern portion of San Diego County, approximately 50 miles east of City of San Diego, 90 miles west of Arizona, and north of the community of Boulevard (see Figure 1). The area is accessible via Interstate 8 (I-8), State Route 94 (SR-94) and Ribbonwood Road junction, and McCain Valley Road off of Old Highway 80. The majority of the Project area lies in the In-Ko-Pah Mountains adjacent to the Tecate Divide, south of the Cleveland National Forest. The topography of the area is gently-to-steep sloping with an elevation ranging between about 3,500 and 5,800 feet above mean sea level. The Project area contains lands administered by the BLM, the Ewiiaapaayp Reservation, the Campo and Manzanita Reservations (access only), the California State Lands Commission (CSLC), and privately-owned parcels under the jurisdiction of the County of San Diego. This report will focus exclusively on the lands under the jurisdiction of the County of San Diego.

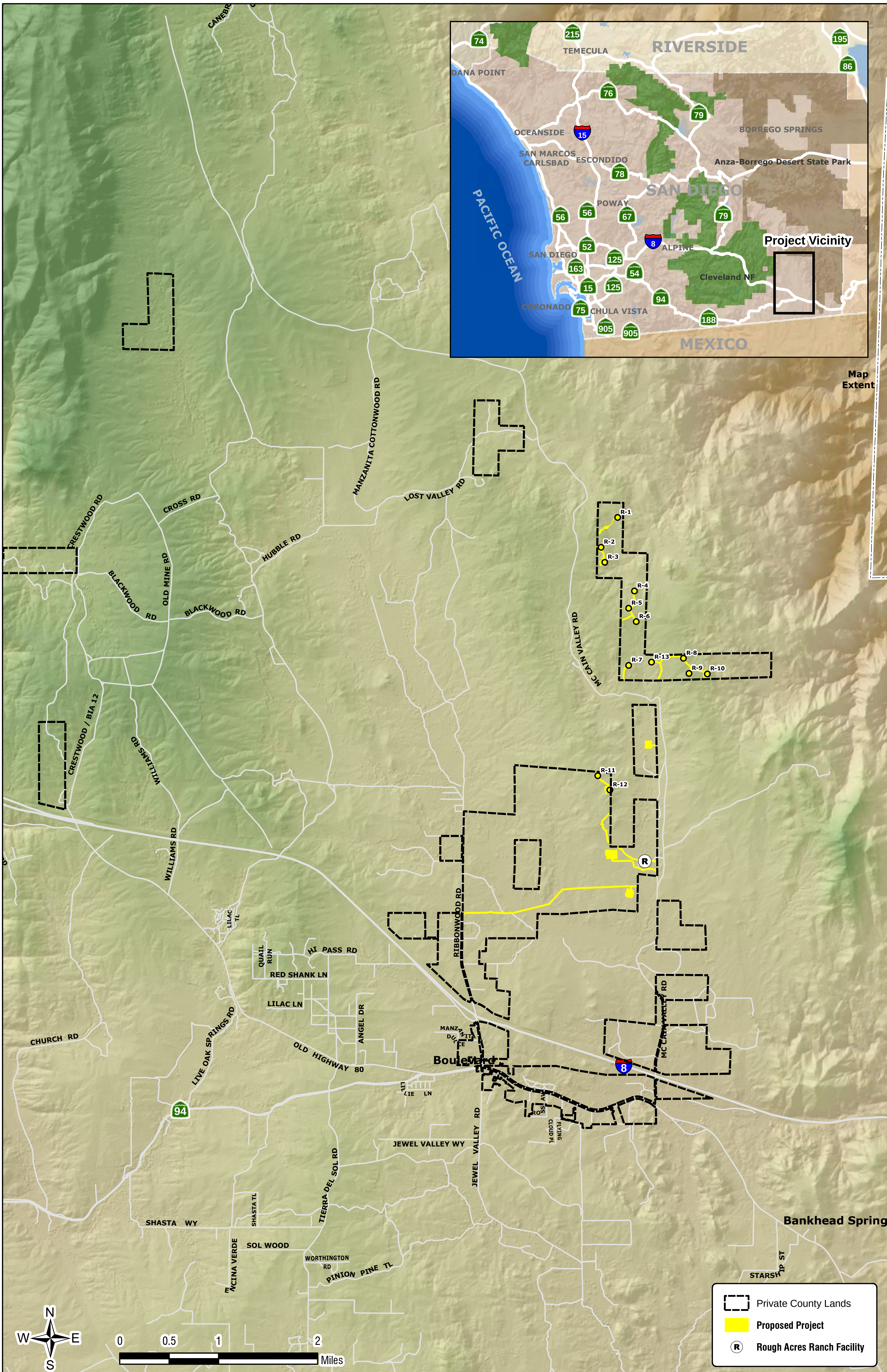
The Project area is not located within any FEMA designated floodplains. Firm panels 06073C1800F, 06073C1825F, 06073C2075F, and 06073C2100F collectively cover the Project site and indicate the Project site is Zone D, area of undetermined but possible flood hazards.

Total Project site area proposed on County of San Diego regulated lands is approximately 1,982 acres, which will permanently impact approximately 77 acres. Total disturbed areas, including temporary construction impacts (widened access roads, trenching, etc), are approximately 127 acres. From a drainage standpoint, all analysis and design addresses permanent impacts only, as additional temporary impacts will be returned to a naturally vegetated state upon completion of the Project.

Under existing conditions the Project site is mainly undeveloped naturally vegetated rocky hills. A number of existing access roads traverse the area, providing service routes to existing utility facilities, rural houses, agricultural facilities, and a landing strip. Naturally occurring native vegetation is predominant throughout the site, with periodic scattered unvegetated rock outcroppings.

Development within the jurisdiction of the County of San Diego will consist of up to 13 wind turbines, 34.5 kilovolt (kV) overhead and underground collector lines, a collector substation site, multiple operation and maintenance building sites, access roads between turbines, and improvements to existing roads to provide site access. A number of operation and maintenance building locations have been developed to provide Project flexibility, all of which were included in evaluations in order to conservatively account for all potential improvements.

Project development proposes up to 13 wind turbines, ranging in size between 328 feet in height to 492 feet in height. Turbines are constructed with a 48-foot diameter concrete foundation. Concrete foundations slope away from the centrally located turbine and will be buried greater than half a foot, so that exposed concrete foundations are approximately 6 inches to 8 inches thick and 18 feet to 20 feet in diameter. Turbines also include five-foot by nine-foot concrete pads for transformer foundations. Graded dirt pads around the turbines will be an approximately 200-foot radius.



Vicinity Map

FIGURE 1

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy

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Access roads between turbines will be 36 feet wide to accommodate self propelled cranes and supply trucks, while access roads to the turbine strings will only need to be 24 feet wide, as the crane and other assembly equipment can be brought onsite in pieces. Thirty-six-foot access roads between turbines are intended to be temporary for construction activities and will be allowed to revegetate to a 24-foot width, pending construction completion. Proposed access road alignments will follow existing access roads to the maximum extent practicable to limit the amount of additional disturbed areas. New access roads will follow existing contours to maximum extent practicable to limit the amount of disturbed areas resulting from grading cuts.

Operation and maintenance facility pads and substation pads will be graded to allow for construction of the required facilities and the accompanying access and operation spaces. Impervious areas associated with these facilities will be minimal, limited to the structures themselves. All access and parking areas will be constructed of permeable materials. Additionally, there is the potential for detention basins attached to these graded pads, in order to adequately address water quality concerns.

Electrical collector lines for the Project will be a combination of overhead and buried, with a majority being buried. Overhead collector lines will be supported by single steel or wood poles; typically 60 feet to 80 feet in height. Foundation footprints for collector line poles will be similar to the diameter of the pole itself. Collector line temporary disturbed widths are assumed to be 24 feet to allow construction vehicle access and trenching or pole erection. After construction, native vegetation will be established over collector line access roads. All buried collector lines will be completely re-vegetated.

Project development will increase impervious areas by a very small amount. Each turbine pad represents approximately 360 square feet of impermeable area. Permanent Project impacts investigated for drainage are approximately 77 acres, which conservatively assumes development of all operation and maintenance siting alternatives. Overall Project development proposes to increase impervious area by approximately 23,669 square feet (0.7% of the 77 acres of permanently disturbed area) or .003% of the total basin area.

2.0 DRAINAGE PATTERNS

Existing and proposed drainage patterns for the Project site are defined below.

2.1 EXISTING DRAINAGE PATTERNS

A number of existing streams will convey flows generated by the Project. The Project drains to the east, ultimately discharging into the Salton Sea.

A northeastern ridgeline crosses the Project, dividing flows southwest into Tule Creek and northeast into Carrizo Wash, Bow Willow Creek, and Canebrake Wash. Approximately one third of the Project drains to Tule Creek via McCain Valley and Lark Canyon. Tule Creek flows are conveyed southeast into Tule Lake, which discharges into Tule Canyon, then converges with Carrizo Wash in Carrizo Gorge. All flows in Carrizo Wash are then conveyed into San Felipe Creek and the Salton Sea. The Salton Sea is a minimum of approximately 45 miles downstream of the Project. See Figure 2 below.

2.1.1 Tule Creek Basin

Tule Creek Basin containing the Project site includes an expansive upstream area draining approximately 18,250 acres and has an approximately 12.1 mile long flow path. The highest upstream point in the basin is at approximately 5,800 feet and the downstream most point is at approximately 3,475feet. Upper reaches of Tule Creek and its tributaries are generally fairly steep and confined to mountainous gullies. Tule Creek in the vicinity of the Project flattens out and takes on the form of a meandering stream in a wider valley with floodplains and flatter fields. See Exhibit A.

Runoff sheet flows across the ground surface until it encounters rivulets which then discharge into larger streams which ultimately discharge into Tule Creek. Precipitation that falls on typical access roads sheet flows off the side of the road where it is collected either in swales running parallel to the road or sheet flows across the surrounding terrain. Swales carry runoff to streams crossing the access road, where it is then conveyed to Tule Creek. There are no major improvements to the drainage features within the basin. However, a number of culverts have been installed on the northeast portion of the drainage basin to facilitate the construction of access roads across the smaller drainage features. An unnamed tributary to Tule Creek along the northeastern edge of the basin crosses a number of public and private roads via culverts just east of the landing strip. Crossings relevant to this Project include two 36-inch culverts for a private road and one 36-inch culvert for McCain Valley Road. Several access roads utilize a depressed on grade type crossing, where flows are conveyed across the top of the road, rather than constructing culverts to carry flows under the road. An existing access road crossing Tule Creek within the Project limits near the downstream half of the basin has this type of crossing.

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Receiving Waters

FIGURE 2

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Drainage patterns are similar to the previously discussed basins; precipitation will sheet flow into small rivulets that will join with surrounding streams and eventually discharge into Carrizo Wash. Roads in the Unnamed Eastern Wash basin are primarily double track trails and do not have any associated drainage improvements.

2.1.3 Unnamed Southern Wash / System 1200

A portion of the Project site is located in an approximately 486 acre basin that drains to Carrizo Gorge. The drainage basin has a maximum flow path of 1.5 miles with a maximum elevation of 4,065 feet and a minimum elevation of 3,200 feet. A ridge divides the basin into a northern and southern portion, each draining into two respective streams. Both streams then join at a confluence at the bottom of the drainage basin, as shown on Exhibit A. Topography for System 1200 is mountainous with streams confined in steep gullies.

Generally, drainage is similar to the Unnamed Eastern Wash; rainfall sheet flows into rivulets and then into larger streams. Terrain is predominantly rocky and steep and will not provide substantial opportunity for infiltration. There are an extremely limited number of roads in the basin; most are single track trails. There are no existing improvements to the drainage features in the basin, given the limited amount of development in the basin.

2.2 PROPOSED DRAINAGE PATTERNS

Proposed Project improvements will aim to mimic existing drainage patterns and will minimize redirection of any flows. Improvements include graded pads, access roads, utility lines, and engineered crossings at each drainage feature. Project improvements propose minimal additional impervious areas. Any increase in runoff resulting from these impacts is determined to be negligible, from a flood impact standpoint, with water quality impacts addressed in the Storm Water Management Plan published under a separate cover by HDR.

2.2.1 Tule Creek Basin

Tule Creek Basin drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 0.3% of the area. Existing drainage patterns within the basin will be maintained.

Access roads will be improved or created throughout the basin connecting turbine pads. McCain Valley Road serves as a central corridor for this access, as well as improved roads aboard Rough Acres Ranch. Drainage of access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features. Construction of access roads will not create diversion of existing flows.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 21,155 square feet impervious areas or 0.003% of basin total area). Impervious areas include the area of six turbine pads, three operational and maintenance (O&M) facilities, and one substation. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

2.1.2 Unnamed Eastern Wash

Eastern portions of the Project site lie within an approximately 734 acre basin that drains to an unnamed wash. Basin drainage has a maximum flow path of approximately 1.9 miles, with a maximum elevation of 4,125 feet and a minimum elevation of 3,620 feet. The Unnamed Eastern Wash basin drains to confined mountainous gullies that are steep and rocky. See Exhibit A.

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Generally, drainage is similar to the Unnamed Eastern Wash; rainfall sheet flows into rivulets and then into larger streams. Terrain is predominantly rocky and steep and will not provide substantial opportunity for infiltration. There are an extremely limited number of roads in the basin; most are single track trails. There are no existing improvements to the drainage features in the basin, given the limited amount of development in the basin.

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Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 21,155 square feet impervious areas or 0.003% of basin total area). Impervious areas include the area of six turbine pads, three operational and maintenance (O&M) facilities, and one substation. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located mainly in the northeastern corner of the basin. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.2 Unnamed Eastern Wash Basin

Unnamed Eastern Wash Drainage Basin drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 2.8% of the basin area. Existing drainage patterns within the basin will be substantially maintained.

Access roads connect two strings of turbines, located roughly in the center of the basin. These connect to McCain Valley Road. Drainage of access roads will be facilitated by brow ditches/swales parallel to proposed roads, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 1,796 square feet impervious areas or 0.006% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of basin turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Transmission lines traverse the basin. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

2.2.3 Unnamed Southern Wash / System 1200

Unnamed Southern Wash drainage patterns will not be altered significantly in proposed conditions. Almost all flow generated by the basin is from existing areas with proposed improvements taking up less than 1.3% of the basin area. Existing drainage patterns within the basin will be substantially maintained.

A single access road connects one string of turbines located on the basin's northern boundary. Drainage of this access road will be facilitated by brow ditches/swales parallel to the proposed road, which will convey flows to existing surface drainage features.

Precipitation falling on the exposed portions of the turbine pads will sheet flow off the proposed features and finished surfaces (a total of roughly 718 square feet impervious areas or 0.003% of basin total area) to surrounding brow ditches/swales. Impervious areas include the area of two turbine pads. Runoff from exposed turbine pads will drain through a layer of gravel surrounding each pad. Runoff will then be directed into the surrounding existing natural drainage features, with overall flow patterns intended to mimic existing drainage features.

Proposed collector lines will be located in conjunction with the turbines. Minor effects on drainage patterns will only be prevalent during construction. Once the collector lines are either hung or buried the surrounding vegetation and grades will be restored to existing conditions. In the long term, existing drainage patterns within the basin will be maintained.

3.0 HYDROLOGY

Hydrologic analysis was completed for the entire project area in order to determine a baseline existing condition and to account for changes due to proposed development. The three distinct watersheds dividing the Project area were studied for existing and proposed conditions. Sub-basins formed by grading and requiring a hydraulically designed road crossing structure were analyzed under proposed conditions.

3.1 HYDROLOGY METHODOLOGY

Existing and proposed hydrology calculations were both completed per the *San Diego County Hydrology Manual*, June 2003 Rational Method criteria. A summary of the hydrology criteria is presented in Table 1. Appendix A contains *County of San Diego Hydrology Manual* runoff coefficient, rainfall intensity, and overland flow time of concentration figures used in calculations.

Table 1. Hydrology Methodology

Land Use:	SANDAG provided land use overlay dated 2009 and associated cover descriptions in Table 4-2 of 2003 *County of San Diego Hydrology Manual*
Precipitation Zone Number	Per PZN Map (Appendix C) of 2003 *County of San Diego Hydrology Manual*
Design Storm:	100 year
Rainfall Intensity:	Per Isopluvial Maps (Appendix B) of 2003 *County of San Diego Hydrology Manual*
Soil Data:	NRCS, SSURGO Database
Topographic Data:	2' Project Flown Contours 20' IFSAR Topo provided by SANDAG

Land use was defined based on data provided by SANDAG, which was then used to select the runoff coefficient from Table 4-2 of the *County of San Diego Hydrology Manual*. Soil type data was derived from the Natural Resources Conservation Service (NRCS) Soil Survey Geographic (SSURGO) Database for California. Rainfall intensities and Precipitation Zone Numbers (PZN) were taken from Appendices B and C of the *County of San Diego Hydrology Manual*, respectively.

ArcMap 9.3.1 was utilized to process all geographic data and to determine appropriate inputs for hydrologic modeling. Existing and proposed drainage basins, flow paths and basin area centroids were all developed within ArcMap. The hydrologic modeling was completed through the use of Civil Design Hydrology software (CivilD) and the San Diego County specific module.

3.2 EXISTING CONDITIONS

3.2.1 Universal Unit Hydrograph

The Universal Unit Hydrograph Method was used to analyze all nodes with basins larger than 640 acres. Basin areas, flow path lengths and length to centroid values were all determined using ArcMap.

Area averaged rainfall intensities were determined for each individual basin for the 100-year 24-hour and 100-year 6-hour events. Precipitation zone numbers (PZN), important in San Diego County's method for curve number adjustment, were interpolated for each basin using the basin area centroid.

An area averaged composite runoff curve number (CN) was determined for each basin through tabulating data for combinations of land use and soil type. Land use information was matched to the cover descriptions assigned in the *County of San Diego Hydrology Manual,* Table 4-2 and were verified through site visits. Curve numbers were manually adjusted per Tables 4-6 and Table 4-10 of the *County of San Diego Hydrology Manual,* using the interpolated PZN values.

Basin lag time was entered into CivilD directly and calculated independently using the United States Army Corps of Engineers (Corps lag) empirical equation, as referenced in *County of San Diego Hydrology Manual*.

Separate hydrologic models were created for the 100-year 24-hour and 100-year 6-hour events, with the intent of determining the maximum peak discharge of the two.

3.2.2 Rational Method

The San Diego County 2003 Rational Method program within CivilD was utilized in calculating runoff for all basins smaller than 640 acres in size. Initial areas and basin subareas were developed within ArcMap per the *County of San Diego Hydrology Manual*.

The 6-hour and 24-hour rainfall intensities were determined through the interpolation of isopluvial information using the basin area centroid.

Land use development type was assumed to be low density residential, specifically, one density unit per acre or less, with an impervious fraction of 10%. Per the *County of San Diego Hydrology Manual* this is the land use type to be used for open undeveloped areas with a possibility for future development. Soil type data was again derived from the NRCS SSURGO Database and analyzed for each basin subarea for model input.

3.3 PROPOSED CONDITIONS

3.3.1 Universal Unit Hydrograph

Identical methods and assumptions were made for proposed conditions Unit Hydrograph analysis. Disturbed areas resulting from proposed conditions were assumed to be bare earth for the cover description. Composite curve numbers were recalculated to account for proposed conditions. It was determined that the PZN adjusted curve numbers for input into CivilD were within rounding error of the existing condition curve numbers and therefore proposed conditions results did not vary from existing conditions results (see Appendix D). As stated in the Section 1.0 Project Description, drainage analysis conservatively included the cumulative proposed impacts from multiple operation and maintenance building alternatives. This is a further indication that actual differences between existing and proposed conditions are even closer than the rounding errors determined in this study, and again indicating that drainage patterns within the Project area will be maintained. See Appendices B and D to review existing and proposed summaries.

3.3.2 Rational Method

Identical methods and assumptions were made for proposed conditions Rational Method analysis. Existing conditions assumed a land use development type of low density residential, specifically, one density unit per acre or less, with an impervious fraction of 10%. Proposed conditions would not increase developed density or impervious fraction past the 10% threshold, and therefore proposed condition results would not vary from existing conditions results. Existing drainage patterns within the Project area will be maintained.

3.4 HYDROLOGY RESULTS

Existing condition hydrology results are summarized for each major drainage basin/system in Tables 2 and 3. Per County of San Diego Hydrology Manual methodology, inputs for modeling proposed conditions did not vary from existing conditions. As such, existing and proposed runoff was identical. See Appendix C for CivilD output.

Table 2. Existing Conditions Hydrology Results, Unit Hydrograph

Basin	Area (acres)	Adjusted PZN (>35yr)	Adjusted CN (>35yr)	Peak Flow (cfs)
Tule Creek	18250	2.58	82	12730
Unnamed Eastern Wash	734	2.45	85	808

Table 3. Existing Conditions Hydrology Results, Rational Method

Basin/System	Area (acres)	Effective C Value	Discharge (cfs)
1200	485.64	0.384	530.45

3.5 HYDROMODIFICATION

The County of San Diego requires a discussion on the proposed Hydromodification Plan (HMP) to be included in all drainage studies. Discussions with the County of San Diego Department of Public Works concluded the Project is outside of the Phase I NPDES permit jurisdiction and as such will not be required to complete a hydromodification analysis for the County. General Construction Permit post-construction BMPs are intended to address hydromodification for areas outside of Phase I and Phase II NPDES permits, which will apply to the Project. These post-construction BMP requirements will go into effect September 2012, and are expected to evolve over the upcoming implementation period. As the criteria currently stand, the Project will be required to complete a Water Balance Calculator summary to identify increases in flows of concern. Mitigation measures are included in the Water Balance Calculator and will be used to address any impacts from Project development on the watersheds. Revisions to the Storm Water Management Plan (SWMP) during final engineering will clearly identify any needed mitigation features for the Project.

4.0 CROSSING HYDRAULICS

Hydraulic analysis was completed on all identified stream crossing locations in order to adequately size the facility. Hydrologic analysis was conducted at each location under proposed conditions in order to obtain a design flow. This is in addition to what is described in Section 3.0, but based on the same methodology.

4.1 CROSSING HYDROLOGY

Crossing hydrology calculations were per the *San Diego County Hydrology Manual*, June 2003 Rational Method criteria. A summary of the hydrology criteria is presented in Table 1. Appendix E contains County of San Diego Hydrology Manual runoff coefficient, rainfall intensity, and overland flow time of concentration figures used in calculations.

4.1.1 Unit Hydrograph Basins

The Universal Unit Hydrograph Method was used to analyze all crossings with associated basins larger than 640 acres. Three crossings were identified requiring a Unit Hydrograph analysis.

These basins were analyzed in a similar fashion to that of the existing and proposed Unit Hydrograph basins above in Section 3.0.

Separate hydrologic models were created for the 100-year 24-hour and 100-year 6-hour events, with the intent of determining the maximum peak discharge of the two. Table 4 provides a summary of the inputs and results.

Table 4. Unit Hydrograph Basin Summary

Basin/Crossing	Area (acres)	Rainfall Intensity 100Yr 6Hr	Rainfall Intensity 100Yr 24Hr	Adjusted CN (>35yr)	100 Year Peak Discharge (cfs)
Tule Creek	13851	3.47	6.69	81	10607
McCain 1	2186	3.00	5.07	83	1487
McCain 2	2256	3.00	5.07	83	1562

4.1.2 Rational Method Systems

There were 16 identified crossing in 15 systems of less than 640 acres in the Project site. The San Diego County 2003 Rational Method program within CivilD was utilized in calculations. Initial areas and basin subareas were developed within ArcMap per the *County of San Diego Hydrology Manual*.

The Project site is mainly located between two isopluvials for the 100-year 6-hour and 24-hour intensities. To be conservative, the highest intensities adjacent to the Project site were used, specifically 3.5 inches and 6 inches.

These systems were analyzed in a similar fashion to that of the Rational Method existing and proposed conditions analysis above in Section 3.0, with the exception of rainfall intensity. Table 5 provides a summary of the inputs and results.

Table 5. Rational Method System Summary

System/ Crossing	Area (acres)	Rainfall Intensity 100Yr 6Hr	Rainfall Intensity 100Yr 24Hr	Effective C Value	Discharge (cfs)
1.3	10.37	3.5	6	0.41	24.6
2.3	13.87	3.5	6	0.41	38.7
3.3	6.12	3.5	6	0.32	9.4
3.4	16.58	3.5	6	0.32	23.3
4.3	0.83	3.5	6	0.32	1.6
5.3	21.66	3.5	6	0.288	25.4
6.3	56.57	3.5	6	0.321	77.4
7.3	21.93	3.5	6	0.32	30.3
8.3	20.38	3.5	6	0.321	29.8
9.3	2.55	3.5	6	0.32	4.3
10.3	20.75	3.5	6	0.326	31.5
11.3	3.74	3.5	6	0.32	5.8
12.3	34.70	3.5	6	0.327	54.4
13.3	57.83	3.5	6	0.336	84.7
14.5	422.76	3.5	6	0.342	432.0
15.3	5.97	3.5	6	0.32	10.9

4.2 CROSSING HYDRAULICS

Hydraulic calculations were completed for each identified crossing for the peak 100-year design discharge. All proposed crossings are at-grade crossings with no low flow culverts and were sized to meet County of San Diego standards.

4.2.1 Crossing Geometry

Three parameters guided the geometry of crossing design. First, per County of San Diego Design Standard 14, low flow culverts are not required for at-grade crossings if the 10 year flow could be conveyed at 10 inches of depth or less over the crest of the crossing. All crossings were designed to ensure this standard was met. Second, specific grade requirements had to be met to facilitate the expected vehicular traffic. A maximum of 6 inches of elevation change could occur for every 50 feet of road. This resulted in gradual approaches into the crossing geometry. Finally, 1-foot of freeboard between the 100-year water surface elevation and the crest of the approach is required.

A standard crossing geometry was developed for use on the majority of the crossings. This crossing is 200 feet wide from approach to approach and is 3 feet deep at the invert. Again, no low flow culverts were used. The standard crossing will be constructed with articulated concrete blocks to provided stability during the design event. See Appendix F for crossing plates.

For larger design flows, specifically the Unit Hydrograph basins of Table 4 and Crossing 14.5 of Table 5, this standard geometry was widened at the invert to accommodate their respective design flows. Both approaches remain the same, but horizontal invert bottom width was added as needed. These crossing will be constructed out of reinforced concrete due to their large size.

Scour protection will be incorporated into the design of each crossing in order to guard against road embankment scour, flow contraction scour, and scour occurring immediately downstream of the crossing. Further development of the scour protection and design will be addressed during final engineering.

4.2.2 Hydraulic Calculations and Results

Hydraulic calculations were completed through the use of Bentley's Culvert Master v.3.1. The standard broad crested weir equation was used with weir coefficient based upon the County of San Diego Drainage Design Manual. Solving for the headwater depth, rating curves were developed for the standard crossing geometry utilized by most of the crossings and for each crossing requiring an expanded version of the typical geometry. These rating curves ultimately provided information to determine the upstream limits of inundation during the design 100-year event as well as ensured the County's hydraulic requirements were met.

All crossings in Table 6 allow for less than 10" of depth for the design 100-year flow, and therefore surpass County requirements. All crossings in Table 7 meet the 10 inches of depth for the 10-year flow. All crossings in the project area maintain 1-foot of freeboard for the design 100- year flows and meet the Project specific road grade restrictions.

Table 6. Standard Crossing Geometry Results

System	Node/Crossing	100 Year Design Flow (cfs)	Head Water Depth (ft)	Crossing Width (ft)
1	1.3	24.6	0.45	200
2	2.3	38.7	0.58	200
3	3.3	9.42	0.27	200
3	3.4	23.3	0.42	200
4	4.3	1.6	0.05	200
5	5.3	25.4	0.45	200
6	6.3	77.4	0.78	200
7	7.3	30.3	0.51	200
8	8.3	29.8	0.46	200
9	9.3	4.3	0.12	200
10	10.3	31.5	0.50	200
11	11.3	5.8	0.17	200
12	12.3	54.4	0.65	200
13	13.3	84.7	0.81	200
15	15.3	10.9	0.30	200

Table 7. Expanded Crossing Geometry Results

Basin/System	Crossing	Event	Design Flow (cfs)	Head Water Depth (ft)	Crossing Width
Tule	Tule	100 Yr	10607.4	1.80	1600
		10 Yr	3249.8	0.830	1600
McCain Valley 1	McCain Valley 1	100 Yr	1487	1.58	375
		10 Yr	487	0.80	375
McCain Valley 2	McCain Valley 2	100 Yr	1562	1.62	375
		10 Yr	498	0.81	375
System 14	14.5	100 Yr	432	0.98	300
		10 Yr	221	0.66	300

5.0 CONCLUSION

Based on a preliminary investigation of the proposed Project plan and the existing drainage patterns, impacts from proposed development are less than significant. Project development will not significantly affect existing drainage patterns and will result in no major flow diversions. Increases in runoff resulting from low frequency storm events associated with flooding will be less than significant, due to the limited amount of proposed impervious area.

Hydraulic analysis was completed for the Project to determine flow rates at specific locations within the studied basins in order to size proposed drainage facilities at road crossings. At-grade crossings were sized to meet County of San Diego requirements. Further hydraulic analysis and design modifications will be complete during final engineering.

APPENDIX A
Hydrology Exhibits

Exhibits A-1: Soils
Exhibits A-2: Land Use
Exhibits A-3: Precipitation

HDR
ONE COMPANY | Many Solutions

Soils Map

EXHIBIT A1

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

ONE COMPANY | Many Solutions

Landuse Map

EXHIBIT A2

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

ONE COMPANY | Many Solutions

Precipitation

EXHIBIT A3

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

APPENDIX B
Existing Conditions Hydrology Summary Tables

Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

Existing Conditions, Unit Hydrograph

Watershed Loss

Watershed	A (mi^2)	A (ac)	CN (AMC II)	PZN	PZN (>35yr)	CN (>35yr)	Soil Type
Tule Creek	28.52	18250	74	3.42	2.58	82	2.1
Eastern Unnamed Wash	1.15	734	80	3.55	2.45	85	2.7

Watershed Lag Time

Watershed	Elev US (ft)	Elev DS (ft)	L (mi)	Lca (mi)	Slope (ft/mi)	Basin n	m	lag (hr)
Tule Creek	5802.5	3473	12.13	5.14	192	0.040	0.38	1.70
Eastern Unnamed Wash	4125	3620	1.91	0.74	265	0.040	0.38	0.38

Precipitation Data

Watershed	100Yr 6Hr	100Yr 24Hr
Tule Creek	3.36	6.31
Eastern Unnamed Wash	3.00	5.01

$$lag = 24n\left(\frac{L \bullet L_{ca}}{S^{0.5}}\right)^m$$

Hydrology Results (Civil D), cfs

Watershed	100Yr 6Hr	100Yr 24Hr
Tule Creek	8790.33	12729.94
Eastern Unnamed Wash	808.32	597.93

Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

Existing Conditions, Rational Method

System	Leg (HDR Node to HDR Node)	Acres	Reach Length	US Elevation	DS Elevation	Soil Group	Soil Group Fraction	Precip 100Yr-6Hr	Precip 100Yr-24Hr	100 Year Runoff
	Initial Area	0.625771	307.19	4047.50	4025.00	B	1.00			1.25
	1200.2 to 1200.3	15.446776	1873.92	4025.00	3840.0	B	0.59			21.43
						D	0.41			
	1200.3 to 1200.4	77.940309	2095.45	3840.0	3606	B	0.19			110.44
						D	0.81			
	1200.4 to 1200.8	116.929537	3996.967	3606	3200	A	0.13			218.15
						B	0.03			
1200						D	0.84	3.00	5.05	
	Initial Area	0.604217	203.19	3965.00	3935.00	B	1.00			1.45
	1200.6 to 1200.7	51.378199	2829.61708	3935.00	3730.0	B	0.29			83.07
						D	0.71			
	1200.7 to 1200.8	223.611859	3560.76	3730.0	3200	A	0.052			374.84
						B	0.084			
						D	0.863			
	Total at Confluence	486.56								530.45

HDR

Project: **Tule Wind**
Subject:
Task:
Job#:

Unit Hydrograph Rainfall

100 Yr 6 Hour

FID	Watershed	Rainfall	Acres	Acres*Rainfall	Area Averaged Rainfall (in)
	Tule Creek	4	1518.463274	6074	
		3	6758.893749	20277	
		3.5	9972.741476	34905	
		Totals	18250.0985	61255	3.356427337
	Unnamed Eastern Wash	3	734.4312233	2203	
		Totals	734.4312233	2203	3

100 Yr 24 Hour

FID	Watershed	Rainfall	Acres	Acres*Rainfall	Area Averaged Rainfall (in)
	Tule Creek	10	309.1901693	3092	
		5	3912.209291	19561	
		8	4163.427072	33307	
		6	9865.271967	59192	
		Totals	18250.0985	115152	6.309664385
	Unnamed Eastern Wash	6	6.787032388	41	
		5	727.6441909	3638	
		Totals	734.4312233	3679	5.009241209

Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

Unnamed Eastern Wash Existing Curve Number

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
	18250							74	1346448	2.1
Tule Creek	0.043088	1000	Spaced Rural Residential				A	50	2.15	1
Tule Creek	0.104102	1000	Spaced Rural Residential				A	50	5.21	1
Tule Creek	0.146983	1000	Spaced Rural Residential				A	50	7.35	1
Tule Creek	0.18566	1000	Spaced Rural Residential				A	50	9.28	1
Tule Creek	0.307448	1000	Spaced Rural Residential				A	50	15.37	1
Tule Creek	2.45739	1000	Spaced Rural Residential				A	50	122.87	1
Tule Creek	2.572043	1000	Spaced Rural Residential				A	50	128.60	1
Tule Creek	6.713096	1000	Spaced Rural Residential				A	50	335.65	1
Tule Creek	7.452114	1000	Spaced Rural Residential				A	50	372.61	1
Tule Creek	9.67432	1000	Spaced Rural Residential				A	50	483.72	1
Tule Creek	9.816206	1000	Spaced Rural Residential				A	50	490.81	1
Tule Creek	9.917752	1000	Spaced Rural Residential				A	50	495.89	1
Tule Creek	10.17541	1000	Spaced Rural Residential				A	50	508.77	1
Tule Creek	12.2153	1000	Spaced Rural Residential				A	50	610.77	1
Tule Creek	12.68086	1000	Spaced Rural Residential				A	50	634.04	1
Tule Creek	13.63845	1000	Spaced Rural Residential				A	50	681.92	1
Tule Creek	14.4015	1000	Spaced Rural Residential				A	50	720.08	1
Tule Creek	18.1944	1000	Spaced Rural Residential				A	50	909.72	1
Tule Creek	21.37183	1000	Spaced Rural Residential				A	50	1068.59	1
Tule Creek	25.76366	1000	Spaced Rural Residential				A	50	1288.18	1
Tule Creek	25.91156	1000	Spaced Rural Residential				A	50	1295.58	1
Tule Creek	27.33742	1000	Spaced Rural Residential				A	50	1366.87	1
Tule Creek	27.62886	1000	Spaced Rural Residential				A	50	1381.44	1
Tule Creek	29.43853	1000	Spaced Rural Residential				A	50	1471.93	1
Tule Creek	32.77032	1000	Spaced Rural Residential				A	50	1638.52	1
Tule Creek	42.71826	1000	Spaced Rural Residential				A	50	2135.91	1
Tule Creek	74.33333	1000	Spaced Rural Residential				A	50	3716.67	1
Tule Creek	78.14983	1000	Spaced Rural Residential				A	50	3907.49	1
Tule Creek	82.03509	1000	Spaced Rural Residential				A	50	4101.75	1
Tule Creek	173.7482	1000	Spaced Rural Residential				A	50	8687.41	1
Tule Creek	0.04751	1000	Spaced Rural Residential				B	69	3.28	2
Tule Creek	0.339073	1000	Spaced Rural Residential				B	69	23.40	2
Tule Creek	0.611627	1000	Spaced Rural Residential				B	69	42.20	2
Tule Creek	0.835743	1000	Spaced Rural Residential				B	69	57.67	2
Tule Creek	1.027563	1000	Spaced Rural Residential				B	69	70.90	2
Tule Creek	1.227552	1000	Spaced Rural Residential				B	69	84.70	2
Tule Creek	1.281048	1000	Spaced Rural Residential				B	69	88.39	2
Tule Creek	1.401359	1000	Spaced Rural Residential				B	69	96.69	2
Tule Creek	1.597418	1000	Spaced Rural Residential				B	69	110.22	2
Tule Creek	2.849452	1000	Spaced Rural Residential				B	69	196.61	2
Tule Creek	3.069729	1000	Spaced Rural Residential				B	69	211.81	2
Tule Creek	3.533041	1000	Spaced Rural Residential				B	69	243.78	2
Tule Creek	6.474168	1000	Spaced Rural Residential				B	69	446.72	2
Tule Creek	6.623204	1000	Spaced Rural Residential				B	69	457.00	2
Tule Creek	7.091565	1000	Spaced Rural Residential				B	69	489.32	2
Tule Creek	7.221005	1000	Spaced Rural Residential				B	69	498.25	2
Tule Creek	7.371222	1000	Spaced Rural Residential				B	69	508.61	2
Tule Creek	7.378903	1000	Spaced Rural Residential				B	69	509.14	2
Tule Creek	7.827621	1000	Spaced Rural Residential				B	69	540.11	2
Tule Creek	11.46181	1000	Spaced Rural Residential				B	69	790.87	2

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	13.53061	1000	Spaced Rural Residential				B	69	933.61	2
Tule Creek	15.1175	1000	Spaced Rural Residential				B	69	1043.11	2
Tule Creek	15.13929	1000	Spaced Rural Residential				B	69	1044.61	2
Tule Creek	15.82326	1000	Spaced Rural Residential				B	69	1091.81	2
Tule Creek	16.62028	1000	Spaced Rural Residential				B	69	1146.80	2
Tule Creek	18.05196	1000	Spaced Rural Residential				B	69	1245.58	2
Tule Creek	18.08603	1000	Spaced Rural Residential				B	69	1247.94	2
Tule Creek	19.03283	1000	Spaced Rural Residential				B	69	1313.27	2
Tule Creek	19.54646	1000	Spaced Rural Residential				B	69	1348.71	2
Tule Creek	20.07371	1000	Spaced Rural Residential				B	69	1385.09	2
Tule Creek	21.90675	1000	Spaced Rural Residential				B	69	1511.57	2
Tule Creek	22.15042	1000	Spaced Rural Residential				B	69	1528.38	2
Tule Creek	23.22073	1000	Spaced Rural Residential				B	69	1602.23	2
Tule Creek	26.59746	1000	Spaced Rural Residential				B	69	1835.22	2
Tule Creek	28.42616	1000	Spaced Rural Residential				B	69	1961.41	2
Tule Creek	31.39782	1000	Spaced Rural Residential				B	69	2166.45	2
Tule Creek	35.05085	1000	Spaced Rural Residential				B	69	2418.51	2
Tule Creek	37.09912	1000	Spaced Rural Residential				B	69	2559.84	2
Tule Creek	42.55808	1000	Spaced Rural Residential				B	69	2936.51	2
Tule Creek	42.91708	1000	Spaced Rural Residential				B	69	2961.28	2
Tule Creek	45.2962	1000	Spaced Rural Residential				B	69	3125.44	2
Tule Creek	46.92178	1000	Spaced Rural Residential				B	69	3237.60	2
Tule Creek	55.14837	1000	Spaced Rural Residential				B	69	3805.24	2
Tule Creek	56.61684	1000	Spaced Rural Residential				B	69	3906.56	2
Tule Creek	58.19453	1000	Spaced Rural Residential				B	69	4015.42	2
Tule Creek	58.66377	1000	Spaced Rural Residential				B	69	4047.80	2
Tule Creek	60.20803	1000	Spaced Rural Residential				B	69	4154.35	2
Tule Creek	76.90194	1000	Spaced Rural Residential				B	69	5306.23	2
Tule Creek	122.2435	1000	Spaced Rural Residential				B	69	8434.80	2
Tule Creek	266.9316	1000	Spaced Rural Residential				B	69	18418.28	2
Tule Creek	270.7531	1000	Spaced Rural Residential				B	69	18681.96	2
Tule Creek	277.8597	1000	Spaced Rural Residential				B	69	19172.32	2
Tule Creek	398.6731	1000	Spaced Rural Residential				B	69	27508.44	2
Tule Creek	428.184	1000	Spaced Rural Residential				B	69	29544.70	2
Tule Creek	474.9666	1000	Spaced Rural Residential				B	69	32772.69	2
Tule Creek	0.001115	1000	Spaced Rural Residential				C	79	0.09	3
Tule Creek	0.171429	1000	Spaced Rural Residential				C	79	13.54	3
Tule Creek	0.349768	1000	Spaced Rural Residential				C	79	27.63	3
Tule Creek	3.91536	1000	Spaced Rural Residential				C	79	309.31	3
Tule Creek	13.95372	1000	Spaced Rural Residential				C	79	1102.34	3
Tule Creek	15.43697	1000	Spaced Rural Residential				C	79	1219.52	3
Tule Creek	23.15	1000	Spaced Rural Residential				C	79	1828.85	3
Tule Creek	27.3161	1000	Spaced Rural Residential				C	79	2157.97	3
Tule Creek	41.93775	1000	Spaced Rural Residential				C	79	3313.08	3
Tule Creek	0.026043	1000	Spaced Rural Residential				D	84	2.19	4
Tule Creek	0.365483	1000	Spaced Rural Residential				D	84	30.70	4
Tule Creek	0.648487	1000	Spaced Rural Residential				D	84	54.47	4
Tule Creek	1.019984	1000	Spaced Rural Residential				D	84	85.68	4
Tule Creek	1.485547	1000	Spaced Rural Residential				D	84	124.79	4
Tule Creek	4.928847	1000	Spaced Rural Residential				D	84	414.02	4
Tule Creek	8.173902	1000	Spaced Rural Residential				D	84	686.61	4
Tule Creek	9.08764	1000	Spaced Rural Residential				D	84	763.36	4
Tule Creek	10.91547	1000	Spaced Rural Residential				D	84	916.90	4
Tule Creek	15.42996	1000	Spaced Rural Residential				D	84	1296.12	4
Tule Creek	15.71257	1000	Spaced Rural Residential				D	84	1319.86	4
Tule Creek	15.79647	1000	Spaced Rural Residential				D	84	1326.90	4
Tule Creek	16.80266	1000	Spaced Rural Residential				D	84	1411.42	4

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	25.60615	1000	Spaced Rural Residential				D	84	2150.92	4
Tule Creek	51.21879	1000	Spaced Rural Residential				D	84	4302.38	4
Tule Creek	83.55671	1000	Spaced Rural Residential				D	84	7018.76	4
Tule Creek	0.967946	1190	Single Family Residential Without Units				A	54	52.27	1
Tule Creek	0.364026	1190	Single Family Residential Without Units				B	70	25.48	2
Tule Creek	0.567625	1190	Single Family Residential Without Units				B	70	39.73	2
Tule Creek	6.729983	1409	Other Group Quarters Facility				A	81	545.13	1
Tule Creek	74.69883	1409	Other Group Quarters Facility				B	88	6573.50	2
Tule Creek	7.775003	1409	Other Group Quarters Facility				C	91	707.53	3
Tule Creek	8.552329	4104	Airstrip				B	86	735.50	2
Tule Creek	0.068954	4112	Freeway				B	98	6.76	2
Tule Creek	5.864552	4112	Freeway				B	98	574.73	2
Tule Creek	31.025	4112	Freeway				B	98	3040.45	2
Tule Creek	31.09615	4112	Freeway				B	98	3047.42	2
Tule Creek	0.006861	4112	Freeway				D	98	0.67	4
Tule Creek	0.433045	4118	Road Right of Way				A	74	32.05	1
Tule Creek	1.011059	4118	Road Right of Way				A	74	74.82	1
Tule Creek	1.282634	4118	Road Right of Way				A	74	94.91	1
Tule Creek	1.346657	4118	Road Right of Way				A	74	99.65	1
Tule Creek	1.538811	4118	Road Right of Way				A	74	113.87	1
Tule Creek	3.343863	4118	Road Right of Way				A	74	247.45	1
Tule Creek	0.133175	4118	Road Right of Way				B	84	11.19	2
Tule Creek	0.455323	4118	Road Right of Way				B	84	38.25	2
Tule Creek	1.085576	4118	Road Right of Way				B	84	91.19	2
Tule Creek	2.195245	4118	Road Right of Way				B	84	184.40	2
Tule Creek	3.307092	4118	Road Right of Way				B	84	277.80	2
Tule Creek	3.378014	4118	Road Right of Way				B	84	283.75	2
Tule Creek	4.184623	4118	Road Right of Way				B	84	351.51	2
Tule Creek	10.91398	4118	Road Right of Way				B	84	916.77	2
Tule Creek	0.559069	4118	Road Right of Way				C	90	50.32	3
Tule Creek	1.49493	4118	Road Right of Way				C	90	134.54	3
Tule Creek	1.214105	4118	Road Right of Way				D	92	111.70	4
Tule Creek	0.145578	7603	Open Space Park or Preserve				A	62	9.03	1
Tule Creek	0.666159	7603	Open Space Park or Preserve				A	62	41.30	1
Tule Creek	0.670833	7603	Open Space Park or Preserve				A	62	41.59	1
Tule Creek	1.291557	7603	Open Space Park or Preserve				A	62	80.08	1
Tule Creek	2.450693	7603	Open Space Park or Preserve				A	62	151.94	1
Tule Creek	6.445348	7603	Open Space Park or Preserve				A	62	399.61	1
Tule Creek	6.492338	7603	Open Space Park or Preserve				A	62	402.52	1
Tule Creek	6.690075	7603	Open Space Park or Preserve				A	62	414.78	1
Tule Creek	7.609108	7603	Open Space Park or Preserve				A	62	471.76	1
Tule Creek	10.63861	7603	Open Space Park or Preserve				A	62	659.59	1
Tule Creek	12.56999	7603	Open Space Park or Preserve				A	62	779.34	1
Tule Creek	15.49857	7603	Open Space Park or Preserve				A	62	960.91	1
Tule Creek	20.82638	7603	Open Space Park or Preserve				A	62	1291.24	1
Tule Creek	24.10463	7603	Open Space Park or Preserve				A	62	1494.49	1
Tule Creek	27.80123	7603	Open Space Park or Preserve				A	62	1723.68	1
Tule Creek	29.00798	7603	Open Space Park or Preserve				A	62	1798.49	1
Tule Creek	35.67334	7603	Open Space Park or Preserve				A	62	2211.75	1
Tule Creek	137.5071	7603	Open Space Park or Preserve				A	62	8525.44	1
Tule Creek	5.79E-06	7603	Open Space Park or Preserve				B	76	0.00	2
Tule Creek	0.001881	7603	Open Space Park or Preserve				B	76	0.14	2
Tule Creek	0.147796	7603	Open Space Park or Preserve				B	76	11.23	2
Tule Creek	0.161165	7603	Open Space Park or Preserve				B	76	12.25	2
Tule Creek	0.272252	7603	Open Space Park or Preserve				B	76	20.69	2
Tule Creek	1.063073	7603	Open Space Park or Preserve				B	76	80.79	2
Tule Creek	1.239796	7603	Open Space Park or Preserve				B	76	94.22	2

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	2.221254	7603	Open Space Park or Preserve				B	76	168.82	2
Tule Creek	2.550184	7603	Open Space Park or Preserve				B	76	193.81	2
Tule Creek	2.719127	7603	Open Space Park or Preserve				B	76	206.65	2
Tule Creek	3.076995	7603	Open Space Park or Preserve				B	76	233.85	2
Tule Creek	6.068157	7603	Open Space Park or Preserve				B	76	461.18	2
Tule Creek	8.725289	7603	Open Space Park or Preserve				B	76	663.12	2
Tule Creek	8.949577	7603	Open Space Park or Preserve				B	76	680.17	2
Tule Creek	9.60439	7603	Open Space Park or Preserve				B	76	729.93	2
Tule Creek	10.74992	7603	Open Space Park or Preserve				B	76	816.99	2
Tule Creek	13.69377	7603	Open Space Park or Preserve				B	76	1040.73	2
Tule Creek	17.32135	7603	Open Space Park or Preserve				B	76	1316.42	2
Tule Creek	18.56011	7603	Open Space Park or Preserve				B	76	1410.57	2
Tule Creek	19.18966	7603	Open Space Park or Preserve				B	76	1458.41	2
Tule Creek	20.83353	7603	Open Space Park or Preserve				B	76	1583.35	2
Tule Creek	26.21576	7603	Open Space Park or Preserve				B	76	1992.40	2
Tule Creek	29.76741	7603	Open Space Park or Preserve				B	76	2262.32	2
Tule Creek	31.46706	7603	Open Space Park or Preserve				B	76	2391.50	2
Tule Creek	55.98659	7603	Open Space Park or Preserve				B	76	4254.98	2
Tule Creek	63.39889	7603	Open Space Park or Preserve				B	76	4818.32	2
Tule Creek	116.9792	7603	Open Space Park or Preserve				B	76	8890.42	2
Tule Creek	131.7281	7603	Open Space Park or Preserve				B	76	10011.34	2
Tule Creek	206.513	7603	Open Space Park or Preserve				B	76	15694.98	2
Tule Creek	213.6675	7603	Open Space Park or Preserve				B	76	16238.73	2
Tule Creek	216.7183	7603	Open Space Park or Preserve				B	76	16470.59	2
Tule Creek	461.4077	7603	Open Space Park or Preserve				B	76	35066.98	2
Tule Creek	522.7041	7603	Open Space Park or Preserve				B	76	39725.51	2
Tule Creek	583.0646	7603	Open Space Park or Preserve				B	76	44312.91	2
Tule Creek	1841.024	7603	Open Space Park or Preserve				B	76	139917.83	2
Tule Creek	0.323417	7603	Open Space Park or Preserve				C	84	27.17	3
Tule Creek	1.426928	7603	Open Space Park or Preserve				C	84	119.86	3
Tule Creek	27.97772	7603	Open Space Park or Preserve				C	84	2350.13	3
Tule Creek	56.1561	7603	Open Space Park or Preserve				C	84	4717.11	3
Tule Creek	0.018809	7603	Open Space Park or Preserve				D	88	1.66	4
Tule Creek	1.990162	7603	Open Space Park or Preserve				D	88	175.13	4
Tule Creek	3.055979	7603	Open Space Park or Preserve				D	88	268.93	4
Tule Creek	4.786524	7603	Open Space Park or Preserve				D	88	421.21	4
Tule Creek	7.507363	7603	Open Space Park or Preserve				D	88	660.65	4
Tule Creek	9.004921	7603	Open Space Park or Preserve				D	88	792.43	4
Tule Creek	21.66482	7603	Open Space Park or Preserve				D	88	1906.50	4
Tule Creek	227.1604	7603	Open Space Park or Preserve				D	88	19990.11	4
Tule Creek	445.3321	7603	Open Space Park or Preserve				D	88	39189.23	4
Tule Creek	4.448867	8003	Field Crops				A	62	275.83	1
Tule Creek	21.15463	8003	Field Crops				A	62	1311.59	1
Tule Creek	27.18965	8003	Field Crops				A	62	1685.76	1
Tule Creek	66.0865	8003	Field Crops				A	62	4097.36	1
Tule Creek	0.341477	8003	Field Crops				B	76	25.95	2
Tule Creek	1.937761	8003	Field Crops				B	76	147.27	2
Tule Creek	3.40635	8003	Field Crops				B	76	258.88	2
Tule Creek	5.150237	8003	Field Crops				B	76	391.42	2
Tule Creek	10.60162	8003	Field Crops				B	76	805.72	2
Tule Creek	5.471035	8003	Field Crops				C	84	459.57	3
Tule Creek	0.039367	8003	Field Crops				D	88	3.46	4
Tule Creek	12.98185	8003	Field Crops				D	88	1142.40	4
Tule Creek	32.0698	8003	Field Crops				D	88	2822.14	4
Tule Creek	0.370491	9101	Vacant and Undeveloped Land				A	62	22.97	1
Tule Creek	0.562932	9101	Vacant and Undeveloped Land				A	62	34.90	1
Tule Creek	0.716577	9101	Vacant and Undeveloped Land				A	62	44.43	1

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	1.423269	9101	Vacant and Undeveloped Land				A	62	88.24	1
Tule Creek	1.479646	9101	Vacant and Undeveloped Land				A	62	91.74	1
Tule Creek	1.77126	9101	Vacant and Undeveloped Land				A	62	109.82	1
Tule Creek	1.795696	9101	Vacant and Undeveloped Land				A	62	111.33	1
Tule Creek	2.104207	9101	Vacant and Undeveloped Land				A	62	130.46	1
Tule Creek	2.38003	9101	Vacant and Undeveloped Land				A	62	147.56	1
Tule Creek	2.44524	9101	Vacant and Undeveloped Land				A	62	151.60	1
Tule Creek	2.78078	9101	Vacant and Undeveloped Land				A	62	172.41	1
Tule Creek	2.988145	9101	Vacant and Undeveloped Land				A	62	185.26	1
Tule Creek	3.702611	9101	Vacant and Undeveloped Land				A	62	229.56	1
Tule Creek	3.813949	9101	Vacant and Undeveloped Land				A	62	236.46	1
Tule Creek	4.302466	9101	Vacant and Undeveloped Land				A	62	266.75	1
Tule Creek	4.632554	9101	Vacant and Undeveloped Land				A	62	287.22	1
Tule Creek	4.742464	9101	Vacant and Undeveloped Land				A	62	294.03	1
Tule Creek	4.95382	9101	Vacant and Undeveloped Land				A	62	307.14	1
Tule Creek	5.398374	9101	Vacant and Undeveloped Land				A	62	334.70	1
Tule Creek	5.950607	9101	Vacant and Undeveloped Land				A	62	368.94	1
Tule Creek	6.035894	9101	Vacant and Undeveloped Land				A	62	374.23	1
Tule Creek	7.552085	9101	Vacant and Undeveloped Land				A	62	468.23	1
Tule Creek	7.770147	9101	Vacant and Undeveloped Land				A	62	481.75	1
Tule Creek	8.015163	9101	Vacant and Undeveloped Land				A	62	496.94	1
Tule Creek	8.178444	9101	Vacant and Undeveloped Land				A	62	507.06	1
Tule Creek	9.503046	9101	Vacant and Undeveloped Land				A	62	589.19	1
Tule Creek	10.1615	9101	Vacant and Undeveloped Land				A	62	630.01	1
Tule Creek	11.43993	9101	Vacant and Undeveloped Land				A	62	709.28	1
Tule Creek	13.19961	9101	Vacant and Undeveloped Land				A	62	818.38	1
Tule Creek	17.14286	9101	Vacant and Undeveloped Land				A	62	1062.86	1
Tule Creek	18.15904	9101	Vacant and Undeveloped Land				A	62	1125.86	1
Tule Creek	22.94393	9101	Vacant and Undeveloped Land				A	62	1422.52	1
Tule Creek	26.10498	9101	Vacant and Undeveloped Land				A	62	1618.51	1
Tule Creek	26.53566	9101	Vacant and Undeveloped Land				A	62	1645.21	1
Tule Creek	28.71079	9101	Vacant and Undeveloped Land				A	62	1780.07	1
Tule Creek	31.26606	9101	Vacant and Undeveloped Land				A	62	1938.50	1
Tule Creek	33.11955	9101	Vacant and Undeveloped Land				A	62	2053.41	1
Tule Creek	33.25553	9101	Vacant and Undeveloped Land				A	62	2061.84	1
Tule Creek	45.79989	9101	Vacant and Undeveloped Land				A	62	2839.59	1
Tule Creek	59.79589	9101	Vacant and Undeveloped Land				A	62	3707.34	1
Tule Creek	77.01624	9101	Vacant and Undeveloped Land				A	62	4775.01	1
Tule Creek	144.7928	9101	Vacant and Undeveloped Land				A	62	8977.16	1
Tule Creek	175.1536	9101	Vacant and Undeveloped Land				A	62	10859.52	1
Tule Creek	193.7297	9101	Vacant and Undeveloped Land				A	62	12011.24	1
Tule Creek	0.123272	9101	Vacant and Undeveloped Land				B	76	9.37	2
Tule Creek	0.126067	9101	Vacant and Undeveloped Land				B	76	9.58	2
Tule Creek	0.259348	9101	Vacant and Undeveloped Land				B	76	19.71	2
Tule Creek	0.439751	9101	Vacant and Undeveloped Land				B	76	33.42	2
Tule Creek	0.488141	9101	Vacant and Undeveloped Land				B	76	37.10	2
Tule Creek	0.555569	9101	Vacant and Undeveloped Land				B	76	42.22	2
Tule Creek	1.046957	9101	Vacant and Undeveloped Land				B	76	79.57	2
Tule Creek	1.506574	9101	Vacant and Undeveloped Land				B	76	114.50	2
Tule Creek	1.800695	9101	Vacant and Undeveloped Land				B	76	136.85	2
Tule Creek	1.872557	9101	Vacant and Undeveloped Land				B	76	142.31	2
Tule Creek	2.28992	9101	Vacant and Undeveloped Land				B	76	174.03	2
Tule Creek	2.524843	9101	Vacant and Undeveloped Land				B	76	191.89	2
Tule Creek	2.675733	9101	Vacant and Undeveloped Land				B	76	203.36	2
Tule Creek	2.678534	9101	Vacant and Undeveloped Land				B	76	203.57	2
Tule Creek	2.955549	9101	Vacant and Undeveloped Land				B	76	224.62	2
Tule Creek	3.082261	9101	Vacant and Undeveloped Land				B	76	234.25	2

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	3.08555	9101	Vacant and Undeveloped Land				B	76	234.50	2
Tule Creek	3.132324	9101	Vacant and Undeveloped Land				B	76	238.06	2
Tule Creek	4.209174	9101	Vacant and Undeveloped Land				B	76	319.90	2
Tule Creek	4.540735	9101	Vacant and Undeveloped Land				B	76	345.10	2
Tule Creek	5.008135	9101	Vacant and Undeveloped Land				B	76	380.62	2
Tule Creek	5.032916	9101	Vacant and Undeveloped Land				B	76	382.50	2
Tule Creek	5.716538	9101	Vacant and Undeveloped Land				B	76	434.46	2
Tule Creek	6.641984	9101	Vacant and Undeveloped Land				B	76	504.79	2
Tule Creek	6.663339	9101	Vacant and Undeveloped Land				B	76	506.41	2
Tule Creek	6.765094	9101	Vacant and Undeveloped Land				B	76	514.15	2
Tule Creek	7.185992	9101	Vacant and Undeveloped Land				B	76	546.14	2
Tule Creek	7.274901	9101	Vacant and Undeveloped Land				B	76	552.89	2
Tule Creek	8.068191	9101	Vacant and Undeveloped Land				B	76	613.18	2
Tule Creek	8.186121	9101	Vacant and Undeveloped Land				B	76	622.15	2
Tule Creek	8.987016	9101	Vacant and Undeveloped Land				B	76	683.01	2
Tule Creek	9.612152	9101	Vacant and Undeveloped Land				B	76	730.52	2
Tule Creek	11.87059	9101	Vacant and Undeveloped Land				B	76	902.17	2
Tule Creek	12.81692	9101	Vacant and Undeveloped Land				B	76	974.09	2
Tule Creek	13.56025	9101	Vacant and Undeveloped Land				B	76	1030.58	2
Tule Creek	14.1667	9101	Vacant and Undeveloped Land				B	76	1076.67	2
Tule Creek	14.51726	9101	Vacant and Undeveloped Land				B	76	1103.31	2
Tule Creek	15.05544	9101	Vacant and Undeveloped Land				B	76	1144.21	2
Tule Creek	19.61081	9101	Vacant and Undeveloped Land				B	76	1490.42	2
Tule Creek	21.16084	9101	Vacant and Undeveloped Land				B	76	1608.22	2
Tule Creek	21.31978	9101	Vacant and Undeveloped Land				B	76	1620.30	2
Tule Creek	21.32974	9101	Vacant and Undeveloped Land				B	76	1621.06	2
Tule Creek	22.34473	9101	Vacant and Undeveloped Land				B	76	1698.20	2
Tule Creek	23.62745	9101	Vacant and Undeveloped Land				B	76	1795.69	2
Tule Creek	23.78879	9101	Vacant and Undeveloped Land				B	76	1807.95	2
Tule Creek	23.8163	9101	Vacant and Undeveloped Land				B	76	1810.04	2
Tule Creek	28.61306	9101	Vacant and Undeveloped Land				B	76	2174.59	2
Tule Creek	32.99727	9101	Vacant and Undeveloped Land				B	76	2507.79	2
Tule Creek	35.74483	9101	Vacant and Undeveloped Land				B	76	2716.61	2
Tule Creek	38.10636	9101	Vacant and Undeveloped Land				B	76	2896.08	2
Tule Creek	44.96019	9101	Vacant and Undeveloped Land				B	76	3416.97	2
Tule Creek	52.76313	9101	Vacant and Undeveloped Land				B	76	4010.00	2
Tule Creek	53.25099	9101	Vacant and Undeveloped Land				B	76	4047.08	2
Tule Creek	55.98927	9101	Vacant and Undeveloped Land				B	76	4255.18	2
Tule Creek	57.37018	9101	Vacant and Undeveloped Land				B	76	4360.13	2
Tule Creek	58.2552	9101	Vacant and Undeveloped Land				B	76	4427.40	2
Tule Creek	59.81501	9101	Vacant and Undeveloped Land				B	76	4545.94	2
Tule Creek	60.3311	9101	Vacant and Undeveloped Land				B	76	4585.16	2
Tule Creek	60.9375	9101	Vacant and Undeveloped Land				B	76	4631.25	2
Tule Creek	79.18654	9101	Vacant and Undeveloped Land				B	76	6018.18	2
Tule Creek	80.80081	9101	Vacant and Undeveloped Land				B	76	6140.86	2
Tule Creek	94.08736	9101	Vacant and Undeveloped Land				B	76	7150.64	2
Tule Creek	95.02456	9101	Vacant and Undeveloped Land				B	76	7221.87	2
Tule Creek	108.8181	9101	Vacant and Undeveloped Land				B	76	8270.18	2
Tule Creek	138.4778	9101	Vacant and Undeveloped Land				B	76	10524.31	2
Tule Creek	173.0043	9101	Vacant and Undeveloped Land				B	76	13148.33	2
Tule Creek	174.746	9101	Vacant and Undeveloped Land				B	76	13280.70	2
Tule Creek	193.3544	9101	Vacant and Undeveloped Land				B	76	14694.94	2
Tule Creek	195.5124	9101	Vacant and Undeveloped Land				B	76	14858.94	2
Tule Creek	200.1965	9101	Vacant and Undeveloped Land				B	76	15214.93	2
Tule Creek	336.0086	9101	Vacant and Undeveloped Land				B	76	25536.66	2
Tule Creek	340.4604	9101	Vacant and Undeveloped Land				B	76	25874.99	2
Tule Creek	362.0771	9101	Vacant and Undeveloped Land				B	76	27517.86	2

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	414.3862	9101	Vacant and Undeveloped Land				B	76	31493.35	2
Tule Creek	845.9782	9101	Vacant and Undeveloped Land				B	76	64294.34	2
Tule Creek	873.8039	9101	Vacant and Undeveloped Land				B	76	66409.10	2
Tule Creek	0.823878	9101	Vacant and Undeveloped Land				C	84	69.21	3
Tule Creek	1.108125	9101	Vacant and Undeveloped Land				C	84	93.08	3
Tule Creek	1.819944	9101	Vacant and Undeveloped Land				C	84	152.88	3
Tule Creek	2.382064	9101	Vacant and Undeveloped Land				C	84	200.09	3
Tule Creek	10.95875	9101	Vacant and Undeveloped Land				C	84	920.53	3
Tule Creek	12.70656	9101	Vacant and Undeveloped Land				C	84	1067.35	3
Tule Creek	24.71978	9101	Vacant and Undeveloped Land				C	84	2076.46	3
Tule Creek	35.63375	9101	Vacant and Undeveloped Land				C	84	2993.24	3
Tule Creek	46.83882	9101	Vacant and Undeveloped Land				C	84	3934.46	3
Tule Creek	59.2223	9101	Vacant and Undeveloped Land				C	84	4974.67	3
Tule Creek	141.554	9101	Vacant and Undeveloped Land				C	84	11890.54	3
Tule Creek	1.754196	9101	Vacant and Undeveloped Land				D	88	154.37	4
Tule Creek	2.768979	9101	Vacant and Undeveloped Land				D	88	243.67	4
Tule Creek	3.07489	9101	Vacant and Undeveloped Land				D	88	270.59	4
Tule Creek	4.559222	9101	Vacant and Undeveloped Land				D	88	401.21	4
Tule Creek	5.128395	9101	Vacant and Undeveloped Land				D	88	451.30	4
Tule Creek	5.392338	9101	Vacant and Undeveloped Land				D	88	474.53	4
Tule Creek	6.6423	9101	Vacant and Undeveloped Land				D	88	584.52	4
Tule Creek	8.121478	9101	Vacant and Undeveloped Land				D	88	714.69	4
Tule Creek	8.617818	9101	Vacant and Undeveloped Land				D	88	758.37	4
Tule Creek	12.56787	9101	Vacant and Undeveloped Land				D	88	1105.97	4
Tule Creek	12.98788	9101	Vacant and Undeveloped Land				D	88	1142.93	4
Tule Creek	13.49973	9101	Vacant and Undeveloped Land				D	88	1187.98	4
Tule Creek	18.14519	9101	Vacant and Undeveloped Land				D	88	1596.78	4
Tule Creek	18.82047	9101	Vacant and Undeveloped Land				D	88	1656.20	4
Tule Creek	36.71697	9101	Vacant and Undeveloped Land				D	88	3231.09	4
Tule Creek	37.72841	9101	Vacant and Undeveloped Land				D	88	3320.10	4
Tule Creek	46.89635	9101	Vacant and Undeveloped Land				D	88	4126.88	4
Tule Creek	64.35243	9101	Vacant and Undeveloped Land				D	88	5663.01	4
Tule Creek	79.68585	9101	Vacant and Undeveloped Land				D	88	7012.35	4
Tule Creek	107.7435	9101	Vacant and Undeveloped Land				D	88	9481.42	4

Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

Unnamed Eastern Wash Existing Curve Number

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
	734							**80**	**58551**	**2.7**
Unnamed Eastern Wash	24.41651	7603	Open Space Park or Preserve				A	62	1513.82	1
	0.004429	7603	Open Space Park or Preserve				B	76	0.34	2
	353.202	7603	Open Space Park or Preserve				B	76	26843.35	2
	0.020961	7603	Open Space Park or Preserve				D	88	1.84	4
	0.354483	7603	Open Space Park or Preserve				D	88	31.19	4
	14.22936	7603	Open Space Park or Preserve				D	88	1252.18	4
	120.2331	7603	Open Space Park or Preserve				D	88	10580.52	4
	100.4407	9101	Vacant and Undeveloped Land				B	76	7633.49	2
	0.003492	9101	Vacant and Undeveloped Land				D	88	0.31	4
	25.58334	9101	Vacant and Undeveloped Land				D	88	2251.33	4
	95.94275	9101	Vacant and Undeveloped Land				D	88	8442.96	4

APPENDIX C

Existing Conditions CivilD Output

Tule 100-Year 6-Hour
Tule 100-Year 24-Hour
Unnamed Eastern Wash 100-Year 6-Hour
Unnamed Eastern Wash 100-Year 24-Hour
System 1200

```
        U N I T   H Y D R O G R A P H   A N A L Y S I S

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                Study date  08/30/10  File: tule100yr6hr.out

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Program License Serial Number 4055

--------------------------------------------------------------------
Tule Wind Project
Tule Creek
Existing 100 Year 6 Hour
Aug 25, 2010
--------------------------------------------------------------------
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Storm Event Year = 100

Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
        Sub-Area(Ac.)       Rainfall (In)
         18250.00             3.36

Rainfall Distribution pattern used in study:
Type B for SCS (small dam) or San Diego 6 hour storms
-------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

********* Area-Averaged SCS Curve Number and Fm *********

Area       Area          SCS CN    SCS CN    Fm      Soil
(Ac.)      fract         (AMC2)    (AMC2)   (In/Hr)  Group
 18250.00   1.000         82.0      82.0     0.050    B

Area-averaged catchment SCS Curve Number AMC(2) = 81.960
Area-averaged Fm value using values listed =  0.050(In/Hr)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Direct entry of lag time by user
Watershed area =   18250.00(Ac.)
Catchment Lag time =   1.700 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 14.7059
Hydrograph baseflow =     0.00(CFS)
Minimum watershed loss rate(Fm) =  0.000(In/Hr)
Average adjusted SCS Curve Number = 81.960

Rainfall depth area reduction factors:
Using a total area of   18250.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 0.974
Rainfall entered for study =    3.360(In)
Adjusted rainfall =    3.272(In)
```

++

The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H
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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 73608.33 (CFS))

0.15	0.250	0.016	179.694	0.002
0.29	0.500	0.051	575.802	0.010
0.44	0.750	0.117	1315.646	0.028
0.59	1.000	0.256	2889.871	0.067
0.74	1.250	0.632	7133.846	0.164
0.88	1.500	0.934	10536.976	0.307
1.03	1.750	1.000	11283.813	0.461
1.18	2.000	0.830	9370.747	0.588
1.32	2.250	0.571	6441.859	0.676
1.47	2.500	0.453	5115.019	0.745
1.62	2.750	0.355	4007.166	0.800
1.76	3.000	0.283	3187.900	0.843
1.91	3.250	0.229	2582.427	0.878
2.06	3.500	0.187	2104.743	0.906
2.21	3.750	0.152	1711.233	0.930
2.35	4.000	0.124	1401.420	0.949
2.50	4.250	0.098	1107.826	0.964
2.65	4.500	0.077	868.940	0.976
2.79	4.750	0.060	671.923	0.985
2.94	5.000	0.043	484.343	0.991
3.09	5.250	0.033	375.400	0.996
3.24	5.500	0.018	198.006	0.999
3.38	5.750	0.006	63.670	1.000
3.53	6.000	0.000	0.061	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

Where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In)	Total SCS Runoff (In)	Rainfall Amount (In)	Runoff Amount (In)	Infiltr-ation (In)	Revised Runoff Min Loss Rate

```
              P        Q           dP         dQ        dP-dQ
-----------------------------------------------------------------------
  0.25   0.0573    0.0000     0.0573     0.0000     0.0573 --------
  0.50   0.1145    0.0000     0.0573     0.0000     0.0573 --------
  0.75   0.1914    0.0000     0.0769     0.0000     0.0769 --------
  1.00   0.2683    0.0000     0.0769     0.0000     0.0769 --------
  1.25   0.3632    0.0000     0.0949     0.0000     0.0949 --------
  1.50   0.4581    0.0001     0.0949     0.0001     0.0948 --------
  1.75   0.6054    0.0115     0.1473     0.0114     0.1359 --------
  2.00   0.7527    0.0388     0.1473     0.0273     0.1200 --------
  2.25   1.3580    0.2701     0.6054     0.2313     0.3741 --------
  2.50   1.9634    0.6230     0.6054     0.3529     0.2525 --------
  2.75   2.1271    0.7319     0.1636     0.1089     0.0547 --------
  3.00   2.2907    0.8452     0.1636     0.1133     0.0503 --------
  3.25   2.4232    0.9398     0.1325     0.0947     0.0379 --------
  3.50   2.5557    1.0368     0.1325     0.0970     0.0356 --------
  3.75   2.6441    1.1026     0.0884     0.0658     0.0225 --------
  4.00   2.7325    1.1694     0.0884     0.0667     0.0216 --------
  4.25   2.8061    1.2256     0.0736     0.0562     0.0174 --------
  4.50   2.8797    1.2824     0.0736     0.0568     0.0168 --------
  4.75   2.9501    1.3372     0.0704     0.0548     0.0156 --------
  5.00   3.0204    1.3924     0.0704     0.0552     0.0151 --------
  5.25   3.0810    1.4403     0.0605     0.0479     0.0127 --------
  5.50   3.1415    1.4885     0.0605     0.0482     0.0124 --------
  5.75   3.2070    1.5409     0.0654     0.0524     0.0130 --------
  6.00   3.2724    1.5937     0.0654     0.0528     0.0127 --------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =       1.68(In)
Total effective runoff =      1.59(In)
---------------------------------------------------------------------
Peak flow rate this hydrograph =        8790.33(CFS)
Total runoff volume this hydrograph =      105575794.9(Ft3)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    6 - H O U R    S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0      2200.0    4400.0    6600.0    8800.0
-----------------------------------------------------------------------
  0+15       0.0000      0.00  Q         |         |         |         |
  0+30       0.0000      0.00  Q         |         |         |         |
  0+45       0.0000      0.00  Q         |         |         |         |
  1+ 0       0.0000      0.00  Q         |         |         |         |
  1+15       0.0000      0.00  Q         |         |         |         |
  1+30       0.0005      0.03  Q         |         |         |         |
  1+45       0.0445      2.13  Q         |         |         |         |
  2+ 0       0.2853     11.65  Q         |         |         |         |
  2+15       1.7869     72.68  Q         |         |         |         |
  2+30       7.2918    266.44  VQ        |         |         |         |
  2+45      21.5208    688.68  V  Q      |         |         |         |
  3+ 0      53.1750   1532.06  V     Q   |         |         |         |
  3+15     121.6185   3312.66  | V       |     Q   |         |         |
  3+30     243.6367   5905.68  |   V     |         |     Q   |         |
  3+45     407.9811   7954.27  |     V   |         |         |     Q   |
  4+ 0     589.5995   8790.33  |        V|         |         |        Q|
  4+15     765.1249   8495.43  |         |  V      |         |       Q |
  4+30     928.5726   7910.87  |         |     V   |         |    Q    |
  4+45    1083.1311   7480.63  |         |       V |         |   Q     |
  5+ 0    1226.9882   6962.68  |         |         V         |Q        |
```

```
    5+15    1360.4103   6457.63  |         |           V      Q|         |
    5+30    1484.4980   6005.84  |         |         |   V  Q  |         |
    5+45    1601.0315   5640.22  |         |         |    QV   |         |
    6+ 0    1711.1007   5327.35  |         |         |   Q   V |         |
    6+15    1815.2382   5040.26  |         |         | Q      V|         |
    6+30    1913.3419   4748.22  |         |         |Q        V         |
    6+45    2005.6635   4468.36  |         |         Q         |  V      |
    7+ 0    2091.5144   4155.19  |         |       Q |         |   V     |
    7+15    2167.2394   3665.09  |         |     Q   |         |    V    |
    7+30    2229.3862   3007.91  |         |  Q      |         |     V   |
    7+45    2276.8745   2298.43  |         Q         |         |      V  |
    8+ 0    2312.3371   1716.39  |      Q  |         |         |       V |
    8+15    2339.6758   1323.19  |     Q   |         |         |       V |
    8+30    2360.8722   1025.91  |   Q     |         |         |       V |
    8+45    2377.2859    794.42  |  Q      |         |         |        V|
    9+ 0    2389.9841    614.59  | Q       |         |         |        V|
    9+15    2399.7394    472.15  | Q       |         |         |        V|
    9+30    2407.1586    359.09  |Q        |         |         |        V|
    9+45    2412.6999    268.20  |Q        |         |         |        V|
   10+ 0    2416.7241    194.77  Q         |         |         |        V|
   10+15    2419.5508    136.81  Q         |         |         |        V|
   10+30    2421.4502     91.93  Q         |         |         |        V|
   10+45    2422.6451     57.83  Q         |         |         |        V|
   11+ 0    2423.3323     33.26  Q         |         |         |        V|
   11+15    2423.6172     13.79  Q         |         |         |        V|
   11+30    2423.6867      3.36  Q         |         |         |        V|
   11+45    2423.6868      0.00  Q         |         |         |         V
-----------------------------------------------------------------------
```

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        U N I T   H Y D R O G R A P H   A N A L Y S I S
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                Study date  08/30/10  File: tule100yr24hr.out

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Program License Serial Number 4055

----------------------------------------------------------------------
Tule Wind Project
Tule Creek
Existing 100 Year 24 Hour
Aug 25, 2010
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Storm Event Year = 100

Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
        Sub-Area(Ac.)       Rainfall (In)
         18250.00             6.41

Rainfall Distribution pattern used in study:
Type B for San Diego area of California
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

********* Area-Averaged SCS Curve Number and Fm *********

Area       Area          SCS CN    SCS CN    Fm       Soil
(Ac.)      fract         (AMC2)    (AMC2)   (In/Hr)   Group
 18250.00   1.000         82.0      82.0     0.050     B

Area-averaged catchment SCS Curve Number AMC(2) = 81.960
Area-averaged Fm value using values listed =  0.050(In/Hr)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Direct entry of lag time by user
Watershed area =   18250.00(Ac.)
Catchment Lag time =   1.700 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 14.7059
Hydrograph baseflow =     0.00(CFS)
Minimum watershed loss rate(Fm) =  0.000(In/Hr)
Average adjusted SCS Curve Number = 81.960

Rainfall depth area reduction factors:
Using a total area of   18250.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 0.974
Rainfall entered for study =    6.410(In)
Adjusted rainfall =    6.243(In)
```

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H

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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 73608.33 (CFS))

0.15	0.250	0.016	179.694	0.002
0.29	0.500	0.051	575.802	0.010
0.44	0.750	0.117	1315.646	0.028
0.59	1.000	0.256	2889.871	0.067
0.74	1.250	0.632	7133.846	0.164
0.88	1.500	0.934	10536.976	0.307
1.03	1.750	1.000	11283.813	0.461
1.18	2.000	0.830	9370.747	0.588
1.32	2.250	0.571	6441.859	0.676
1.47	2.500	0.453	5115.019	0.745
1.62	2.750	0.355	4007.166	0.800
1.76	3.000	0.283	3187.900	0.843
1.91	3.250	0.229	2582.427	0.878
2.06	3.500	0.187	2104.743	0.906
2.21	3.750	0.152	1711.233	0.930
2.35	4.000	0.124	1401.420	0.949
2.50	4.250	0.098	1107.826	0.964
2.65	4.500	0.077	868.940	0.976
2.79	4.750	0.060	671.923	0.985
2.94	5.000	0.043	484.343	0.991
3.09	5.250	0.033	375.400	0.996
3.24	5.500	0.018	198.006	0.999
3.38	5.750	0.006	63.670	1.000
3.53	6.000	0.000	0.061	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

Where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In)	Total SCS Runoff (In)	Rainfall Amount (In)	Runoff Amount (In)	Infiltr-ation (In)	Revised Runoff Min Loss Rate

	P	Q	dP	dQ	dP-dQ	
0.25	0.0281	0.0000	0.0281	0.0000	0.0281	--------
0.50	0.0562	0.0000	0.0281	0.0000	0.0281	--------
0.75	0.0780	0.0000	0.0219	0.0000	0.0219	--------
1.00	0.0999	0.0000	0.0219	0.0000	0.0219	--------
1.25	0.1280	0.0000	0.0281	0.0000	0.0281	--------
1.50	0.1561	0.0000	0.0281	0.0000	0.0281	--------
1.75	0.1842	0.0000	0.0281	0.0000	0.0281	--------
2.00	0.2123	0.0000	0.0281	0.0000	0.0281	--------
2.25	0.2466	0.0000	0.0343	0.0000	0.0343	--------
2.50	0.2809	0.0000	0.0343	0.0000	0.0343	--------
2.75	0.3090	0.0000	0.0281	0.0000	0.0281	--------
3.00	0.3371	0.0000	0.0281	0.0000	0.0281	--------
3.25	0.3715	0.0000	0.0343	0.0000	0.0343	--------
3.50	0.4058	0.0000	0.0343	0.0000	0.0343	--------
3.75	0.4432	0.0000	0.0375	0.0000	0.0375	--------
4.00	0.4807	0.0007	0.0375	0.0007	0.0367	--------
4.25	0.5213	0.0029	0.0406	0.0021	0.0384	--------
4.50	0.5619	0.0064	0.0406	0.0035	0.0371	--------
4.75	0.6056	0.0116	0.0437	0.0052	0.0385	--------
5.00	0.6493	0.0181	0.0437	0.0066	0.0371	--------
5.25	0.6992	0.0273	0.0499	0.0091	0.0408	--------
5.50	0.7491	0.0380	0.0499	0.0108	0.0392	--------
5.75	0.8022	0.0511	0.0531	0.0131	0.0400	--------
6.00	0.8553	0.0659	0.0531	0.0147	0.0383	--------
6.25	0.9177	0.0851	0.0624	0.0193	0.0432	--------
6.50	0.9801	0.1064	0.0624	0.0212	0.0412	--------
6.75	1.0519	0.1330	0.0718	0.0267	0.0451	--------
7.00	1.1237	0.1620	0.0718	0.0289	0.0429	--------
7.25	1.2174	0.2028	0.0936	0.0408	0.0528	--------
7.50	1.3110	0.2468	0.0936	0.0441	0.0496	--------
7.75	1.4515	0.3183	0.1405	0.0715	0.0690	--------
8.00	1.5919	0.3956	0.1405	0.0773	0.0632	--------
8.25	1.8011	0.5199	0.2091	0.1243	0.0848	--------
8.50	2.0102	0.6536	0.2091	0.1337	0.0754	--------
8.75	2.2849	0.8411	0.2747	0.1875	0.0872	--------
9.00	2.5596	1.0396	0.2747	0.1986	0.0761	--------
9.25	2.8592	1.2666	0.2997	0.2269	0.0727	--------
9.50	3.1589	1.5024	0.2997	0.2358	0.0639	--------
9.75	3.4149	1.7096	0.2560	0.2073	0.0487	--------
10.00	3.6708	1.9215	0.2560	0.2118	0.0441	--------
10.25	3.7988	2.0289	0.1280	0.1074	0.0205	--------
10.50	3.9268	2.1373	0.1280	0.1084	0.0196	--------
10.75	4.0111	2.2091	0.0843	0.0718	0.0124	--------
11.00	4.0953	2.2813	0.0843	0.0722	0.0121	--------
11.25	4.1671	2.3431	0.0718	0.0618	0.0100	--------
11.50	4.2389	2.4051	0.0718	0.0620	0.0098	--------
11.75	4.3045	2.4619	0.0656	0.0568	0.0087	--------
12.00	4.3700	2.5190	0.0656	0.0570	0.0085	--------
12.25	4.4325	2.5734	0.0624	0.0545	0.0080	--------
12.50	4.4949	2.6280	0.0624	0.0546	0.0078	--------
12.75	4.5542	2.6801	0.0593	0.0520	0.0073	--------
13.00	4.6135	2.7322	0.0593	0.0522	0.0071	--------
13.25	4.6666	2.7790	0.0531	0.0468	0.0063	--------
13.50	4.7196	2.8259	0.0531	0.0469	0.0062	--------
13.75	4.7696	2.8701	0.0499	0.0442	0.0057	--------
14.00	4.8195	2.9145	0.0499	0.0443	0.0056	--------
14.25	4.8757	2.9644	0.0562	0.0500	0.0062	--------
14.50	4.9319	3.0145	0.0562	0.0501	0.0061	--------
14.75	4.9631	3.0423	0.0312	0.0279	0.0034	--------
15.00	4.9943	3.0702	0.0312	0.0279	0.0033	--------
15.25	5.0443	3.1149	0.0499	0.0447	0.0053	--------

```
  15.50   5.0942    3.1596    0.0499    0.0448    0.0052 --------
  15.75   5.1410    3.2017    0.0468    0.0420    0.0048 --------
  16.00   5.1878    3.2438    0.0468    0.0421    0.0047 --------
  16.25   5.2315    3.2831    0.0437    0.0393    0.0044 --------
  16.50   5.2752    3.3225    0.0437    0.0394    0.0043 --------
  16.75   5.3221    3.3648    0.0468    0.0423    0.0046 --------
  17.00   5.3689    3.4071    0.0468    0.0423    0.0045 --------
  17.25   5.4063    3.4410    0.0375    0.0339    0.0036 --------
  17.50   5.4438    3.4750    0.0375    0.0339    0.0035 --------
  17.75   5.4844    3.5118    0.0406    0.0368    0.0038 --------
  18.00   5.5250    3.5486    0.0406    0.0369    0.0037 --------
  18.25   5.5562    3.5770    0.0312    0.0284    0.0028 --------
  18.50   5.5874    3.6054    0.0312    0.0284    0.0028 --------
  18.75   5.6186    3.6338    0.0312    0.0284    0.0028 --------
  19.00   5.6498    3.6623    0.0312    0.0284    0.0028 --------
  19.25   5.6779    3.6879    0.0281    0.0256    0.0025 --------
  19.50   5.7060    3.7135    0.0281    0.0256    0.0025 --------
  19.75   5.7372    3.7421    0.0312    0.0285    0.0027 --------
  20.00   5.7684    3.7706    0.0312    0.0285    0.0027 --------
  20.25   5.8028    3.8020    0.0343    0.0314    0.0029 --------
  20.50   5.8371    3.8334    0.0343    0.0314    0.0029 --------
  20.75   5.8683    3.8621    0.0312    0.0286    0.0026 --------
  21.00   5.8995    3.8907    0.0312    0.0286    0.0026 --------
  21.25   5.9276    3.9165    0.0281    0.0258    0.0023 --------
  21.50   5.9557    3.9423    0.0281    0.0258    0.0023 --------
  21.75   5.9838    3.9681    0.0281    0.0258    0.0023 --------
  22.00   6.0119    3.9939    0.0281    0.0258    0.0023 --------
  22.25   6.0400    4.0198    0.0281    0.0258    0.0022 --------
  22.50   6.0681    4.0456    0.0281    0.0259    0.0022 --------
  22.75   6.0962    4.0715    0.0281    0.0259    0.0022 --------
  23.00   6.1243    4.0974    0.0281    0.0259    0.0022 --------
  23.25   6.1555    4.1262    0.0312    0.0288    0.0024 --------
  23.50   6.1867    4.1550    0.0312    0.0288    0.0024 --------
  23.75   6.2148    4.1809    0.0281    0.0259    0.0021 --------
  24.00   6.2429    4.2069    0.0281    0.0260    0.0021 --------
 --------------------------------------------------------------------
 --------------------------------------------------------------------
 Total soil rain loss =      2.04(In)
 Total effective runoff =      4.21(In)
 ---------------------------------------------------------------------
 Peak flow rate this hydrograph =       12729.94(CFS)
 Total runoff volume this hydrograph =      278697131.9(Ft3)
 ---------------------------------------------------------------------
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                     24 - H O U R   S T O R M
                R u n o f f     H y d r o g r a p h
 --------------------------------------------------------------------
             Hydrograph in  15   Minute intervals ((CFS))

 --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0     3200.0    6400.0    9600.0   12800.0
-----------------------------------------------------------------------
  0+15       0.0000      0.00  Q         |         |         |         |
  0+30       0.0000      0.00  Q         |         |         |         |
  0+45       0.0000      0.00  Q         |         |         |         |
  1+ 0       0.0000      0.00  Q         |         |         |         |
  1+15       0.0000      0.00  Q         |         |         |         |
  1+30       0.0000      0.00  Q         |         |         |         |
  1+45       0.0000      0.00  Q         |         |         |         |
  2+ 0       0.0000      0.00  Q         |         |         |         |
  2+15       0.0000      0.00  Q         |         |         |         |
  2+30       0.0000      0.00  Q         |         |         |         |
  2+45       0.0000      0.00  Q         |         |         |         |
```

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 3+ 0      0.0000       0.00  Q         |         |         |         |
 3+15      0.0000       0.00  Q         |         |         |         |
 3+30      0.0000       0.00  Q         |         |         |         |
 3+45      0.0000       0.00  Q         |         |         |         |
 4+ 0      0.0028       0.13  Q         |         |         |         |
 4+15      0.0195       0.81  Q         |         |         |         |
 4+30      0.0780       2.83  Q         |         |         |         |
 4+45      0.2412       7.90  Q         |         |         |         |
 5+ 0      0.6586      20.20  Q         |         |         |         |
 5+15      1.5960      45.37  Q         |         |         |         |
 5+30      3.3855      86.61  Q         |         |         |         |
 5+45      6.3692     144.42  Q         |         |         |         |
 6+ 0     10.8425     216.51  Q         |         |         |         |
 6+15     17.1135     303.51  Q         |         |         |         |
 6+30     25.4676     404.34  VQ        |         |         |         |
 6+45     36.1834     518.64  VQ        |         |         |         |
 7+ 0     49.5280     645.88  V Q       |         |         |         |
 7+15     65.9163     793.20  V Q       |         |         |         |
 7+30     85.8278     963.71  V  Q      |         |         |         |
 7+45    109.9483    1167.43  V  Q      |         |         |         |
 8+ 0    139.0896    1410.44  V   Q     |         |         |         |
 8+15    174.7255    1724.78   V   Q    |         |         |         |
 8+30    218.7898    2132.71  |V    Q   |         |         |         |
 8+45    274.5783    2700.17  |V      Q |         |         |         |
 9+ 0    345.7514    3444.78  | V       Q         |         |         |
 9+15    437.3751    4434.59  | V       |  Q      |         |         |
 9+30    553.9603    5642.72  |  V      |      Q  |         |         |
 9+45    699.8940    7063.19  |   V     |         | Q       |         |
10+ 0    877.4999    8596.13  |    V    |         |     Q   |         |
10+15   1086.0227   10092.50  |     V   |         |         |Q        |
10+30   1321.8367   11413.40  |       V |         |         |    Q    |
10+45   1576.2290   12312.59  |        V|         |         |       Q |
11+ 0   1839.2444   12729.94  |         |V        |         |        Q|
11+15   2096.2586   12439.49  |         |  V      |         |       Q |
11+30   2336.5239   11628.84  |         |   V     |         |     Q   |
11+45   2554.1326   10532.26  |         |    V    |         | Q       |
12+ 0   2748.8195    9422.85  |         |      V  |        Q|         |
12+15   2924.2585    8491.25  |         |       V |     Q   |         |
12+30   3082.8764    7677.11  |         |        V|  Q      |         |
12+45   3227.7878    7013.71  |         |         VQ        |         |
13+ 0   3360.9639    6445.72  |         |         QV        |         |
13+15   3484.2396    5966.54  |         |       Q |V        |         |
13+30   3598.8847    5548.82  |         |      Q  | V       |         |
13+45   3706.0344    5186.05  |         |     Q   |  V      |         |
14+ 0   3806.4028    4857.83  |         |    Q    |  V      |         |
14+15   3900.5737    4557.87  |         |   Q     |   V     |         |
14+30   3989.0939    4284.38  |         |  Q      |   V     |         |
14+45   4072.5711    4040.30  |         | Q       |    V    |         |
15+ 0   4151.8703    3838.08  |         |Q        |    V    |         |
15+15   4228.1148    3690.23  |         |Q        |     V   |         |
15+30   4302.0655    3579.21  |         |Q        |     V   |         |
15+45   4372.8783    3427.34  |         Q         |      V  |         |
16+ 0   4439.8259    3240.26  |         Q         |      V  |         |
16+15   4503.9461    3103.42  |        Q|         |       V |         |
16+30   4567.2598    3064.38  |        Q|         |       V |         |
16+45   4631.1113    3090.42  |        Q|         |       V |         |
17+ 0   4695.2077    3102.26  |        Q|         |        V|         |
17+15   4758.7820    3077.00  |        Q|         |        V|         |
17+30   4821.7003    3045.25  |        Q|         |         V         |
17+45   4884.1151    3020.87  |        Q|         |         V         |
18+ 0   4946.1050    3000.31  |        Q|         |         V         |
18+15   5007.1815    2956.10  |        Q|         |         |V        |
18+30   5066.7635    2883.77  |        Q|         |         |V        |
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   18+45    5124.7593   2807.00  |       Q |         |         | V       |
   19+ 0    5181.4172   2742.24  |       Q |         |         | V       |
   19+15    5236.5097   2666.48  |       Q |         |         | V       |
   19+30    5289.5151   2565.46  |       Q |         |         |  V      |
   19+45    5340.2574   2455.93  |      Q  |         |         |  V      |
   20+ 0    5389.0775   2362.89  |      Q  |         |         |  V      |
   20+15    5436.3614   2288.54  |      Q  |         |         |  V      |
   20+30    5482.2650   2221.74  |     Q   |         |         |   V     |
   20+45    5527.2068   2175.19  |     Q   |         |         |   V     |
   21+ 0    5571.7227   2154.57  |     Q   |         |         |   V     |
   21+15    5616.3609   2160.49  |     Q   |         |         |    V    |
   21+30    5661.2815   2174.16  |     Q   |         |         |    V    |
   21+45    5706.2140   2174.73  |     Q   |         |         |    V    |
   22+ 0    5750.7873   2157.35  |     Q   |         |         |    V    |
   22+15    5794.5535   2118.29  |     Q   |         |         |     V   |
   22+30    5837.3825   2072.92  |     Q   |         |         |     V   |
   22+45    5879.3752   2032.45  |     Q   |         |         |     V   |
   23+ 0    5920.6972   1999.99  |     Q   |         |         |      V  |
   23+15    5961.5664   1978.07  |     Q   |         |         |      V  |
   23+30    6002.1275   1963.15  |     Q   |         |         |      V  |
   23+45    6042.5090   1954.46  |     Q   |         |         |      V  |
   24+ 0    6082.8470   1952.36  |     Q   |         |         |       V |
   24+15    6123.2897   1957.43  |     Q   |         |         |       V |
   24+30    6163.7649   1959.00  |     Q   |         |         |       V |
   24+45    6203.6977   1932.75  |     Q   |         |         |       V |
   25+ 0    6241.9407   1850.96  |    Q    |         |         |        V|
   25+15    6276.0107   1648.99  |    Q    |         |         |        V|
   25+30    6304.1245   1360.71  |   Q     |         |         |        V|
   25+45    6325.9961   1058.59  |  Q      |         |         |        V|
   26+ 0    6342.6965    808.30  | Q       |         |         |        V|
   26+15    6355.8389    636.09  |Q        |         |         |        V|
   26+30    6366.1678    499.92  |Q        |         |         |        V|
   26+45    6374.2965    393.43  |Q        |         |         |        V|
   27+ 0    6380.6774    308.83  Q         |         |         |        V|
   27+15    6385.6401    240.20  Q         |         |         |        V|
   27+30    6389.4444    184.13  Q         |         |         |        V|
   27+45    6392.3067    138.53  Q         |         |         |        V|
   28+ 0    6394.3956    101.10  Q         |         |         |        V|
   28+15    6395.8735     71.53  Q         |         |         |        V|
   28+30    6396.8689     48.18  Q         |         |         |        V|
   28+45    6397.4858     29.85  Q         |         |         |        V|
   29+ 0    6397.8312     16.72  Q         |         |         |        V|
   29+15    6397.9716      6.79  Q         |         |         |        V|
   29+30    6398.0058      1.65  Q         |         |         |        V|
   29+45    6398.0058      0.00  Q         |         |         |        V|
-----------------------------------------------------------------------
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        U N I T   H Y D R O G R A P H   A N A L Y S I S
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                Study date  08/30/10  File: east100yr6hr.out

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Program License Serial Number 4055

----------------------------------------------------------------------
Tule Wind Project
Unnamed Eastern Wash
Existing 100 Year 6 Hour
Aug 25, 2010
----------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Storm Event Year = 100

Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
        Sub-Area(Ac.)       Rainfall (In)
           734.00             3.00

Rainfall Distribution pattern used in study:
Type B for SCS (small dam) or San Diego 6 hour storms
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

********* Area-Averaged SCS Curve Number and Fm *********

Area       Area          SCS CN    SCS CN    Fm      Soil
(Ac.)      fract         (AMC2)    (AMC2)   (In/Hr)  Group
   734.00   1.000         85.1      85.1     0.050    C

Area-averaged catchment SCS Curve Number AMC(2) = 85.130
Area-averaged Fm value using values listed =  0.050(In/Hr)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Direct entry of lag time by user
Watershed area =     734.00(Ac.)
Catchment Lag time =   0.380 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 21.9298
Hydrograph baseflow =     0.00(CFS)
Minimum watershed loss rate(Fm) =  0.000(In/Hr)
Average adjusted SCS Curve Number = 85.130

Rainfall depth area reduction factors:
Using a total area of     734.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study =    3.000(In)
Adjusted rainfall =    3.000(In)
```

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T   H Y D R O G R A P H
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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 8881.40 (CFS))

0.22	0.083	0.017	34.408	0.004
0.44	0.167	0.085	169.808	0.023
0.66	0.250	0.290	580.041	0.088
0.88	0.333	0.784	1566.642	0.265
1.10	0.417	1.000	1997.798	0.490
1.32	0.500	0.716	1430.728	0.651
1.54	0.583	0.467	933.347	0.756
1.75	0.667	0.329	656.341	0.830
1.97	0.750	0.237	473.266	0.883
2.19	0.833	0.175	348.921	0.922
2.41	0.917	0.129	256.962	0.951
2.63	1.000	0.091	181.388	0.972
2.85	1.083	0.062	124.326	0.986
3.07	1.167	0.040	80.165	0.995
3.29	1.250	0.020	40.797	0.999
3.51	1.333	0.003	6.463	1.000

+++

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr-ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0175	0.0000	0.0175	0.0000	0.0175	--------
0.17	0.0350	0.0000	0.0175	0.0000	0.0175	--------
0.25	0.0525	0.0000	0.0175	0.0000	0.0175	--------
0.33	0.0700	0.0000	0.0175	0.0000	0.0175	--------
0.42	0.0875	0.0000	0.0175	0.0000	0.0175	--------
0.50	0.1050	0.0000	0.0175	0.0000	0.0175	--------

0.58	0.1285	0.0000	0.0235	0.0000	0.0235	--------
0.67	0.1520	0.0000	0.0235	0.0000	0.0235	--------
0.75	0.1755	0.0000	0.0235	0.0000	0.0235	--------
0.83	0.1990	0.0000	0.0235	0.0000	0.0235	--------
0.92	0.2225	0.0000	0.0235	0.0000	0.0235	--------
1.00	0.2460	0.0000	0.0235	0.0000	0.0235	--------
1.08	0.2750	0.0000	0.0290	0.0000	0.0290	--------
1.17	0.3040	0.0000	0.0290	0.0000	0.0290	--------
1.25	0.3330	0.0000	0.0290	0.0000	0.0290	--------
1.33	0.3620	0.0001	0.0290	0.0001	0.0289	--------
1.42	0.3910	0.0010	0.0290	0.0009	0.0281	--------
1.50	0.4200	0.0027	0.0290	0.0018	0.0272	--------
1.58	0.4650	0.0072	0.0450	0.0044	0.0406	--------
1.67	0.5100	0.0135	0.0450	0.0063	0.0387	--------
1.75	0.5550	0.0217	0.0450	0.0081	0.0369	--------
1.83	0.6000	0.0315	0.0450	0.0098	0.0352	--------
1.92	0.6450	0.0428	0.0450	0.0113	0.0337	--------
2.00	0.6900	0.0556	0.0450	0.0128	0.0322	--------
2.08	0.8750	0.1216	0.1850	0.0660	0.1190	--------
2.17	1.0600	0.2055	0.1850	0.0839	0.1011	--------
2.25	1.2450	0.3036	0.1850	0.0981	0.0869	--------
2.33	1.4300	0.4130	0.1850	0.1094	0.0756	--------
2.42	1.6150	0.5318	0.1850	0.1187	0.0663	--------
2.50	1.8000	0.6582	0.1850	0.1264	0.0586	--------
2.58	1.8500	0.6935	0.0500	0.0353	0.0147	--------
2.67	1.9000	0.7292	0.0500	0.0358	0.0142	--------
2.75	1.9500	0.7654	0.0500	0.0362	0.0138	--------
2.83	2.0000	0.8020	0.0500	0.0366	0.0134	--------
2.92	2.0500	0.8390	0.0500	0.0370	0.0130	--------
3.00	2.1000	0.8763	0.0500	0.0373	0.0127	--------
3.08	2.1405	0.9068	0.0405	0.0305	0.0100	--------
3.17	2.1810	0.9376	0.0405	0.0307	0.0098	--------
3.25	2.2215	0.9685	0.0405	0.0310	0.0095	--------
3.33	2.2620	0.9997	0.0405	0.0312	0.0093	--------
3.42	2.3025	1.0311	0.0405	0.0314	0.0091	--------
3.50	2.3430	1.0626	0.0405	0.0316	0.0089	--------
3.58	2.3700	1.0838	0.0270	0.0212	0.0058	--------
3.67	2.3970	1.1050	0.0270	0.0212	0.0058	--------
3.75	2.4240	1.1263	0.0270	0.0213	0.0057	--------
3.83	2.4510	1.1477	0.0270	0.0214	0.0056	--------
3.92	2.4780	1.1692	0.0270	0.0215	0.0055	--------
4.00	2.5050	1.1908	0.0270	0.0216	0.0054	--------
4.08	2.5275	1.2088	0.0225	0.0180	0.0045	--------
4.17	2.5500	1.2269	0.0225	0.0181	0.0044	--------
4.25	2.5725	1.2450	0.0225	0.0181	0.0044	--------
4.33	2.5950	1.2631	0.0225	0.0182	0.0043	--------
4.42	2.6175	1.2814	0.0225	0.0182	0.0043	--------
4.50	2.6400	1.2996	0.0225	0.0183	0.0042	--------
4.58	2.6615	1.3171	0.0215	0.0175	0.0040	--------
4.67	2.6830	1.3347	0.0215	0.0175	0.0040	--------
4.75	2.7045	1.3522	0.0215	0.0176	0.0039	--------
4.83	2.7260	1.3699	0.0215	0.0176	0.0039	--------
4.92	2.7475	1.3875	0.0215	0.0177	0.0038	--------
5.00	2.7690	1.4052	0.0215	0.0177	0.0038	--------
5.08	2.7875	1.4205	0.0185	0.0153	0.0032	--------
5.17	2.8060	1.4358	0.0185	0.0153	0.0032	--------
5.25	2.8245	1.4511	0.0185	0.0153	0.0032	--------
5.33	2.8430	1.4664	0.0185	0.0153	0.0032	--------
5.42	2.8615	1.4818	0.0185	0.0154	0.0031	--------
5.50	2.8800	1.4972	0.0185	0.0154	0.0031	--------
5.58	2.9000	1.5139	0.0200	0.0167	0.0033	--------
5.67	2.9200	1.5306	0.0200	0.0167	0.0033	--------
5.75	2.9400	1.5474	0.0200	0.0167	0.0033	--------

```
     5.83    2.9600     1.5641     0.0200     0.0168     0.0032 --------
     5.92    2.9800     1.5809     0.0200     0.0168     0.0032 --------
     6.00    3.0000     1.5978     0.0200     0.0168     0.0032 --------
   --------------------------------------------------------------------
   --------------------------------------------------------------------
   Total soil rain loss =      1.40(In)
   Total effective runoff =      1.60(In)
   ---------------------------------------------------------------------
   Peak flow rate this hydrograph =         808.32(CFS)
   Total runoff volume this hydrograph =       4257090.5(Ft3)
   ---------------------------------------------------------------------
   ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                       6 - H O U R   S T O R M
                  R u n o f f     H y d r o g r a p h
   --------------------------------------------------------------------
               Hydrograph in   5   Minute intervals ((CFS))

   --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0      225.0     450.0     675.0     900.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  Q         |         |         |         |
  0+10       0.0000      0.00  Q         |         |         |         |
  0+15       0.0000      0.00  Q         |         |         |         |
  0+20       0.0000      0.00  Q         |         |         |         |
  0+25       0.0000      0.00  Q         |         |         |         |
  0+30       0.0000      0.00  Q         |         |         |         |
  0+35       0.0000      0.00  Q         |         |         |         |
  0+40       0.0000      0.00  Q         |         |         |         |
  0+45       0.0000      0.00  Q         |         |         |         |
  0+50       0.0000      0.00  Q         |         |         |         |
  0+55       0.0000      0.00  Q         |         |         |         |
  1+ 0       0.0000      0.00  Q         |         |         |         |
  1+ 5       0.0000      0.00  Q         |         |         |         |
  1+10       0.0000      0.00  Q         |         |         |         |
  1+15       0.0000      0.00  Q         |         |         |         |
  1+20       0.0000      0.00  Q         |         |         |         |
  1+25       0.0003      0.05  Q         |         |         |         |
  1+30       0.0021      0.26  Q         |         |         |         |
  1+35       0.0098      1.11  Q         |         |         |         |
  1+40       0.0343      3.56  Q         |         |         |         |
  1+45       0.0935      8.60  Q         |         |         |         |
  1+50       0.2123     17.24  Q         |         |         |         |
  1+55       0.4120     29.00  VQ        |         |         |         |
  2+ 0       0.7019     42.09  VQ        |         |         |         |
  2+ 5       1.0975     57.45  V Q       |         |         |         |
  2+10       1.6519     80.49  V  Q      |         |         |         |
  2+15       2.5289    127.34  |V    Q   |         |         |         |
  2+20       4.1401    233.94  |V        Q         |         |         |
  2+25       6.7974    385.85  | V       |      Q  |         |         |
  2+30      10.4704    533.31  |   V     |         | Q       |         |
  2+35      15.0279    661.76  |     V   |         |       Q|         |
  2+40      20.2786    762.39  |       V |         |         |   Q     |
  2+45      25.8455    808.32  |         V         |         |     Q   |
  2+50      30.9599    742.61  |         | V       |         |   Q     |
  2+55      35.2026    616.05  |         |   V     |     Q   |         |
  3+ 0      38.8239    525.81  |         |    V    | Q       |         |
  3+ 5      42.0612    470.06  |         |      V  Q         |         |
  3+10      45.0275    430.70  |         |       VQ|         |         |
  3+15      47.7741    398.81  |         |      Q V|         |         |
  3+20      50.2944    365.94  |         |     Q   V         |         |
  3+25      52.6021    335.08  |         |   Q     |V        |         |
  3+30      54.7581    313.05  |         |  Q      | V       |         |
  3+35      56.8108    298.06  |         |  Q      |  V      |         |
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    3+40      58.7860    286.80  |         | Q       |   V     |         |
    3+45      60.6844    275.64  |         | Q       |   V     |         |
    3+50      62.4600    257.82  |         |Q        |    V    |         |
    3+55      64.0881    236.41  |         Q         |     V   |         |
    4+ 0      65.6120    221.27  |        Q|         |     V   |         |
    4+ 5      67.0686    211.49  |        Q|         |      V  |         |
    4+10      68.4758    204.33  |        Q|         |       V |         |
    4+15      69.8381    197.81  |       Q |         |       V |         |
    4+20      71.1412    189.20  |       Q |         |        V|         |
    4+25      72.3806    179.97  |      Q  |         |        V|         |
    4+30      73.5756    173.51  |      Q  |         |         V         |
    4+35      74.7419    169.35  |      Q  |         |         V         |
    4+40      75.8887    166.51  |      Q  |         |         |V        |
    4+45      77.0207    164.37  |      Q  |         |         |V        |
    4+50      78.1380    162.22  |      Q  |         |         |V        |
    4+55      79.2406    160.10  |      Q  |         |         | V       |
    5+ 0      80.3335    158.69  |      Q  |         |         | V       |
    5+ 5      81.4203    157.79  |      Q  |         |         |  V      |
    5+10      82.5010    156.93  |     Q   |         |         |  V      |
    5+15      83.5708    155.33  |     Q   |         |         |   V     |
    5+20      84.6142    151.50  |     Q   |         |         |   V     |
    5+25      85.6243    146.67  |     Q   |         |         |    V    |
    5+30      86.6111    143.29  |     Q   |         |         |    V    |
    5+35      87.5836    141.20  |     Q   |         |         |    V    |
    5+40      88.5478    140.00  |     Q   |         |         |     V   |
    5+45      89.5105    139.78  |     Q   |         |         |     V   |
    5+50      90.4825    141.13  |     Q   |         |         |      V  |
    5+55      91.4691    143.26  |     Q   |         |         |      V  |
    6+ 0      92.4667    144.86  |     Q   |         |         |      V  |
    6+ 5      93.4681    145.40  |     Q   |         |         |       V |
    6+10      94.4559    143.42  |     Q   |         |         |       V |
    6+15      95.3814    134.39  |    Q    |         |         |        V|
    6+20      96.1296    108.64  |   Q     |         |         |        V|
    6+25      96.6494     75.47  |  Q      |         |         |        V|
    6+30      97.0055     51.71  | Q       |         |         |        V|
    6+35      97.2549     36.22  |Q        |         |         |        V|
    6+40      97.4292     25.32  |Q        |         |         |        V|
    6+45      97.5493     17.43  Q         |         |         |        V|
    6+50      97.6291     11.59  Q         |         |         |        V|
    6+55      97.6792      7.28  Q         |         |         |        V|
    7+ 0      97.7084      4.23  Q         |         |         |        V|
    7+ 5      97.7231      2.14  Q         |         |         |        V|
    7+10      97.7286      0.80  Q         |         |         |        V|
    7+15      97.7294      0.11  Q         |         |         |        V|
-----------------------------------------------------------------------
```

U N I T   H Y D R O G R A P H   A N A L Y S I S

Study date 08/30/10 File: east100yr24hr.out

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Program License Serial Number 4055

Tule Wind Project
Unnamed Eastern Wash
Existing 100 Year 24 Hour
Aug 25, 2010

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Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
734.00	5.40

Rainfall Distribution pattern used in study:
Type B for San Diego area of California

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********* Area-Averaged SCS Curve Number and Fm *********

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
734.00	1.000	85.1	85.1	0.050	C

Area-averaged catchment SCS Curve Number AMC(2) = 85.130
Area-averaged Fm value using values listed = 0.050(In/Hr)
+++
Direct entry of lag time by user
Watershed area =   734.00(Ac.)
Catchment Lag time =   0.380 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 21.9298
Hydrograph baseflow =   0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 85.130

Rainfall depth area reduction factors:
Using a total area of   734.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study =   5.400(In)
Adjusted rainfall =   5.400(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H
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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 8881.40 (CFS))

0.22	0.083	0.017	34.408	0.004
0.44	0.167	0.085	169.808	0.023
0.66	0.250	0.290	580.041	0.088
0.88	0.333	0.784	1566.642	0.265
1.10	0.417	1.000	1997.798	0.490
1.32	0.500	0.716	1430.728	0.651
1.54	0.583	0.467	933.347	0.756
1.75	0.667	0.329	656.341	0.830
1.97	0.750	0.237	473.266	0.883
2.19	0.833	0.175	348.921	0.922
2.41	0.917	0.129	256.962	0.951
2.63	1.000	0.091	181.388	0.972
2.85	1.083	0.062	124.326	0.986
3.07	1.167	0.040	80.165	0.995
3.29	1.250	0.020	40.797	0.999
3.51	1.333	0.003	6.463	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \qquad \text{and} \qquad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr-ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0081	0.0000	0.0081	0.0000	0.0081	--------
0.17	0.0162	0.0000	0.0081	0.0000	0.0081	--------
0.25	0.0243	0.0000	0.0081	0.0000	0.0081	--------
0.33	0.0324	0.0000	0.0081	0.0000	0.0081	--------
0.42	0.0405	0.0000	0.0081	0.0000	0.0081	--------
0.50	0.0486	0.0000	0.0081	0.0000	0.0081	--------

0.58	0.0549	0.0000	0.0063	0.0000	0.0063	--------
0.67	0.0612	0.0000	0.0063	0.0000	0.0063	--------
0.75	0.0675	0.0000	0.0063	0.0000	0.0063	--------
0.83	0.0738	0.0000	0.0063	0.0000	0.0063	--------
0.92	0.0801	0.0000	0.0063	0.0000	0.0063	--------
1.00	0.0864	0.0000	0.0063	0.0000	0.0063	--------
1.08	0.0945	0.0000	0.0081	0.0000	0.0081	--------
1.17	0.1026	0.0000	0.0081	0.0000	0.0081	--------
1.25	0.1107	0.0000	0.0081	0.0000	0.0081	--------
1.33	0.1188	0.0000	0.0081	0.0000	0.0081	--------
1.42	0.1269	0.0000	0.0081	0.0000	0.0081	--------
1.50	0.1350	0.0000	0.0081	0.0000	0.0081	--------
1.58	0.1431	0.0000	0.0081	0.0000	0.0081	--------
1.67	0.1512	0.0000	0.0081	0.0000	0.0081	--------
1.75	0.1593	0.0000	0.0081	0.0000	0.0081	--------
1.83	0.1674	0.0000	0.0081	0.0000	0.0081	--------
1.92	0.1755	0.0000	0.0081	0.0000	0.0081	--------
2.00	0.1836	0.0000	0.0081	0.0000	0.0081	--------
2.08	0.1935	0.0000	0.0099	0.0000	0.0099	--------
2.17	0.2034	0.0000	0.0099	0.0000	0.0099	--------
2.25	0.2133	0.0000	0.0099	0.0000	0.0099	--------
2.33	0.2232	0.0000	0.0099	0.0000	0.0099	--------
2.42	0.2331	0.0000	0.0099	0.0000	0.0099	--------
2.50	0.2430	0.0000	0.0099	0.0000	0.0099	--------
2.58	0.2511	0.0000	0.0081	0.0000	0.0081	--------
2.67	0.2592	0.0000	0.0081	0.0000	0.0081	--------
2.75	0.2673	0.0000	0.0081	0.0000	0.0081	--------
2.83	0.2754	0.0000	0.0081	0.0000	0.0081	--------
2.92	0.2835	0.0000	0.0081	0.0000	0.0081	--------
3.00	0.2916	0.0000	0.0081	0.0000	0.0081	--------
3.08	0.3015	0.0000	0.0099	0.0000	0.0099	--------
3.17	0.3114	0.0000	0.0099	0.0000	0.0099	--------
3.25	0.3213	0.0000	0.0099	0.0000	0.0099	--------
3.33	0.3312	0.0000	0.0099	0.0000	0.0099	--------
3.42	0.3411	0.0000	0.0099	0.0000	0.0099	--------
3.50	0.3510	0.0000	0.0099	0.0000	0.0099	--------
3.58	0.3618	0.0001	0.0108	0.0001	0.0107	--------
3.67	0.3726	0.0003	0.0108	0.0002	0.0106	--------
3.75	0.3834	0.0007	0.0108	0.0003	0.0105	--------
3.83	0.3942	0.0011	0.0108	0.0005	0.0103	--------
3.92	0.4050	0.0017	0.0108	0.0006	0.0102	--------
4.00	0.4158	0.0024	0.0108	0.0007	0.0101	--------
4.08	0.4275	0.0033	0.0117	0.0009	0.0108	--------
4.17	0.4392	0.0044	0.0117	0.0010	0.0107	--------
4.25	0.4509	0.0056	0.0117	0.0012	0.0105	--------
4.33	0.4626	0.0069	0.0117	0.0013	0.0104	--------
4.42	0.4743	0.0083	0.0117	0.0014	0.0103	--------
4.50	0.4860	0.0099	0.0117	0.0016	0.0101	--------
4.58	0.4986	0.0117	0.0126	0.0018	0.0108	--------
4.67	0.5112	0.0137	0.0126	0.0020	0.0106	--------
4.75	0.5238	0.0158	0.0126	0.0021	0.0105	--------
4.83	0.5364	0.0181	0.0126	0.0023	0.0103	--------
4.92	0.5490	0.0205	0.0126	0.0024	0.0102	--------
5.00	0.5616	0.0230	0.0126	0.0025	0.0101	--------
5.08	0.5760	0.0260	0.0144	0.0030	0.0114	--------
5.17	0.5904	0.0292	0.0144	0.0032	0.0112	--------
5.25	0.6048	0.0326	0.0144	0.0034	0.0110	--------
5.33	0.6192	0.0361	0.0144	0.0035	0.0109	--------
5.42	0.6336	0.0398	0.0144	0.0037	0.0107	--------
5.50	0.6480	0.0436	0.0144	0.0038	0.0106	--------
5.58	0.6633	0.0478	0.0153	0.0042	0.0111	--------
5.67	0.6786	0.0522	0.0153	0.0044	0.0109	--------
5.75	0.6939	0.0568	0.0153	0.0045	0.0108	--------

5.83	0.7092	0.0615	0.0153	0.0047	0.0106	--------
5.92	0.7245	0.0663	0.0153	0.0049	0.0104	--------
6.00	0.7398	0.0713	0.0153	0.0050	0.0103	--------
6.08	0.7578	0.0774	0.0180	0.0061	0.0119	--------
6.17	0.7758	0.0837	0.0180	0.0063	0.0117	--------
6.25	0.7938	0.0902	0.0180	0.0065	0.0115	--------
6.33	0.8118	0.0968	0.0180	0.0067	0.0113	--------
6.42	0.8298	0.1036	0.0180	0.0068	0.0112	--------
6.50	0.8478	0.1107	0.0180	0.0070	0.0110	--------
6.58	0.8685	0.1189	0.0207	0.0083	0.0124	--------
6.67	0.8892	0.1275	0.0207	0.0085	0.0122	--------
6.75	0.9099	0.1362	0.0207	0.0087	0.0120	--------
6.83	0.9306	0.1451	0.0207	0.0089	0.0118	--------
6.92	0.9513	0.1543	0.0207	0.0091	0.0116	--------
7.00	0.9720	0.1636	0.0207	0.0094	0.0113	--------
7.08	0.9990	0.1761	0.0270	0.0125	0.0145	--------
7.17	1.0260	0.1889	0.0270	0.0128	0.0142	--------
7.25	1.0530	0.2021	0.0270	0.0131	0.0139	--------
7.33	1.0800	0.2155	0.0270	0.0134	0.0136	--------
7.42	1.1070	0.2292	0.0270	0.0137	0.0133	--------
7.50	1.1340	0.2432	0.0270	0.0140	0.0130	--------
7.58	1.1745	0.2647	0.0405	0.0215	0.0190	--------
7.67	1.2150	0.2868	0.0405	0.0221	0.0184	--------
7.75	1.2555	0.3095	0.0405	0.0227	0.0178	--------
7.83	1.2960	0.3327	0.0405	0.0232	0.0173	--------
7.92	1.3365	0.3564	0.0405	0.0237	0.0168	--------
8.00	1.3770	0.3806	0.0405	0.0242	0.0163	--------
8.08	1.4373	0.4176	0.0603	0.0369	0.0234	--------
8.17	1.4976	0.4554	0.0603	0.0379	0.0224	--------
8.25	1.5579	0.4942	0.0603	0.0388	0.0215	--------
8.33	1.6182	0.5339	0.0603	0.0397	0.0206	--------
8.42	1.6785	0.5744	0.0603	0.0405	0.0198	--------
8.50	1.7388	0.6156	0.0603	0.0412	0.0191	--------
8.58	1.8180	0.6708	0.0792	0.0552	0.0240	--------
8.67	1.8972	0.7272	0.0792	0.0564	0.0228	--------
8.75	1.9764	0.7847	0.0792	0.0575	0.0217	--------
8.83	2.0556	0.8431	0.0792	0.0585	0.0207	--------
8.92	2.1348	0.9025	0.0792	0.0594	0.0198	--------
9.00	2.2140	0.9628	0.0792	0.0603	0.0189	--------
9.08	2.3004	1.0294	0.0864	0.0667	0.0197	--------
9.17	2.3868	1.0970	0.0864	0.0676	0.0188	--------
9.25	2.4732	1.1654	0.0864	0.0684	0.0180	--------
9.33	2.5596	1.2346	0.0864	0.0692	0.0172	--------
9.42	2.6460	1.3045	0.0864	0.0699	0.0165	--------
9.50	2.7324	1.3751	0.0864	0.0706	0.0158	--------
9.58	2.8062	1.4359	0.0738	0.0608	0.0130	--------
9.67	2.8800	1.4972	0.0738	0.0613	0.0125	--------
9.75	2.9538	1.5589	0.0738	0.0617	0.0121	--------
9.83	3.0276	1.6210	0.0738	0.0621	0.0117	--------
9.92	3.1014	1.6835	0.0738	0.0625	0.0113	--------
10.00	3.1752	1.7464	0.0738	0.0629	0.0109	--------
10.08	3.2121	1.7779	0.0369	0.0316	0.0053	--------
10.17	3.2490	1.8096	0.0369	0.0316	0.0053	--------
10.25	3.2859	1.8413	0.0369	0.0317	0.0052	--------
10.33	3.3228	1.8731	0.0369	0.0318	0.0051	--------
10.42	3.3597	1.9050	0.0369	0.0319	0.0050	--------
10.50	3.3966	1.9370	0.0369	0.0320	0.0049	--------
10.58	3.4209	1.9580	0.0243	0.0211	0.0032	--------
10.67	3.4452	1.9792	0.0243	0.0211	0.0032	--------
10.75	3.4695	2.0003	0.0243	0.0212	0.0031	--------
10.83	3.4938	2.0215	0.0243	0.0212	0.0031	--------
10.92	3.5181	2.0427	0.0243	0.0212	0.0031	--------
11.00	3.5424	2.0640	0.0243	0.0212	0.0031	--------

11.08	3.5631	2.0821	0.0207	0.0181	0.0026	--------
11.17	3.5838	2.1002	0.0207	0.0181	0.0026	--------
11.25	3.6045	2.1184	0.0207	0.0182	0.0025	--------
11.33	3.6252	2.1366	0.0207	0.0182	0.0025	--------
11.42	3.6459	2.1548	0.0207	0.0182	0.0025	--------
11.50	3.6666	2.1730	0.0207	0.0182	0.0025	--------
11.58	3.6855	2.1897	0.0189	0.0167	0.0022	--------
11.67	3.7044	2.2064	0.0189	0.0167	0.0022	--------
11.75	3.7233	2.2230	0.0189	0.0167	0.0022	--------
11.83	3.7422	2.2398	0.0189	0.0167	0.0022	--------
11.92	3.7611	2.2565	0.0189	0.0167	0.0022	--------
12.00	3.7800	2.2732	0.0189	0.0167	0.0022	--------
12.08	3.7980	2.2892	0.0180	0.0160	0.0020	--------
12.17	3.8160	2.3052	0.0180	0.0160	0.0020	--------
12.25	3.8340	2.3211	0.0180	0.0160	0.0020	--------
12.33	3.8520	2.3371	0.0180	0.0160	0.0020	--------
12.42	3.8700	2.3532	0.0180	0.0160	0.0020	--------
12.50	3.8880	2.3692	0.0180	0.0160	0.0020	--------
12.58	3.9051	2.3844	0.0171	0.0152	0.0019	--------
12.67	3.9222	2.3997	0.0171	0.0153	0.0018	--------
12.75	3.9393	2.4149	0.0171	0.0153	0.0018	--------
12.83	3.9564	2.4302	0.0171	0.0153	0.0018	--------
12.92	3.9735	2.4455	0.0171	0.0153	0.0018	--------
13.00	3.9906	2.4608	0.0171	0.0153	0.0018	--------
13.08	4.0059	2.4745	0.0153	0.0137	0.0016	--------
13.17	4.0212	2.4882	0.0153	0.0137	0.0016	--------
13.25	4.0365	2.5019	0.0153	0.0137	0.0016	--------
13.33	4.0518	2.5156	0.0153	0.0137	0.0016	--------
13.42	4.0671	2.5294	0.0153	0.0137	0.0016	--------
13.50	4.0824	2.5431	0.0153	0.0137	0.0016	--------
13.58	4.0968	2.5560	0.0144	0.0129	0.0015	--------
13.67	4.1112	2.5690	0.0144	0.0129	0.0015	--------
13.75	4.1256	2.5819	0.0144	0.0130	0.0014	--------
13.83	4.1400	2.5949	0.0144	0.0130	0.0014	--------
13.92	4.1544	2.6079	0.0144	0.0130	0.0014	--------
14.00	4.1688	2.6209	0.0144	0.0130	0.0014	--------
14.08	4.1850	2.6355	0.0162	0.0146	0.0016	--------
14.17	4.2012	2.6501	0.0162	0.0146	0.0016	--------
14.25	4.2174	2.6647	0.0162	0.0146	0.0016	--------
14.33	4.2336	2.6794	0.0162	0.0146	0.0016	--------
14.42	4.2498	2.6940	0.0162	0.0146	0.0016	--------
14.50	4.2660	2.7087	0.0162	0.0147	0.0015	--------
14.58	4.2750	2.7168	0.0090	0.0081	0.0009	--------
14.67	4.2840	2.7249	0.0090	0.0081	0.0009	--------
14.75	4.2930	2.7331	0.0090	0.0082	0.0008	--------
14.83	4.3020	2.7412	0.0090	0.0082	0.0008	--------
14.92	4.3110	2.7494	0.0090	0.0082	0.0008	--------
15.00	4.3200	2.7576	0.0090	0.0082	0.0008	--------
15.08	4.3344	2.7706	0.0144	0.0131	0.0013	--------
15.17	4.3488	2.7837	0.0144	0.0131	0.0013	--------
15.25	4.3632	2.7968	0.0144	0.0131	0.0013	--------
15.33	4.3776	2.8098	0.0144	0.0131	0.0013	--------
15.42	4.3920	2.8229	0.0144	0.0131	0.0013	--------
15.50	4.4064	2.8360	0.0144	0.0131	0.0013	--------
15.58	4.4199	2.8483	0.0135	0.0123	0.0012	--------
15.67	4.4334	2.8606	0.0135	0.0123	0.0012	--------
15.75	4.4469	2.8729	0.0135	0.0123	0.0012	--------
15.83	4.4604	2.8852	0.0135	0.0123	0.0012	--------
15.92	4.4739	2.8975	0.0135	0.0123	0.0012	--------
16.00	4.4874	2.9098	0.0135	0.0123	0.0012	--------
16.08	4.5000	2.9213	0.0126	0.0115	0.0011	--------
16.17	4.5126	2.9328	0.0126	0.0115	0.0011	--------
16.25	4.5252	2.9443	0.0126	0.0115	0.0011	--------

16.33	4.5378	2.9558	0.0126	0.0115	0.0011	--------
16.42	4.5504	2.9673	0.0126	0.0115	0.0011	--------
16.50	4.5630	2.9788	0.0126	0.0115	0.0011	--------
16.58	4.5765	2.9912	0.0135	0.0123	0.0012	--------
16.67	4.5900	3.0035	0.0135	0.0123	0.0012	--------
16.75	4.6035	3.0159	0.0135	0.0124	0.0011	--------
16.83	4.6170	3.0282	0.0135	0.0124	0.0011	--------
16.92	4.6305	3.0406	0.0135	0.0124	0.0011	--------
17.00	4.6440	3.0529	0.0135	0.0124	0.0011	--------
17.08	4.6548	3.0628	0.0108	0.0099	0.0009	--------
17.17	4.6656	3.0727	0.0108	0.0099	0.0009	--------
17.25	4.6764	3.0827	0.0108	0.0099	0.0009	--------
17.33	4.6872	3.0926	0.0108	0.0099	0.0009	--------
17.42	4.6980	3.1025	0.0108	0.0099	0.0009	--------
17.50	4.7088	3.1124	0.0108	0.0099	0.0009	--------
17.58	4.7205	3.1231	0.0117	0.0107	0.0010	--------
17.67	4.7322	3.1339	0.0117	0.0107	0.0010	--------
17.75	4.7439	3.1446	0.0117	0.0108	0.0009	--------
17.83	4.7556	3.1554	0.0117	0.0108	0.0009	--------
17.92	4.7673	3.1661	0.0117	0.0108	0.0009	--------
18.00	4.7790	3.1769	0.0117	0.0108	0.0009	--------
18.08	4.7880	3.1852	0.0090	0.0083	0.0007	--------
18.17	4.7970	3.1935	0.0090	0.0083	0.0007	--------
18.25	4.8060	3.2018	0.0090	0.0083	0.0007	--------
18.33	4.8150	3.2100	0.0090	0.0083	0.0007	--------
18.42	4.8240	3.2183	0.0090	0.0083	0.0007	--------
18.50	4.8330	3.2266	0.0090	0.0083	0.0007	--------
18.58	4.8420	3.2349	0.0090	0.0083	0.0007	--------
18.67	4.8510	3.2432	0.0090	0.0083	0.0007	--------
18.75	4.8600	3.2515	0.0090	0.0083	0.0007	--------
18.83	4.8690	3.2598	0.0090	0.0083	0.0007	--------
18.92	4.8780	3.2681	0.0090	0.0083	0.0007	--------
19.00	4.8870	3.2764	0.0090	0.0083	0.0007	--------
19.08	4.8951	3.2839	0.0081	0.0075	0.0006	--------
19.17	4.9032	3.2914	0.0081	0.0075	0.0006	--------
19.25	4.9113	3.2988	0.0081	0.0075	0.0006	--------
19.33	4.9194	3.3063	0.0081	0.0075	0.0006	--------
19.42	4.9275	3.3138	0.0081	0.0075	0.0006	--------
19.50	4.9356	3.3213	0.0081	0.0075	0.0006	--------
19.58	4.9446	3.3296	0.0090	0.0083	0.0007	--------
19.67	4.9536	3.3379	0.0090	0.0083	0.0007	--------
19.75	4.9626	3.3462	0.0090	0.0083	0.0007	--------
19.83	4.9716	3.3546	0.0090	0.0083	0.0007	--------
19.92	4.9806	3.3629	0.0090	0.0083	0.0007	--------
20.00	4.9896	3.3712	0.0090	0.0083	0.0007	--------
20.08	4.9995	3.3804	0.0099	0.0092	0.0007	--------
20.17	5.0094	3.3895	0.0099	0.0092	0.0007	--------
20.25	5.0193	3.3987	0.0099	0.0092	0.0007	--------
20.33	5.0292	3.4079	0.0099	0.0092	0.0007	--------
20.42	5.0391	3.4170	0.0099	0.0092	0.0007	--------
20.50	5.0490	3.4262	0.0099	0.0092	0.0007	--------
20.58	5.0580	3.4346	0.0090	0.0083	0.0007	--------
20.67	5.0670	3.4429	0.0090	0.0083	0.0007	--------
20.75	5.0760	3.4512	0.0090	0.0083	0.0007	--------
20.83	5.0850	3.4596	0.0090	0.0083	0.0007	--------
20.92	5.0940	3.4679	0.0090	0.0083	0.0007	--------
21.00	5.1030	3.4763	0.0090	0.0083	0.0007	--------
21.08	5.1111	3.4838	0.0081	0.0075	0.0006	--------
21.17	5.1192	3.4913	0.0081	0.0075	0.0006	--------
21.25	5.1273	3.4988	0.0081	0.0075	0.0006	--------
21.33	5.1354	3.5064	0.0081	0.0075	0.0006	--------
21.42	5.1435	3.5139	0.0081	0.0075	0.0006	--------
21.50	5.1516	3.5214	0.0081	0.0075	0.0006	--------

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 21.58   5.1597    3.5289    0.0081    0.0075    0.0006 --------
 21.67   5.1678    3.5365    0.0081    0.0075    0.0006 --------
 21.75   5.1759    3.5440    0.0081    0.0075    0.0006 --------
 21.83   5.1840    3.5515    0.0081    0.0075    0.0006 --------
 21.92   5.1921    3.5590    0.0081    0.0075    0.0006 --------
 22.00   5.2002    3.5666    0.0081    0.0075    0.0006 --------
 22.08   5.2083    3.5741    0.0081    0.0075    0.0006 --------
 22.17   5.2164    3.5816    0.0081    0.0075    0.0006 --------
 22.25   5.2245    3.5892    0.0081    0.0075    0.0006 --------
 22.33   5.2326    3.5967    0.0081    0.0075    0.0006 --------
 22.42   5.2407    3.6042    0.0081    0.0075    0.0006 --------
 22.50   5.2488    3.6118    0.0081    0.0075    0.0006 --------
 22.58   5.2569    3.6193    0.0081    0.0075    0.0006 --------
 22.67   5.2650    3.6269    0.0081    0.0075    0.0006 --------
 22.75   5.2731    3.6344    0.0081    0.0075    0.0006 --------
 22.83   5.2812    3.6420    0.0081    0.0075    0.0006 --------
 22.92   5.2893    3.6495    0.0081    0.0075    0.0006 --------
 23.00   5.2974    3.6571    0.0081    0.0075    0.0006 --------
 23.08   5.3064    3.6654    0.0090    0.0084    0.0006 --------
 23.17   5.3154    3.6738    0.0090    0.0084    0.0006 --------
 23.25   5.3244    3.6822    0.0090    0.0084    0.0006 --------
 23.33   5.3334    3.6906    0.0090    0.0084    0.0006 --------
 23.42   5.3424    3.6990    0.0090    0.0084    0.0006 --------
 23.50   5.3514    3.7074    0.0090    0.0084    0.0006 --------
 23.58   5.3595    3.7150    0.0081    0.0076    0.0005 --------
 23.67   5.3676    3.7225    0.0081    0.0076    0.0005 --------
 23.75   5.3757    3.7301    0.0081    0.0076    0.0005 --------
 23.83   5.3838    3.7376    0.0081    0.0076    0.0005 --------
 23.92   5.3919    3.7452    0.0081    0.0076    0.0005 --------
 24.00   5.4000    3.7528    0.0081    0.0076    0.0005 --------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      1.65(In)
Total effective runoff =      3.75(In)
---------------------------------------------------------------------
Peak flow rate this hydrograph =         597.93(CFS)
Total runoff volume this hydrograph =        9998969.3(Ft3)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0      150.0     300.0     450.0     600.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  Q         |         |         |         |
  0+10       0.0000      0.00  Q         |         |         |         |
  0+15       0.0000      0.00  Q         |         |         |         |
  0+20       0.0000      0.00  Q         |         |         |         |
  0+25       0.0000      0.00  Q         |         |         |         |
  0+30       0.0000      0.00  Q         |         |         |         |
  0+35       0.0000      0.00  Q         |         |         |         |
  0+40       0.0000      0.00  Q         |         |         |         |
  0+45       0.0000      0.00  Q         |         |         |         |
  0+50       0.0000      0.00  Q         |         |         |         |
  0+55       0.0000      0.00  Q         |         |         |         |
  1+ 0       0.0000      0.00  Q         |         |         |         |
  1+ 5       0.0000      0.00  Q         |         |         |         |
  1+10       0.0000      0.00  Q         |         |         |         |
  1+15       0.0000      0.00  Q         |         |         |         |
  1+20       0.0000      0.00  Q         |         |         |         |
```

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1+25       0.0000      0.00  Q          |         |         |         |
1+30       0.0000      0.00  Q          |         |         |         |
1+35       0.0000      0.00  Q          |         |         |         |
1+40       0.0000      0.00  Q          |         |         |         |
1+45       0.0000      0.00  Q          |         |         |         |
1+50       0.0000      0.00  Q          |         |         |         |
1+55       0.0000      0.00  Q          |         |         |         |
2+ 0       0.0000      0.00  Q          |         |         |         |
2+ 5       0.0000      0.00  Q          |         |         |         |
2+10       0.0000      0.00  Q          |         |         |         |
2+15       0.0000      0.00  Q          |         |         |         |
2+20       0.0000      0.00  Q          |         |         |         |
2+25       0.0000      0.00  Q          |         |         |         |
2+30       0.0000      0.00  Q          |         |         |         |
2+35       0.0000      0.00  Q          |         |         |         |
2+40       0.0000      0.00  Q          |         |         |         |
2+45       0.0000      0.00  Q          |         |         |         |
2+50       0.0000      0.00  Q          |         |         |         |
2+55       0.0000      0.00  Q          |         |         |         |
3+ 0       0.0000      0.00  Q          |         |         |         |
3+ 5       0.0000      0.00  Q          |         |         |         |
3+10       0.0000      0.00  Q          |         |         |         |
3+15       0.0000      0.00  Q          |         |         |         |
3+20       0.0000      0.00  Q          |         |         |         |
3+25       0.0000      0.00  Q          |         |         |         |
3+30       0.0000      0.00  Q          |         |         |         |
3+35       0.0000      0.00  Q          |         |         |         |
3+40       0.0002      0.02  Q          |         |         |         |
3+45       0.0009      0.10  Q          |         |         |         |
3+50       0.0032      0.34  Q          |         |         |         |
3+55       0.0088      0.82  Q          |         |         |         |
4+ 0       0.0192      1.50  Q          |         |         |         |
4+ 5       0.0352      2.32  Q          |         |         |         |
4+10       0.0575      3.24  Q          |         |         |         |
4+15       0.0867      4.24  Q          |         |         |         |
4+20       0.1236      5.37  Q          |         |         |         |
4+25       0.1689      6.58  Q          |         |         |         |
4+30       0.2226      7.79  Q          |         |         |         |
4+35       0.2846      9.00  Q          |         |         |         |
4+40       0.3550     10.22  Q          |         |         |         |
4+45       0.4341     11.49  Q          |         |         |         |
4+50       0.5228     12.88  Q          |         |         |         |
4+55       0.6215     14.33  Q          |         |         |         |
5+ 0       0.7299     15.73  VQ         |         |         |         |
5+ 5       0.8475     17.08  VQ         |         |         |         |
5+10       0.9745     18.44  VQ         |         |         |         |
5+15       1.1117     19.93  VQ         |         |         |         |
5+20       1.2617     21.79  VQ         |         |         |         |
5+25       1.4260     23.84  VQ         |         |         |         |
5+30       1.6031     25.73  VQ         |         |         |         |
5+35       1.7922     27.45  VQ         |         |         |         |
5+40       1.9927     29.11  VQ         |         |         |         |
5+45       2.2048     30.79  V Q        |         |         |         |
5+50       2.4298     32.68  V Q        |         |         |         |
5+55       2.6684     34.65  V Q        |         |         |         |
6+ 0       2.9195     36.46  V Q        |         |         |         |
6+ 5       3.1823     38.16  V Q        |         |         |         |
6+10       3.4571     39.90  V Q        |         |         |         |
6+15       3.7459     41.94  V Q        |         |         |         |
6+20       4.0549     44.87  V Q        |         |         |         |
6+25       4.3871     48.23  V   Q      |         |         |         |
6+30       4.7392     51.12  V   Q      |         |         |         |
6+35       5.1085     53.63  V   Q      |         |         |         |
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  6+40        5.4944      56.04  V  Q      |         |         |         |
  6+45        5.8988      58.72  |V Q      |         |         |         |
  6+50        6.3284      62.38  |V  Q     |         |         |         |
  6+55        6.7863      66.48  |V  Q     |         |         |         |
  7+ 0        7.2683      69.98  |V  Q     |         |         |         |
  7+ 5        7.7712      73.03  |V  Q     |         |         |         |
  7+10        8.2957      76.15  |V   Q    |         |         |         |
  7+15        8.8483      80.25  |V   Q    |         |         |         |
  7+20        9.4485      87.14  |V   Q    |         |         |         |
  7+25       10.1053      95.38  |V    Q   |         |         |         |
  7+30       10.8083     102.07  |V    Q   |         |         |         |
  7+35       11.5495     107.62  | V    Q  |         |         |         |
  7+40       12.3303     113.36  | V    Q  |         |         |         |
  7+45       13.1674     121.55  | V     Q |         |         |         |
  7+50       14.1085     136.65  | V      Q|         |         |         |
  7+55       15.1763     155.05  | V       Q         |         |         |
  8+ 0       16.3449     169.68  | V       |Q        |         |         |
  8+ 5       17.5936     181.30  |  V      | Q       |         |         |
  8+10       18.9201     192.61  |  V      | Q       |         |         |
  8+15       20.3500     207.62  |  V      |  Q      |         |         |
  8+20       21.9613     233.97  |  V      |    Q    |         |         |
  8+25       23.7907     265.62  |   V     |      Q  |         |         |
  8+30       25.7925     290.67  |   V     |        Q|         |         |
  8+35       27.9284     310.14  |   V     |         Q         |         |
  8+40       30.1866     327.88  |    V    |         |Q        |         |
  8+45       32.5874     348.61  |    V    |         |  Q      |         |
  8+50       35.2102     380.82  |     V   |         |    Q    |         |
  8+55       38.0897     418.10  |     V   |         |      Q  |         |
  9+ 0       41.1719     447.54  |      V  |         |        Q|         |
  9+ 5       44.4096     470.11  |      V  |         |         |Q        |
  9+10       47.7786     489.18  |       V |         |         | Q       |
  9+15       51.2735     507.45  |       V |         |         |  Q      |
  9+20       54.9164     528.96  |        V|         |         |    Q    |
  9+25       58.7142     551.43  |         V         |         |     Q   |
  9+30       62.6372     569.62  |         V         |         |      Q  |
  9+35       66.6571     583.69  |         |V        |         |       Q |
  9+40       70.7474     593.90  |         | V       |         |        Q|
  9+45       74.8653     597.93  |         |  V      |         |        Q|
  9+50       78.9291     590.06  |         |  V      |         |        Q|
  9+55       82.8994     576.49  |         |   V     |         |       Q |
 10+ 0       86.8098     567.78  |         |    V    |         |      Q  |
 10+ 5       90.6827     562.34  |         |    V    |         |      Q  |
 10+10       94.5040     554.86  |         |     V   |         |     Q   |
 10+15       98.1935     535.72  |         |      V  |         |    Q    |
 10+20      101.5409     486.04  |         |      V  |         | Q       |
 10+25      104.4543     423.02  |         |       V |       Q |         |
 10+30      107.0580     378.06  |         |       V |    Q    |         |
 10+35      109.4587     348.58  |         |        V|  Q      |         |
 10+40      111.7074     326.51  |         |        V|Q        |         |
 10+45      113.8144     305.92  |         |        VQ         |         |
 10+50      115.7333     278.63  |         |       Q V         |         |
 10+55      117.4511     249.42  |         |     Q   V         |         |
 11+ 0      119.0257     228.63  |         |    Q    V         |         |
 11+ 5      120.5055     214.87  |         |   Q     V         |         |
 11+10      121.9175     205.02  |         |  Q      |V        |         |
 11+15      123.2748     197.08  |         |  Q      |V        |         |
 11+20      124.5725     188.43  |         | Q       |V        |         |
 11+25      125.8094     179.60  |         |Q        |V        |         |
 11+30      127.0033     173.35  |         |Q        | V       |         |
 11+35      128.1687     169.22  |         |Q        | V       |         |
 11+40      129.3134     166.21  |         |Q        | V       |         |
 11+45      130.4398     163.55  |         Q         | V       |         |
 11+50      131.5424     160.09  |         Q         | V       |         |
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11+55     132.6187    156.28  |         Q         |  V      |         |
12+ 0     133.6766    153.61  |         Q         |  V      |         |
12+ 5     134.7226    151.87  |         Q         |  V      |         |
12+10     135.7597    150.59  |         Q         |  V      |         |
12+15     136.7887    149.40  |        Q|         |  V      |         |
12+20     137.8060    147.72  |        Q|         |   V     |         |
12+25     138.8106    145.86  |        Q|         |   V     |         |
12+30     139.8062    144.56  |        Q|         |   V     |         |
12+35     140.7960    143.73  |        Q|         |   V     |         |
12+40     141.7813    143.07  |        Q|         |   V     |         |
12+45     142.7612    142.28  |        Q|         |   V     |         |
12+50     143.7313    140.86  |        Q|         |    V    |         |
12+55     144.6898    139.17  |        Q|         |    V    |         |
13+ 0     145.6402    137.99  |        Q|         |    V    |         |
13+ 5     146.5851    137.20  |        Q|         |    V    |         |
13+10     147.5247    136.44  |        Q|         |    V    |         |
13+15     148.4559    135.20  |        Q|         |    V    |         |
13+20     149.3684    132.49  |       Q |         |     V   |         |
13+25     150.2580    129.17  |       Q |         |     V   |         |
13+30     151.1313    126.81  |       Q |         |     V   |         |
13+35     151.9940    125.26  |       Q |         |     V   |         |
13+40     152.8486    124.09  |       Q |         |     V   |         |
13+45     153.6950    122.91  |       Q |         |     V   |         |
13+50     154.5294    121.15  |       Q |         |     V   |         |
13+55     155.3503    119.20  |      Q  |         |      V  |         |
14+ 0     156.1618    117.82  |      Q  |         |      V  |         |
14+ 5     156.9675    116.99  |      Q  |         |      V  |         |
14+10     157.7711    116.68  |      Q  |         |      V  |         |
14+15     158.5785    117.24  |      Q  |         |      V  |         |
14+20     159.4020    119.56  |      Q  |         |      V  |         |
14+25     160.2468    122.67  |       Q |         |      V  |         |
14+30     161.1071    124.92  |       Q |         |       V |         |
14+35     161.9761    126.18  |       Q |         |       V |         |
14+40     162.8450    126.16  |       Q |         |       V |         |
14+45     163.6934    123.19  |       Q |         |       V |         |
14+50     164.4758    113.61  |      Q  |         |       V |         |
14+55     165.1719    101.07  |     Q   |         |       V |         |
15+ 0     165.8061     92.09  |     Q   |         |       V |         |
15+ 5     166.4013     86.42  |    Q    |         |       V |         |
15+10     166.9739     83.14  |    Q    |         |        V|         |
15+15     167.5455     83.00  |    Q    |         |        V|         |
15+20     168.1545     88.44  |    Q    |         |        V|         |
15+25     168.8197     96.59  |     Q   |         |        V|         |
15+30     169.5254    102.46  |     Q   |         |        V|         |
15+35     170.2570    106.24  |      Q  |         |        V|         |
15+40     171.0066    108.84  |      Q  |         |        V|         |
15+45     171.7674    110.47  |      Q  |         |        V|         |
15+50     172.5313    110.91  |      Q  |         |         V         |
15+55     173.2929    110.59  |      Q  |         |         V         |
16+ 0     174.0529    110.35  |      Q  |         |         V         |
16+ 5     174.8120    110.22  |      Q  |         |         V         |
16+10     175.5695    109.99  |      Q  |         |         V         |
16+15     176.3228    109.38  |      Q  |         |         V         |
16+20     177.0658    107.88  |      Q  |         |         V         |
16+25     177.7964    106.08  |      Q  |         |         V         |
16+30     178.5182    104.80  |     Q   |         |         |V        |
16+35     179.2345    104.01  |     Q   |         |         |V        |
16+40     179.9479    103.59  |     Q   |         |         |V        |
16+45     180.6620    103.69  |     Q   |         |         |V        |
16+50     181.3833    104.73  |     Q   |         |         |V        |
16+55     182.1147    106.20  |      Q  |         |         |V        |
17+ 0     182.8535    107.27  |      Q  |         |         |V        |
17+ 5     183.5966    107.90  |      Q  |         |         |V        |
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17+10	184.3404	108.00	Q			V
17+15	185.0771	106.96	Q			V
17+20	185.7893	103.41	Q			V
17+25	186.4692	98.72	Q			V
17+30	187.1259	95.36	Q			V
17+35	187.7679	93.22	Q			V
17+40	188.4004	91.83	Q			V
17+45	189.0285	91.20	Q			V
17+50	189.6598	91.67	Q			V
17+55	190.2984	92.72	Q			V
18+ 0	190.9422	93.48	Q			V
18+ 5	191.5888	93.89	Q			V
18+10	192.2352	93.85	Q			V
18+15	192.8738	92.72	Q			V
18+20	193.4876	89.13	Q			V
18+25	194.0690	84.41	Q			V
18+30	194.6271	81.03	Q			V
18+35	195.1700	78.84	Q			V
18+40	195.7023	77.29	Q			V
18+45	196.2270	76.17	Q			V
18+50	196.7458	75.33	Q			V
18+55	197.2603	74.71	Q			V
19+ 0	197.7719	74.28	Q			V
19+ 5	198.2813	73.96	Q			V
19+10	198.7884	73.64	Q			V
19+15	199.2917	73.07	Q			V
19+20	199.7860	71.77	Q			V
19+25	200.2690	70.13	Q			V
19+30	200.7439	68.96	Q			V
19+35	201.2138	68.23	Q			V
19+40	201.6810	67.84	Q			V
19+45	202.1489	67.94	Q			V
19+50	202.6239	68.97	Q			V
19+55	203.1090	70.43	Q			V
20+ 0	203.6014	71.49	Q			V
20+ 5	204.0987	72.21	Q			V
20+10	204.6004	72.84	Q			V
20+15	205.1080	73.70	Q			V
20+20	205.6266	75.31	Q			V
20+25	206.1583	77.21	Q			V
20+30	206.6994	78.57	Q			V
20+35	207.2465	79.44	Q			V
20+40	207.7970	79.93	Q			V
20+45	208.3472	79.89	Q			V
20+50	208.8906	78.90	Q			V
20+55	209.4241	77.47	Q			V
21+ 0	209.9506	76.44	Q			V
21+ 5	210.4723	75.76	Q			V
21+10	210.9899	75.15	Q			V
21+15	211.5018	74.32	Q			V
21+20	212.0028	72.74	Q			V
21+25	212.4909	70.88	Q			V
21+30	212.9699	69.55	Q			V
21+35	213.4429	68.68	Q			V
21+40	213.9117	68.08	Q			V
21+45	214.3777	67.66	Q			V
21+50	214.8417	67.38	Q			V
21+55	215.3043	67.17	Q			V
22+ 0	215.7660	67.04	Q			V
22+ 5	216.2271	66.94	Q			V
22+10	216.6877	66.89	Q			V
22+15	217.1483	66.87	Q			V
22+20	217.6088	66.88	Q			V

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   22+25     218.0695     66.89  |   Q     |         |         |       V |
   22+30     218.5303     66.90  |   Q     |         |         |       V |
   22+35     218.9911     66.91  |   Q     |         |         |       V |
   22+40     219.4520     66.93  |   Q     |         |         |       V |
   22+45     219.9130     66.94  |   Q     |         |         |       V |
   22+50     220.3741     66.95  |   Q     |         |         |       V |
   22+55     220.8353     66.96  |   Q     |         |         |       V |
   23+ 0     221.2965     66.97  |   Q     |         |         |       V |
   23+ 5     221.7580     67.01  |   Q     |         |         |       V |
   23+10     222.2206     67.17  |   Q     |         |         |       V |
   23+15     222.6867     67.67  |   Q     |         |         |       V |
   23+20     223.1618     68.99  |   Q     |         |         |       V |
   23+25     223.6486     70.68  |   Q     |         |         |       V |
   23+30     224.1438     71.90  |   Q     |         |         |        V|
   23+35     224.6442     72.66  |   Q     |         |         |        V|
   23+40     225.1476     73.09  |   Q     |         |         |        V|
   23+45     225.6504     73.01  |   Q     |         |         |        V|
   23+50     226.1463     72.00  |   Q     |         |         |        V|
   23+55     226.6322     70.55  |   Q     |         |         |        V|
   24+ 0     227.1109     69.51  |   Q     |         |         |        V|
   24+ 5     227.5833     68.59  |   Q     |         |         |        V|
   24+10     228.0436     66.83  |   Q     |         |         |        V|
   24+15     228.4712     62.09  |   Q     |         |         |        V|
   24+20     228.8153     49.96  |  Q      |         |         |        V|
   24+25     229.0538     34.64  | Q       |         |         |        V|
   24+30     229.2168     23.67  |Q        |         |         |        V|
   24+35     229.3305     16.51  |Q        |         |         |        V|
   24+40     229.4095     11.48  Q          |         |         |        V|
   24+45     229.4637      7.86  Q          |         |         |        V|
   24+50     229.4996      5.22  Q          |         |         |        V|
   24+55     229.5222      3.28  Q          |         |         |        V|
   25+ 0     229.5353      1.90  Q          |         |         |        V|
   25+ 5     229.5420      0.96  Q          |         |         |        V|
   25+10     229.5444      0.36  Q          |         |         |        V|
   25+15     229.5447      0.05  Q          |         |         |        V|
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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 09/10/10
------------------------------------------------------------------------
Tule Wind Project
System 1200
Proposed Conditions 100 Year


------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.000
24 hour precipitation(inches) =  5.050
P6/P24 =    59.4%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1200.100 to Point/Station     1200.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =  307.190(Ft.)
Highest elevation = 4047.500(Ft.)
Lowest elevation = 4025.000(Ft.)
Elevation difference =   22.500(Ft.) Slope =  7.324 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   7.32 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.23 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(   7.324^(1/3)]=   7.23
Rainfall intensity (I) =      6.231(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      1.248(CFS)
Total initial stream area =       0.626(Ac.)
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Process from Point/Station     1200.200 to Point/Station     1200.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  4025.000(Ft.)
Downstream point elevation =  3840.000(Ft.)
Channel length thru subarea  =  1873.920(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     11.382(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     11.382(CFS)
Depth of flow =   0.243(Ft.), Average velocity =   4.277(Ft/s)
Channel flow top width =   11.941(Ft.)
Flow Velocity =    4.28(Ft/s)
Travel time  =    7.30 min.
Time of concentration =   14.53 min.
Critical depth =      0.328(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.590
Decimal fraction soil group C = 0.410
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.336
Rainfall intensity =      3.972(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.336  CA =      5.397
Subarea runoff =     20.186(CFS) for     15.447(Ac.)
Total runoff =     21.434(CFS)  Total area =      16.073(Ac.)
Depth of flow =   0.351(Ft.), Average velocity =   5.353(Ft/s)
Critical depth =      0.488(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1200.300 to Point/Station     1200.400
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3840.000(Ft.)
Downstream point elevation =  3606.000(Ft.)
Channel length thru subarea  =  2095.450(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     65.976(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     65.976(CFS)
Depth of flow =   0.645(Ft.), Average velocity =   8.128(Ft/s)
Channel flow top width =   15.161(Ft.)
Flow Velocity =    8.13(Ft/s)
Travel time  =    4.30 min.
Time of concentration =   18.83 min.
Critical depth =      0.969(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.190
Decimal fraction soil group C = 0.810
Decimal fraction soil group D = 0.000
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[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.352
Rainfall intensity =      3.361(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.350  CA =     32.863
Subarea runoff =     89.007(CFS) for     77.940(Ac.)
Total runoff =    110.442(CFS)  Total area =      94.013(Ac.)
Depth of flow =   0.860(Ft.), Average velocity =   9.562(Ft/s)
Critical depth =      1.297(Ft.)


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Process from Point/Station     1200.400 to Point/Station     1200.800
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3606.000(Ft.)
Downstream point elevation =  3200.000(Ft.)
Channel length thru subarea  =  3996.967(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =    164.331(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    164.331(CFS)
Depth of flow =   1.095(Ft.), Average velocity =  10.436(Ft/s)
Channel flow top width =   18.760(Ft.)
Flow Velocity =   10.44(Ft/s)
Travel time  =    6.38 min.
Time of concentration =   25.21 min.
Critical depth =      1.625(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.130
Decimal fraction soil group B = 0.030
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.840
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.389
Rainfall intensity =      2.784(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.371  CA =     78.360
Subarea runoff =    107.705(CFS) for    116.930(Ac.)
Total runoff =    218.146(CFS)  Total area =     210.943(Ac.)
Depth of flow =   1.274(Ft.), Average velocity =  11.344(Ft/s)
Critical depth =      1.906(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station     1200.400 to Point/Station     1200.800
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 1
Stream flow area =    210.943(Ac.)
Runoff from this stream =    218.146(CFS)
Time of concentration =   25.21 min.
Rainfall intensity =     2.784(In/Hr)


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Process from Point/Station     1200.500 to Point/Station     1200.600
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less      )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =  203.190(Ft.)
Highest elevation = 3965.000(Ft.)
Lowest elevation = 3935.000(Ft.)
Elevation difference =   30.000(Ft.) Slope = 14.765 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  14.77 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.72 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(  14.765^(1/3)]=   5.72
Rainfall intensity (I) =      7.245(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      1.451(CFS)
Total initial stream area =       0.626(Ac.)


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Process from Point/Station     1200.600 to Point/Station     1200.700
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3935.000(Ft.)
Downstream point elevation =  3730.000(Ft.)
Channel length thru subarea  =  2829.617(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     42.307(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     42.307(CFS)
Depth of flow =   0.567(Ft.), Average velocity =   6.080(Ft/s)
Channel flow top width =   14.537(Ft.)
Flow Velocity =    6.08(Ft/s)
Travel time  =    7.76 min.
Time of concentration =   13.48 min.
Critical depth =      0.742(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.290
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.710
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less      )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.384
Rainfall intensity =      4.169(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.383  CA =     19.924
Subarea runoff =     81.616(CFS) for     51.378(Ac.)
Total runoff =     83.068(CFS)  Total area =      52.004(Ac.)
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Depth of flow =   0.828(Ft.), Average velocity =   7.540(Ft/s)
Critical depth =      1.109(Ft.)


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Process from Point/Station     1200.700 to Point/Station     1200.800
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3730.000(Ft.)
Downstream point elevation =  3200.000(Ft.)
Channel length thru subarea  =  3560.760(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =    228.996(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    228.996(CFS)
Depth of flow =   1.181(Ft.), Average velocity =  13.171(Ft/s)
Channel flow top width =   19.447(Ft.)
Flow Velocity =   13.17(Ft/s)
Travel time  =    4.51 min.
Time of concentration =   17.99 min.
Critical depth =      1.953(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.052
Decimal fraction soil group B = 0.084
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.864
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.395
Rainfall intensity =      3.462(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.393  CA =    108.287
Subarea runoff =    291.768(CFS) for    223.612(Ac.)
Total runoff =    374.835(CFS)  Total area =     275.616(Ac.)
Depth of flow =   1.531(Ft.), Average velocity =  15.189(Ft/s)
Critical depth =      2.531(Ft.)


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Process from Point/Station     1200.700 to Point/Station     1200.800
**** CONFLUENCE OF MINOR STREAMS ****
______________________________________________________________________
Along Main Stream number: 1 in normal stream number 2
Stream flow area =    275.616(Ac.)
Runoff from this stream =    374.835(CFS)
Time of concentration =   17.99 min.
Rainfall intensity =     3.462(In/Hr)
Summary of stream data:

Stream   Flow rate      TC            Rainfall Intensity
 No.       (CFS)       (min)                 (In/Hr)


1      218.146     25.21                 2.784
2      374.835     17.99                 3.462
Qmax(1) =
           1.000 *    1.000 *   218.146) +
           0.804 *    1.000 *   374.835) + =     519.605
Qmax(2) =
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           1.000 *    0.713 *   218.146) +
           1.000 *    1.000 *   374.835) + =     530.454

Total of 2 streams to confluence:
Flow rates before confluence point:
     218.146     374.835
Maximum flow rates at confluence using above data:
      519.605      530.454
Area of streams before confluence:
      210.943      275.616
Results of confluence:
Total flow rate =    530.454(CFS)
Time of concentration =    17.986 min.
Effective stream area after confluence =    486.559(Ac.)
End of computations, total study area =         486.559 (Ac.)
```

APPENDIX D
Proposed Conditions Hydrology Summary

Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

Proposed Conditions, Unit Hydrograph

Watershed Loss

Watershed	A (mi^2)	A (ac)	CN (AMC II)	PZN	PZN (>35yr)	CN (>35yr)	Soil Type
Tule Creek	28.52	18250	74	3.42	2.58	82	2.1
Eastern Unnamed Wash	1.15	734	80	3.55	2.45	85	2.7

Watershed Lag

Watershed	Elev US (ft)	Elev DS (ft)	L (mi)	Lca (mi)	Slope (ft/mi)	Basin n	m	lag (hr)
Tule Creek	5802.5	3473	12.13	5.14	192	0.040	0.38	1.70
Eastern Unnamed Wash	4125	3620	1.91	0.74	265	0.040	0.38	0.38

$$lag = 24n\left(\frac{L \bullet L_{ca}}{S^{0.5}}\right)^m$$

Subwatershed Rainfall, Inches (SDC Hydrology Manual)

Watershed	100Yr 6Hr	100Yr 24Hr
Tule Creek	3.36	6.31
Eastern Unnamed Wash	3.00	5.01

Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

Proposed Permanent Impact Summary

Watershed	Basin Area (acres)	Perm Impacted Area	% Impacted	Turbines	O&M	Substation	Total Impervious Area (sq ft)	Total Impervious Area (acres)	% Impervious
Tule Creek	18250.10	50.82	0.28%	6	3	1	21155	0.485651042	0.003%
Eastern Unnamed Wash	734.43	20.52	2.79%	5			1796	0.041225884	0.006%
1200	485.64	6.12	1.26%	2			718	0.016490354	0.003%
Totals	19470.17	77.46		13			23669	0.54336728	0.701%
									0.0028%

Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

Unit Hydrograph Basin Rainfall

100 Yr 6 Hour

FID	Watershed	Rainfall	Acres	Acres*Rainfall	Area Averaged Rainfall (in)
	Tule Creek	4	1518.463274	6074	
		3	6758.893749	20277	
		3.5	9972.741476	34905	
		Totals	18250.0985	61255	3.356427337
	Unnamed Eastern Wash	3	734.4312233	2203	
		Totals	734.4312233	2203	3

100 Yr 24 Hour

FID	Watershed	Rainfall	Acres	Acres*Rainfall	Area Averaged Rainfall (in)
	Tule Creek	10	309.1901693	3092	
		5	3912.209291	19561	
		8	4163.427072	33307	
		6	9865.271967	59192	
		Totals	18250.0985	115152	6.309664385
	Unnamed Eastern Wash	6	6.787032388	41	
		5	727.6441909	3638	
		Totals	734.4312233	3679	5.009241209

Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

Unit Hydrograph Basin Rainfall

100 Yr 6 Hour

FID	Watershed	Rainfall	Acres	Acres*Rainfall	Area Averaged Rainfall (in)
	Tule Creek	4	1518.463274	6074	
		3	6758.893749	20277	
		3.5	9972.741476	34905	
		Totals	18250.0985	61255	3.356427337
	Unnamed Eastern Wash	3	734.4312233	2203	
		Totals	734.4312233	2203	3

100 Yr 24 Hour

FID	Watershed	Rainfall	Acres	Acres*Rainfall	Area Averaged Rainfall (in)
	Tule Creek	10	309.1901693	3092	
		5	3912.209291	19561	
		8	4163.427072	33307	
		6	9865.271967	59192	
		Totals	18250.0985	115152	6.309664385
	Unnamed Eastern Wash	6	6.787032388	41	
		5	727.6441909	3638	
		Totals	734.4312233	3679	5.009241209

Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

Tule Creek Proposed Curve Number

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
	18250							73.86	1347895	2.07
Tule Creek	0.043088	1000	Spaced Rural Residential				A	50	2.15	1
Tule Creek	0.104102	1000	Spaced Rural Residential				A	50	5.21	1
Tule Creek	0.146983	1000	Spaced Rural Residential				A	50	7.35	1
Tule Creek	0.18566	1000	Spaced Rural Residential				A	50	9.28	1
Tule Creek	0.307448	1000	Spaced Rural Residential				A	50	15.37	1
Tule Creek	2.45739	1000	Spaced Rural Residential				A	50	122.87	1
Tule Creek	2.572043	1000	Spaced Rural Residential				A	50	128.60	1
Tule Creek	6.713096	1000	Spaced Rural Residential				A	50	335.65	1
Tule Creek	7.452114	1000	Spaced Rural Residential				A	50	372.61	1
Tule Creek	9.67432	1000	Spaced Rural Residential				A	50	483.72	1
Tule Creek	9.816206	1000	Spaced Rural Residential				A	50	490.81	1
Tule Creek	9.917752	1000	Spaced Rural Residential				A	50	495.89	1
Tule Creek	10.17541	1000	Spaced Rural Residential				A	50	508.77	1
Tule Creek	12.2153	1000	Spaced Rural Residential				A	50	610.77	1
Tule Creek	12.68086	1000	Spaced Rural Residential				A	50	634.04	1
Tule Creek	13.63845	1000	Spaced Rural Residential				A	50	681.92	1
Tule Creek	14.4015	1000	Spaced Rural Residential				A	50	720.08	1
Tule Creek	18.1944	1000	Spaced Rural Residential				A	50	909.72	1
Tule Creek	21.37183	1000	Spaced Rural Residential				A	50	1068.59	1
Tule Creek	25.76366	1000	Spaced Rural Residential				A	50	1288.18	1
Tule Creek	25.91156	1000	Spaced Rural Residential				A	50	1295.58	1
Tule Creek	27.33742	1000	Spaced Rural Residential				A	50	1366.87	1
Tule Creek	27.62886	1000	Spaced Rural Residential				A	50	1381.44	1
Tule Creek	29.31003	1000	Spaced Rural Residential				A	50	1465.50	1
Tule Creek	32.76803	1000	Spaced Rural Residential				A	50	1638.40	1
Tule Creek	42.71826	1000	Spaced Rural Residential				A	50	2135.91	1
Tule Creek	74.33333	1000	Spaced Rural Residential				A	50	3716.67	1
Tule Creek	78.14983	1000	Spaced Rural Residential				A	50	3907.49	1
Tule Creek	80.58518	1000	Spaced Rural Residential				A	50	4029.26	1
Tule Creek	173.7482	1000	Spaced Rural Residential				A	50	8687.41	1
Tule Creek	0.047511	1000	Spaced Rural Residential				B	69	3.28	2
Tule Creek	0.339073	1000	Spaced Rural Residential				B	69	23.40	2
Tule Creek	0.610479	1000	Spaced Rural Residential				B	69	42.12	2
Tule Creek	0.835743	1000	Spaced Rural Residential				B	69	57.67	2
Tule Creek	1.027563	1000	Spaced Rural Residential				B	69	70.90	2
Tule Creek	1.227552	1000	Spaced Rural Residential				B	69	84.70	2
Tule Creek	1.281048	1000	Spaced Rural Residential				B	69	88.39	2
Tule Creek	1.401359	1000	Spaced Rural Residential				B	69	96.69	2
Tule Creek	1.597418	1000	Spaced Rural Residential				B	69	110.22	2
Tule Creek	2.849452	1000	Spaced Rural Residential				B	69	196.61	2
Tule Creek	3.069729	1000	Spaced Rural Residential				B	69	211.81	2
Tule Creek	3.533041	1000	Spaced Rural Residential				B	69	243.78	2
Tule Creek	6.474168	1000	Spaced Rural Residential				B	69	446.72	2
Tule Creek	6.623204	1000	Spaced Rural Residential				B	69	457.00	2
Tule Creek	7.091565	1000	Spaced Rural Residential				B	69	489.32	2
Tule Creek	7.221005	1000	Spaced Rural Residential				B	69	498.25	2
Tule Creek	7.371222	1000	Spaced Rural Residential				B	69	508.61	2
Tule Creek	7.378903	1000	Spaced Rural Residential				B	69	509.14	2
Tule Creek	7.827621	1000	Spaced Rural Residential				B	69	540.11	2
Tule Creek	11.46181	1000	Spaced Rural Residential				B	69	790.87	2
Tule Creek	13.53061	1000	Spaced Rural Residential				B	69	933.61	2
Tule Creek	15.11635	1000	Spaced Rural Residential				B	69	1043.03	2
Tule Creek	15.13929	1000	Spaced Rural Residential				B	69	1044.61	2
Tule Creek	15.82326	1000	Spaced Rural Residential				B	69	1091.81	2
Tule Creek	16.62028	1000	Spaced Rural Residential				B	69	1146.80	2
Tule Creek	18.05196	1000	Spaced Rural Residential				B	69	1245.58	2
Tule Creek	18.08603	1000	Spaced Rural Residential				B	69	1247.94	2
Tule Creek	19.03283	1000	Spaced Rural Residential				B	69	1313.27	2

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	19.54646	1000	Spaced Rural Residential				B	69	1348.71	2
Tule Creek	20.07256	1000	Spaced Rural Residential				B	69	1385.01	2
Tule Creek	21.90675	1000	Spaced Rural Residential				B	69	1511.57	2
Tule Creek	22.15042	1000	Spaced Rural Residential				B	69	1528.38	2
Tule Creek	23.22073	1000	Spaced Rural Residential				B	69	1602.23	2
Tule Creek	26.59746	1000	Spaced Rural Residential				B	69	1835.22	2
Tule Creek	28.42616	1000	Spaced Rural Residential				B	69	1961.41	2
Tule Creek	31.39665	1000	Spaced Rural Residential				B	69	2166.37	2
Tule Creek	35.05085	1000	Spaced Rural Residential				B	69	2418.51	2
Tule Creek	36.19485	1000	Spaced Rural Residential				B	69	2497.44	2
Tule Creek	37.09682	1000	Spaced Rural Residential				B	69	2559.68	2
Tule Creek	42.55808	1000	Spaced Rural Residential				B	69	2936.51	2
Tule Creek	42.91708	1000	Spaced Rural Residential				B	69	2961.28	2
Tule Creek	45.79757	1000	Spaced Rural Residential				B	69	3160.03	2
Tule Creek	55.14837	1000	Spaced Rural Residential				B	69	3805.24	2
Tule Creek	56.61085	1000	Spaced Rural Residential				B	69	3906.15	2
Tule Creek	58.19453	1000	Spaced Rural Residential				B	69	4015.42	2
Tule Creek	58.66377	1000	Spaced Rural Residential				B	69	4047.80	2
Tule Creek	60.20803	1000	Spaced Rural Residential				B	69	4154.35	2
Tule Creek	75.67494	1000	Spaced Rural Residential				B	69	5221.57	2
Tule Creek	122.2435	1000	Spaced Rural Residential				B	69	8434.80	2
Tule Creek	266.9316	1000	Spaced Rural Residential				B	69	18418.28	2
Tule Creek	270.7531	1000	Spaced Rural Residential				B	69	18681.96	2
Tule Creek	277.8597	1000	Spaced Rural Residential				B	69	19172.32	2
Tule Creek	398.6731	1000	Spaced Rural Residential				B	69	27508.44	2
Tule Creek	428.184	1000	Spaced Rural Residential				B	69	29544.70	2
Tule Creek	474.5826	1000	Spaced Rural Residential				B	69	32746.20	2
Tule Creek	0.001115	1000	Spaced Rural Residential				C	79	0.09	3
Tule Creek	0.171429	1000	Spaced Rural Residential				C	79	13.54	3
Tule Creek	0.349768	1000	Spaced Rural Residential				C	79	27.63	3
Tule Creek	3.91536	1000	Spaced Rural Residential				C	79	309.31	3
Tule Creek	13.95372	1000	Spaced Rural Residential				C	79	1102.34	3
Tule Creek	15.43697	1000	Spaced Rural Residential				C	79	1219.52	3
Tule Creek	23.14885	1000	Spaced Rural Residential				C	79	1828.76	3
Tule Creek	27.3161	1000	Spaced Rural Residential				C	79	2157.97	3
Tule Creek	41.93775	1000	Spaced Rural Residential				C	79	3313.08	3
Tule Creek	0.026043	1000	Spaced Rural Residential				D	84	2.19	4
Tule Creek	0.365483	1000	Spaced Rural Residential				D	84	30.70	4
Tule Creek	0.648487	1000	Spaced Rural Residential				D	84	54.47	4
Tule Creek	1.019984	1000	Spaced Rural Residential				D	84	85.68	4
Tule Creek	1.485547	1000	Spaced Rural Residential				D	84	124.79	4
Tule Creek	4.928847	1000	Spaced Rural Residential				D	84	414.02	4
Tule Creek	8.173902	1000	Spaced Rural Residential				D	84	686.61	4
Tule Creek	9.08764	1000	Spaced Rural Residential				D	84	763.36	4
Tule Creek	10.91547	1000	Spaced Rural Residential				D	84	916.90	4
Tule Creek	15.42996	1000	Spaced Rural Residential				D	84	1296.12	4
Tule Creek	15.71257	1000	Spaced Rural Residential				D	84	1319.86	4
Tule Creek	15.79647	1000	Spaced Rural Residential				D	84	1326.90	4
Tule Creek	16.80266	1000	Spaced Rural Residential				D	84	1411.42	4
Tule Creek	25.60615	1000	Spaced Rural Residential				D	84	2150.92	4
Tule Creek	51.21879	1000	Spaced Rural Residential				D	84	4302.38	4
Tule Creek	83.55671	1000	Spaced Rural Residential				D	84	7018.76	4
Tule Creek	0.967946	1190	Single Family Residential Without Units				A	54	52.27	1
Tule Creek	0.364026	1190	Single Family Residential Without Units				B	70	25.48	2
Tule Creek	0.567625	1190	Single Family Residential Without Units				B	70	39.73	2
Tule Creek	6.729983	1409	Other Group Quarters Facility				A	81	545.13	1
Tule Creek	74.69883	1409	Other Group Quarters Facility				B	88	6573.50	2
Tule Creek	7.775003	1409	Other Group Quarters Facility				C	91	707.53	3
Tule Creek	6.907187	4104	Airstrip				B	86	594.02	2
Tule Creek	0.068954	4112	Freeway				B	98	6.76	2
Tule Creek	5.864552	4112	Freeway				B	98	574.73	2
Tule Creek	31.025	4112	Freeway				B	98	3040.45	2
Tule Creek	31.09615	4112	Freeway				B	98	3047.42	2
Tule Creek	0.006861	4112	Freeway				D	98	0.67	4
Tule Creek	0.001148	4117	Impacts				A	72	0.08	1

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	0.002298	4117	Impacts				A	72	0.17	1
Tule Creek	0.206868	4117	Impacts				A	72	14.89	1
Tule Creek	0.212409	4117	Impacts				A	72	15.29	1
Tule Creek	0.329749	4117	Impacts				A	72	23.74	1
Tule Creek	0.367846	4117	Impacts				A	72	26.48	1
Tule Creek	0.624498	4117	Impacts				A	72	44.96	1
Tule Creek	0.793344	4117	Impacts				A	72	57.12	1
Tule Creek	1.850883	4117	Impacts				A	72	133.26	1
Tule Creek	5.040098	4117	Impacts				A	72	362.89	1
Tule Creek	6.875633	4117	Impacts				A	72	495.05	1
Tule Creek	0.000349	4117	Impacts				B	82	0.03	2
Tule Creek	0.001148	4117	Impacts				B	82	0.09	2
Tule Creek	0.001148	4117	Impacts				B	82	0.09	2
Tule Creek	0.005995	4117	Impacts				B	82	0.49	2
Tule Creek	0.259838	4117	Impacts				B	82	21.31	2
Tule Creek	0.281823	4117	Impacts				B	82	23.11	2
Tule Creek	0.352984	4117	Impacts				B	82	28.94	2
Tule Creek	0.436816	4117	Impacts				B	82	35.82	2
Tule Creek	0.443356	4117	Impacts				B	82	36.36	2
Tule Creek	1.352088	4117	Impacts				B	82	110.87	2
Tule Creek	2.147759	4117	Impacts				B	82	176.12	2
Tule Creek	2.179399	4117	Impacts				B	82	178.71	2
Tule Creek	2.758698	4117	Impacts				B	82	226.21	2
Tule Creek	2.997167	4117	Impacts				B	82	245.77	2
Tule Creek	4.307296	4117	Impacts				B	82	353.20	2
Tule Creek	4.620158	4117	Impacts				B	82	378.85	2
Tule Creek	6.801421	4117	Impacts				B	82	557.72	2
Tule Creek	21.10186	4117	Impacts				B	82	1730.35	2
Tule Creek	21.15543	4117	Impacts				B	82	1734.75	2
Tule Creek	39.43635	4117	Impacts				B	82	3233.78	2
Tule Creek	88.94534	4117	Impacts				B	82	7293.52	2
Tule Creek	2.712069	4117	Impacts				C	87	235.95	3
Tule Creek	0.020028	4117	Impacts				D	89	1.78	4
Tule Creek	0.082071	4117	Impacts				D	89	7.30	4
Tule Creek	0.098335	4117	Impacts				D	89	8.75	4
Tule Creek	0.3336	4117	Impacts				D	89	29.69	4
Tule Creek	0.970867	4117	Impacts				D	89	86.41	4
Tule Creek	6.219915	4117	Impacts				D	89	553.57	4
Tule Creek	12.84793	4117	Impacts				D	89	1143.47	4
Tule Creek	0.433045	4118	Road Right of Way				A	74	32.05	1
Tule Creek	0.557935	4118	Road Right of Way				A	74	41.29	1
Tule Creek	0.870485	4118	Road Right of Way				A	74	64.42	1
Tule Creek	1.282634	4118	Road Right of Way				A	74	94.91	1
Tule Creek	1.538811	4118	Road Right of Way				A	74	113.87	1
Tule Creek	3.343863	4118	Road Right of Way				A	74	247.45	1
Tule Creek	0.133175	4118	Road Right of Way				B	84	11.19	2
Tule Creek	0.258242	4118	Road Right of Way				B	84	21.69	2
Tule Creek	0.578129	4118	Road Right of Way				B	84	48.56	2
Tule Creek	2.195245	4118	Road Right of Way				B	84	184.40	2
Tule Creek	3.187266	4118	Road Right of Way				B	84	267.73	2
Tule Creek	3.307092	4118	Road Right of Way				B	84	277.80	2
Tule Creek	4.184623	4118	Road Right of Way				B	84	351.51	2
Tule Creek	9.665824	4118	Road Right of Way				B	84	811.93	2
Tule Creek	0.559069	4118	Road Right of Way				C	90	50.32	3
Tule Creek	1.49493	4118	Road Right of Way				C	90	134.54	3
Tule Creek	1.214105	4118	Road Right of Way				D	92	111.70	4
Tule Creek	0.145578	7603	Open Space Park or Preserve				A	62	9.03	1
Tule Creek	0.666159	7603	Open Space Park or Preserve				A	62	41.30	1
Tule Creek	0.670833	7603	Open Space Park or Preserve				A	62	41.59	1
Tule Creek	1.291557	7603	Open Space Park or Preserve				A	62	80.08	1
Tule Creek	2.450693	7603	Open Space Park or Preserve				A	62	151.94	1
Tule Creek	6.445348	7603	Open Space Park or Preserve				A	62	399.61	1
Tule Creek	6.492338	7603	Open Space Park or Preserve				A	62	402.52	1
Tule Creek	6.690075	7603	Open Space Park or Preserve				A	62	414.78	1
Tule Creek	7.609108	7603	Open Space Park or Preserve				A	62	471.76	1

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	10.61757	7603	Open Space Park or Preserve				A	62	658.29	1
Tule Creek	12.56999	7603	Open Space Park or Preserve				A	62	779.34	1
Tule Creek	15.49857	7603	Open Space Park or Preserve				A	62	960.91	1
Tule Creek	20.82638	7603	Open Space Park or Preserve				A	62	1291.24	1
Tule Creek	24.10463	7603	Open Space Park or Preserve				A	62	1494.49	1
Tule Creek	27.80123	7603	Open Space Park or Preserve				A	62	1723.68	1
Tule Creek	28.28145	7603	Open Space Park or Preserve				A	62	1753.45	1
Tule Creek	35.04884	7603	Open Space Park or Preserve				A	62	2173.03	1
Tule Creek	133.5828	7603	Open Space Park or Preserve				A	62	8282.13	1
Tule Creek	5.79E-06	7603	Open Space Park or Preserve				B	76	0.00	2
Tule Creek	0.001532	7603	Open Space Park or Preserve				B	76	0.12	2
Tule Creek	0.147796	7603	Open Space Park or Preserve				B	76	11.23	2
Tule Creek	0.161165	7603	Open Space Park or Preserve				B	76	12.25	2
Tule Creek	0.191822	7603	Open Space Park or Preserve				B	76	14.58	2
Tule Creek	1.063073	7603	Open Space Park or Preserve				B	76	80.79	2
Tule Creek	1.239796	7603	Open Space Park or Preserve				B	76	94.22	2
Tule Creek	2.221254	7603	Open Space Park or Preserve				B	76	168.82	2
Tule Creek	2.550184	7603	Open Space Park or Preserve				B	76	193.81	2
Tule Creek	2.719127	7603	Open Space Park or Preserve				B	76	206.65	2
Tule Creek	3.014238	7603	Open Space Park or Preserve				B	76	229.08	2
Tule Creek	6.068157	7603	Open Space Park or Preserve				B	76	461.18	2
Tule Creek	8.725289	7603	Open Space Park or Preserve				B	76	663.12	2
Tule Creek	8.948429	7603	Open Space Park or Preserve				B	76	680.08	2
Tule Creek	9.60439	7603	Open Space Park or Preserve				B	76	729.93	2
Tule Creek	10.74877	7603	Open Space Park or Preserve				B	76	816.91	2
Tule Creek	13.69377	7603	Open Space Park or Preserve				B	76	1040.73	2
Tule Creek	14.32418	7603	Open Space Park or Preserve				B	76	1088.64	2
Tule Creek	18.20713	7603	Open Space Park or Preserve				B	76	1383.74	2
Tule Creek	19.02761	7603	Open Space Park or Preserve				B	76	1446.10	2
Tule Creek	20.83353	7603	Open Space Park or Preserve				B	76	1583.35	2
Tule Creek	26.21576	7603	Open Space Park or Preserve				B	76	1992.40	2
Tule Creek	26.8469	7603	Open Space Park or Preserve				B	76	2040.36	2
Tule Creek	29.76741	7603	Open Space Park or Preserve				B	76	2262.32	2
Tule Creek	55.98659	7603	Open Space Park or Preserve				B	76	4254.98	2
Tule Creek	63.39889	7603	Open Space Park or Preserve				B	76	4818.32	2
Tule Creek	116.7971	7603	Open Space Park or Preserve				B	76	8876.58	2
Tule Creek	131.2913	7603	Open Space Park or Preserve				B	76	9978.14	2
Tule Creek	198.0989	7603	Open Space Park or Preserve				B	76	15055.52	2
Tule Creek	206.8661	7603	Open Space Park or Preserve				B	76	15721.83	2
Tule Creek	212.795	7603	Open Space Park or Preserve				B	76	16172.42	2
Tule Creek	440.3058	7603	Open Space Park or Preserve				B	76	33463.24	2
Tule Creek	491.6818	7603	Open Space Park or Preserve				B	76	37367.82	2
Tule Creek	561.9367	7603	Open Space Park or Preserve				B	76	42707.19	2
Tule Creek	1796.067	7603	Open Space Park or Preserve				B	76	136501.10	2
Tule Creek	0.323417	7603	Open Space Park or Preserve				C	84	27.17	3
Tule Creek	1.426928	7603	Open Space Park or Preserve				C	84	119.86	3
Tule Creek	27.97658	7603	Open Space Park or Preserve				C	84	2350.03	3
Tule Creek	56.1561	7603	Open Space Park or Preserve				C	84	4717.11	3
Tule Creek	0.018809	7603	Open Space Park or Preserve				D	88	1.66	4
Tule Creek	1.990162	7603	Open Space Park or Preserve				D	88	175.13	4
Tule Creek	3.055979	7603	Open Space Park or Preserve				D	88	268.93	4
Tule Creek	4.786524	7603	Open Space Park or Preserve				D	88	421.21	4
Tule Creek	7.507363	7603	Open Space Park or Preserve				D	88	660.65	4
Tule Creek	9.004921	7603	Open Space Park or Preserve				D	88	792.43	4
Tule Creek	21.39379	7603	Open Space Park or Preserve				D	88	1882.65	4
Tule Creek	217.9231	7603	Open Space Park or Preserve				D	88	19177.24	4
Tule Creek	442.4383	7603	Open Space Park or Preserve				D	88	38934.57	4
Tule Creek	4.448867	8003	Field Crops				A	62	275.83	1
Tule Creek	16.13558	8003	Field Crops				A	62	1000.41	1
Tule Creek	27.18965	8003	Field Crops				A	62	1685.76	1
Tule Creek	65.95404	8003	Field Crops				A	62	4089.15	1
Tule Creek	0.341477	8003	Field Crops				B	76	25.95	2
Tule Creek	1.937761	8003	Field Crops				B	76	147.27	2
Tule Creek	3.40635	8003	Field Crops				B	76	258.88	2
Tule Creek	5.150237	8003	Field Crops				B	76	391.42	2

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	10.60162	8003	Field Crops				B	76	805.72	2
Tule Creek	5.471035	8003	Field Crops				C	84	459.57	3
Tule Creek	0.039367	8003	Field Crops				D	88	3.46	4
Tule Creek	12.98185	8003	Field Crops				D	88	1142.40	4
Tule Creek	32.0698	8003	Field Crops				D	88	2822.14	4
Tule Creek	0.370491	9101	Vacant and Undeveloped Land				A	62	22.97	1
Tule Creek	0.462587	9101	Vacant and Undeveloped Land				A	62	28.68	1
Tule Creek	0.716577	9101	Vacant and Undeveloped Land				A	62	44.43	1
Tule Creek	1.423269	9101	Vacant and Undeveloped Land				A	62	88.24	1
Tule Creek	1.479646	9101	Vacant and Undeveloped Land				A	62	91.74	1
Tule Creek	1.77126	9101	Vacant and Undeveloped Land				A	62	109.82	1
Tule Creek	1.795696	9101	Vacant and Undeveloped Land				A	62	111.33	1
Tule Creek	2.104207	9101	Vacant and Undeveloped Land				A	62	130.46	1
Tule Creek	2.255969	9101	Vacant and Undeveloped Land				A	62	139.87	1
Tule Creek	2.38003	9101	Vacant and Undeveloped Land				A	62	147.56	1
Tule Creek	2.78078	9101	Vacant and Undeveloped Land				A	62	172.41	1
Tule Creek	2.988145	9101	Vacant and Undeveloped Land				A	62	185.26	1
Tule Creek	3.702611	9101	Vacant and Undeveloped Land				A	62	229.56	1
Tule Creek	3.813949	9101	Vacant and Undeveloped Land				A	62	236.46	1
Tule Creek	4.095598	9101	Vacant and Undeveloped Land				A	62	253.93	1
Tule Creek	4.585974	9101	Vacant and Undeveloped Land				A	62	284.33	1
Tule Creek	4.632554	9101	Vacant and Undeveloped Land				A	62	287.22	1
Tule Creek	4.742464	9101	Vacant and Undeveloped Land				A	62	294.03	1
Tule Creek	5.398374	9101	Vacant and Undeveloped Land				A	62	334.70	1
Tule Creek	5.950607	9101	Vacant and Undeveloped Land				A	62	368.94	1
Tule Creek	6.035894	9101	Vacant and Undeveloped Land				A	62	374.23	1
Tule Creek	7.440398	9101	Vacant and Undeveloped Land				A	62	461.30	1
Tule Creek	7.550937	9101	Vacant and Undeveloped Land				A	62	468.16	1
Tule Creek	7.926843	9101	Vacant and Undeveloped Land				A	62	491.46	1
Tule Creek	8.178444	9101	Vacant and Undeveloped Land				A	62	507.06	1
Tule Creek	9.503046	9101	Vacant and Undeveloped Land				A	62	589.19	1
Tule Creek	10.1615	9101	Vacant and Undeveloped Land				A	62	630.01	1
Tule Creek	11.43993	9101	Vacant and Undeveloped Land				A	62	709.28	1
Tule Creek	13.19961	9101	Vacant and Undeveloped Land				A	62	818.38	1
Tule Creek	16.93045	9101	Vacant and Undeveloped Land				A	62	1049.69	1
Tule Creek	18.15904	9101	Vacant and Undeveloped Land				A	62	1125.86	1
Tule Creek	22.94393	9101	Vacant and Undeveloped Land				A	62	1422.52	1
Tule Creek	24.80073	9101	Vacant and Undeveloped Land				A	62	1537.65	1
Tule Creek	26.53566	9101	Vacant and Undeveloped Land				A	62	1645.21	1
Tule Creek	28.16416	9101	Vacant and Undeveloped Land				A	62	1746.18	1
Tule Creek	31.26606	9101	Vacant and Undeveloped Land				A	62	1938.50	1
Tule Creek	33.11955	9101	Vacant and Undeveloped Land				A	62	2053.41	1
Tule Creek	33.25553	9101	Vacant and Undeveloped Land				A	62	2061.84	1
Tule Creek	45.79989	9101	Vacant and Undeveloped Land				A	62	2839.59	1
Tule Creek	59.79589	9101	Vacant and Undeveloped Land				A	62	3707.34	1
Tule Creek	77.01624	9101	Vacant and Undeveloped Land				A	62	4775.01	1
Tule Creek	144.7928	9101	Vacant and Undeveloped Land				A	62	8977.16	1
Tule Creek	175.1536	9101	Vacant and Undeveloped Land				A	62	10859.52	1
Tule Creek	193.7297	9101	Vacant and Undeveloped Land				A	62	12011.24	1
Tule Creek	0.123272	9101	Vacant and Undeveloped Land				B	76	9.37	2
Tule Creek	0.126067	9101	Vacant and Undeveloped Land				B	76	9.58	2
Tule Creek	0.259348	9101	Vacant and Undeveloped Land				B	76	19.71	2
Tule Creek	0.439751	9101	Vacant and Undeveloped Land				B	76	33.42	2
Tule Creek	0.488141	9101	Vacant and Undeveloped Land				B	76	37.10	2
Tule Creek	0.555569	9101	Vacant and Undeveloped Land				B	76	42.22	2
Tule Creek	1.046957	9101	Vacant and Undeveloped Land				B	76	79.57	2
Tule Creek	1.506574	9101	Vacant and Undeveloped Land				B	76	114.50	2
Tule Creek	1.800695	9101	Vacant and Undeveloped Land				B	76	136.85	2
Tule Creek	1.872557	9101	Vacant and Undeveloped Land				B	76	142.31	2
Tule Creek	2.28992	9101	Vacant and Undeveloped Land				B	76	174.03	2
Tule Creek	2.39391	9101	Vacant and Undeveloped Land				B	76	181.94	2
Tule Creek	2.524843	9101	Vacant and Undeveloped Land				B	76	191.89	2
Tule Creek	2.678534	9101	Vacant and Undeveloped Land				B	76	203.57	2
Tule Creek	2.955549	9101	Vacant and Undeveloped Land				B	76	224.62	2
Tule Creek	3.082261	9101	Vacant and Undeveloped Land				B	76	234.25	2

		Land Use				Soils		CN		
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Tule Creek	3.08555	9101	Vacant and Undeveloped Land				B	76	234.50	2
Tule Creek	3.132324	9101	Vacant and Undeveloped Land				B	76	238.06	2
Tule Creek	4.209174	9101	Vacant and Undeveloped Land				B	76	319.90	2
Tule Creek	4.540735	9101	Vacant and Undeveloped Land				B	76	345.10	2
Tule Creek	5.008135	9101	Vacant and Undeveloped Land				B	76	380.62	2
Tule Creek	5.032916	9101	Vacant and Undeveloped Land				B	76	382.50	2
Tule Creek	5.716538	9101	Vacant and Undeveloped Land				B	76	434.46	2
Tule Creek	6.402167	9101	Vacant and Undeveloped Land				B	76	486.56	2
Tule Creek	6.640836	9101	Vacant and Undeveloped Land				B	76	504.70	2
Tule Creek	6.663339	9101	Vacant and Undeveloped Land				B	76	506.41	2
Tule Creek	7.185992	9101	Vacant and Undeveloped Land				B	76	546.14	2
Tule Creek	7.274901	9101	Vacant and Undeveloped Land				B	76	552.89	2
Tule Creek	7.883665	9101	Vacant and Undeveloped Land				B	76	599.16	2
Tule Creek	8.068191	9101	Vacant and Undeveloped Land				B	76	613.18	2
Tule Creek	8.987016	9101	Vacant and Undeveloped Land				B	76	683.01	2
Tule Creek	9.612152	9101	Vacant and Undeveloped Land				B	76	730.52	2
Tule Creek	11.87059	9101	Vacant and Undeveloped Land				B	76	902.17	2
Tule Creek	12.81692	9101	Vacant and Undeveloped Land				B	76	974.09	2
Tule Creek	13.56025	9101	Vacant and Undeveloped Land				B	76	1030.58	2
Tule Creek	14.1667	9101	Vacant and Undeveloped Land				B	76	1076.67	2
Tule Creek	14.51726	9101	Vacant and Undeveloped Land				B	76	1103.31	2
Tule Creek	15.05544	9101	Vacant and Undeveloped Land				B	76	1144.21	2
Tule Creek	19.61081	9101	Vacant and Undeveloped Land				B	76	1490.42	2
Tule Creek	21.07988	9101	Vacant and Undeveloped Land				B	76	1602.07	2
Tule Creek	21.10185	9101	Vacant and Undeveloped Land				B	76	1603.74	2
Tule Creek	21.31978	9101	Vacant and Undeveloped Land				B	76	1620.30	2
Tule Creek	22.34473	9101	Vacant and Undeveloped Land				B	76	1698.20	2
Tule Creek	23.62745	9101	Vacant and Undeveloped Land				B	76	1795.69	2
Tule Creek	23.78581	9101	Vacant and Undeveloped Land				B	76	1807.72	2
Tule Creek	23.8163	9101	Vacant and Undeveloped Land				B	76	1810.04	2
Tule Creek	28.61306	9101	Vacant and Undeveloped Land				B	76	2174.59	2
Tule Creek	32.99727	9101	Vacant and Undeveloped Land				B	76	2507.79	2
Tule Creek	35.74483	9101	Vacant and Undeveloped Land				B	76	2716.61	2
Tule Creek	38.07883	9101	Vacant and Undeveloped Land				B	76	2893.99	2
Tule Creek	44.96019	9101	Vacant and Undeveloped Land				B	76	3416.97	2
Tule Creek	52.76313	9101	Vacant and Undeveloped Land				B	76	4010.00	2
Tule Creek	53.25099	9101	Vacant and Undeveloped Land				B	76	4047.08	2
Tule Creek	55.83849	9101	Vacant and Undeveloped Land				B	76	4243.72	2
Tule Creek	55.98927	9101	Vacant and Undeveloped Land				B	76	4255.18	2
Tule Creek	57.6379	9101	Vacant and Undeveloped Land				B	76	4380.48	2
Tule Creek	58.25291	9101	Vacant and Undeveloped Land				B	76	4427.22	2
Tule Creek	60.3311	9101	Vacant and Undeveloped Land				B	76	4585.16	2
Tule Creek	60.9375	9101	Vacant and Undeveloped Land				B	76	4631.25	2
Tule Creek	79.18654	9101	Vacant and Undeveloped Land				B	76	6018.18	2
Tule Creek	80.80081	9101	Vacant and Undeveloped Land				B	76	6140.86	2
Tule Creek	94.08736	9101	Vacant and Undeveloped Land				B	76	7150.64	2
Tule Creek	95.02456	9101	Vacant and Undeveloped Land				B	76	7221.87	2
Tule Creek	108.8181	9101	Vacant and Undeveloped Land				B	76	8270.18	2
Tule Creek	127.1741	9101	Vacant and Undeveloped Land				B	76	9665.23	2
Tule Creek	173.0043	9101	Vacant and Undeveloped Land				B	76	13148.33	2
Tule Creek	174.746	9101	Vacant and Undeveloped Land				B	76	13280.70	2
Tule Creek	184.1736	9101	Vacant and Undeveloped Land				B	76	13997.19	2
Tule Creek	195.5124	9101	Vacant and Undeveloped Land				B	76	14858.94	2
Tule Creek	200.1965	9101	Vacant and Undeveloped Land				B	76	15214.93	2
Tule Creek	336.0086	9101	Vacant and Undeveloped Land				B	76	25536.66	2
Tule Creek	340.4604	9101	Vacant and Undeveloped Land				B	76	25874.99	2
Tule Creek	362.0771	9101	Vacant and Undeveloped Land				B	76	27517.86	2
Tule Creek	402.1661	9101	Vacant and Undeveloped Land				B	76	30564.62	2
Tule Creek	845.9782	9101	Vacant and Undeveloped Land				B	76	64294.34	2
Tule Creek	873.8039	9101	Vacant and Undeveloped Land				B	76	66409.10	2
Tule Creek	0.823878	9101	Vacant and Undeveloped Land				C	84	69.21	3
Tule Creek	1.108125	9101	Vacant and Undeveloped Land				C	84	93.08	3
Tule Creek	1.819944	9101	Vacant and Undeveloped Land				C	84	152.88	3
Tule Creek	2.382064	9101	Vacant and Undeveloped Land				C	84	200.09	3
Tule Creek	10.95875	9101	Vacant and Undeveloped Land				C	84	920.53	3

		Land Use				Soils		CN		
Name	Acres	Land Use Code	Land Use Description	Description	Percent Impervious	MUSYM	HydSoilGrp	CN	CN*A	Soil Group
Tule Creek	12.52151	9101	Vacant and Undeveloped Land				C	84	1051.81	3
Tule Creek	24.71978	9101	Vacant and Undeveloped Land				C	84	2076.46	3
Tule Creek	34.91707	9101	Vacant and Undeveloped Land				C	84	2933.03	3
Tule Creek	46.83882	9101	Vacant and Undeveloped Land				C	84	3934.46	3
Tule Creek	57.41426	9101	Vacant and Undeveloped Land				C	84	4822.80	3
Tule Creek	141.554	9101	Vacant and Undeveloped Land				C	84	11890.54	3
Tule Creek	1.754196	9101	Vacant and Undeveloped Land				D	88	154.37	4
Tule Creek	2.670644	9101	Vacant and Undeveloped Land				D	88	235.02	4
Tule Creek	3.07489	9101	Vacant and Undeveloped Land				D	88	270.59	4
Tule Creek	4.539194	9101	Vacant and Undeveloped Land				D	88	399.45	4
Tule Creek	5.128395	9101	Vacant and Undeveloped Land				D	88	451.30	4
Tule Creek	5.392338	9101	Vacant and Undeveloped Land				D	88	474.53	4
Tule Creek	6.6423	9101	Vacant and Undeveloped Land				D	88	584.52	4
Tule Creek	8.121478	9101	Vacant and Undeveloped Land				D	88	714.69	4
Tule Creek	8.617818	9101	Vacant and Undeveloped Land				D	88	758.37	4
Tule Creek	12.23427	9101	Vacant and Undeveloped Land				D	88	1076.62	4
Tule Creek	12.98788	9101	Vacant and Undeveloped Land				D	88	1142.93	4
Tule Creek	13.49973	9101	Vacant and Undeveloped Land				D	88	1187.98	4
Tule Creek	18.14519	9101	Vacant and Undeveloped Land				D	88	1596.78	4
Tule Creek	18.7384	9101	Vacant and Undeveloped Land				D	88	1648.98	4
Tule Creek	33.39091	9101	Vacant and Undeveloped Land				D	88	2938.40	4
Tule Creek	37.60921	9101	Vacant and Undeveloped Land				D	88	3309.61	4
Tule Creek	46.89635	9101	Vacant and Undeveloped Land				D	88	4126.88	4
Tule Creek	63.77179	9101	Vacant and Undeveloped Land				D	88	5611.92	4
Tule Creek	76.07516	9101	Vacant and Undeveloped Land				D	88	6694.61	4
Tule Creek	107.7435	9101	Vacant and Undeveloped Land				D	88	9481.42	4

Project: Tule Wind
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Unnamed Eastern Wash Proposed Curve Number

		Land Use				Soils		CN		
Name	**Acres**	**Land Use Code**	**Land Use Description**	**Description**	**Percent Impervious**	**MUSYM**	**HydSoilGrp**	**CN**	**CN*A**	**Soil Group**
	734							**79.829**	**58629**	**2.7**
	9.1382E-06	4117	Impacts				B	82	0.00	2
	11.44859229	4117	Impacts				B	82	938.78	2
	5.67858E-06	4117	Impacts				D	89	0.00	4
	0.653770822	4117	Impacts				D	89	58.19	4
	8.421768087	4117	Impacts				D	89	749.54	4
	24.41650518	7603	Open Space Park or Preserve				A	62	1513.82	1
Unnamed	0.004416701	7603	Open Space Park or Preserve				B	76	0.34	2
Eastern	349.0087525	7603	Open Space Park or Preserve				B	76	26524.67	2
Wash	0.020955468	7603	Open Space Park or Preserve				D	88	1.84	4
	0.354483367	7603	Open Space Park or Preserve				D	88	31.19	4
	14.05971799	7603	Open Space Park or Preserve				D	88	1237.26	4
	120.2331318	7603	Open Space Park or Preserve				D	88	10580.52	4
	93.1853517	9101	Vacant and Undeveloped Land				B	76	7082.09	2
	0.003492472	9101	Vacant and Undeveloped Land				D	88	0.31	4
	24.92957258	9101	Vacant and Undeveloped Land				D	88	2193.80	4
	87.69063242	9101	Vacant and Undeveloped Land				D	88	7716.78	4

APPENDIX E

Crossing Hydrology Summary Tables

Project: Tule Wind
Subject: Drainage Report
Task: 21
Job#: 115965

Unit Hydrograph Summary

Watershed Loss

Name	Watershed	A (mi^2)	A (ac)	CN (AMC II)	PZN	PZN (<35yr)	CN (<35yr)	PZN (>35yr)	CN (>35yr)	Soil Type
	Tule Creek	21.64	13851.04	73	3.42	1.79	69	2.58	81	2.0
	McCain Valley 1	3.41	2185.54	78	3.55	1.73	73	2.45	83	2.6
	McCain Valley 2	3.53	2256.19	78	3.55	1.73	73	2.45	83	2.5

Watershed Lag

Name	Watershed	Elev US (ft)	Elev DS (ft)	L (mi)	Lca (mi)	Slope (ft/mi)	Basin n	m	lag (hr)
	Tule	5802.5	3538	10.43	4.23	217	0.040	0.38	1.46
	McCain Valley 1	4112.5	3600	3.71	1.60	138	0.040	0.38	0.7411
	McCain Valley 2	4112.5	3592	3.83	1.70	136	0.040	0.38	0.7698

Watershed Rainfall, Inches (SDC Hydrology Manual)

Name	Watershed	100Yr 6Hr	100Yr 24Hr	10Yr 24Hr
	Tule Creek	3.47	6.69	4.47
	McCain Valley 1	3.00	5.07	3.50
	McCain Valley 2	3.00	5.07	3.50

$$lag = 24n\left(\frac{L \bullet L_{ca}}{S^{0.5}}\right)^m$$

Watershed Calculated Flow, cfs (CivilD)

Name	Watershed	100Yr 6Hr	100Yr 24Hr	10Yr 24Hr
	Tule Creek	7626	10607	3250
	McCain Valley 1	1487	1434	487
	McCain Valley 2	1562	1472	498

Project: Tule Wind
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Unit Hydrograph Rainfall

100 Yr 6 Hour

FID	Watershed	Rainfall	Acres	Acres*Rainfall	Area Averaged Rainfall (in)
	Tule Creek	4	1547.986013	6192	
		3.5	9834.300108	34420	
		3	2468.750611	7406	
		Totals	13851.03673	48018	3.466761889
	Northern	3	735.9643	2208	
		Totals	735.9643	2208	3
	McCain Valley 1	3	2186	6559	
		Totals	2186.435792	6559	3
	McCain Valley 2	3	2250	6751	
		Totals	2250.169791	6751	3

100 Yr 24 Hour

FID	Watershed	Rainfall	Acres	Acres*Rainfall	Area Averaged Rainfall (in)
	Tule Creek	10	303.744804	3037	
		8	4253.839575	34031	
		6	9157.798355	54947	
		5	33.299288	166	
		5	102.38491	512	
		Totals	13851.06693	92693	6.692146982
	Northern	6	12.411057	74	
		5	722.641609	3613	
		Totals	735.052666	3688	5.016884582
	McCain Valley 1	6	157.391384	944	
		5	2029.044409	10145	
		Totals	2186.435793	11090	5.071985367
	McCain Valley 2	6	157.391384	944	
		5	2092.778407	10464	
		Totals	2250.169791	11408	5.069946448

10 Yr 24 Hour

FID	Watershed	Rainfall	Acres	Acres*Rainfall	Area Averaged Rainfall (in)
	Tule Creek	6	1053.215147	6319	
		5	4923.38483	24617	
		4	6792.47866	27170	
		3.5	366.783471	1284	
		3.5	715.174823	2503	
		Totals	13851.03693	61893	4.468472939
	Northern	3.5	735.9643	2576	
		Totals	735.9643	2576	3.5
	McCain Valley 1	3.5	2186	7653	
		Totals	2186.435792	7653	3.5
	McCain Valley 2	3.5	2250	7876	
		Totals	2250.169791	7876	3.5

Project: Tule Wind
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Rational Method Summary

System	WPS Crossing Number	Leg (HDR Node to HDR Node)	Acres	Reach Length	US Elevation	DS Elevation	Soil Group	Soil Group Percent	100 Year Runoff	10 Year Runoff	System Effective C
1		Initial Area	0.234	184.12	3965.00	3953.0	D		0.74		
			10.132	709.83	3953.0	3926.00	D		24.65		
			10.366								
2		Initial Area	0.157	147.25	4068.00	4015.0	D		0.59		
			13.717	918.23	4015.0	3931.00	D		38.67		
			13.874								
3		Initial Area	0.042	72.89	4062.00	4058.0	B		0.09		
		3.2 to 3.3	6.119	1068.19	4058.0	3963.00	B		9.42		
		3.3 to 3.4	10.416791	482.37	3963.00	3933	B		23.31		
			16.577791								
4		Initial Area	0.2	84.85	3978.00	3970.0	B		0.49		
			0.625	295.28	3970.0	3943.00	B		1.61		
			0.825								
5		Initial Area	0.102	132.71	3908.00	3882.0	B		0.18		
			21.558	1743.68	3882.0	3715.00	A	0.65	25.37		
			21.66				B	0.35			
6		Initial Area	0.576	311.19	3910.00	3894.0	B		1.24		
			55.991	2700.48	3894.0	3750.00	B	0.99	77.38		
			56.567				D	0.00			
7		Initial Area	0.049038	92.07	3689.00	3685.0	B		0.12		
			21.878578	2100.79	3685.0	3585.00	B		30.34		
			21.927616								
8		Initial Area SG D	0.071	97.49	3720	3710.0	D		0.25		
			20.304059	2167.8	3710.0	3590.0	B	0.99	29.80		
			20.375059				D	0.01			
9		Initial Area	0.0727	88.12	3611.00	3606.0	B		0.16		
			2.478	411.1	3606.0	3592.0	B		4.29		
			2.5507								
10		Initial Area	0.106	103.135	3728.00	3715.0	D		0.38		
			20.645	2242.89	3715.0	3582.0	B	0.93	31.50		
			20.751				D	0.07			
11		Initial Area	0.073	92.72	3609.00	3606.0	B		0.14		
			3.736	694.44	3606.0	3530.0	B		5.85		
12		Initial Area	0.09	105.19	3712.00	3700.0	B	0.04	0.32		
							D	0.96			
			34.613	2438.64	3700.0	3556.0	B	0.92	54.40		
			34.703				D	0.08			
13		Initial Area	0.189	123.4	3822.00	3806.0	D		0.69		
			57.644	3804.3	3806.0	3554.0	A	0.04	84.68		
			57.833				B	0.76			
							D	0.20			
14		Initial Area	0.468	233.59	3994.00	3949.00	D		1.77		
		14.2 to 14.3	58.556	3533.69	3949.00	3743.0	B	0.86	90.16		
							D	0.14			
		14.3 to 14.4	264.517	3814.58	3743.0	3620	A	0.07	373.51		
							B	0.71			
							D	0.22			
		14.4 to 14.5	99.219	2848.9	3620	3542	A	0.17	431.99	221.2	
							B	0.25			
			422.76				D	0.58			
15		Initial Area	0.056514	59.59	3699.00	3694.0	B		0.14		
			5.911685	661.42	3694.0	3645.00	B		10.86		
			5.968199								

APPENDIX F

Crossing Hydrology CivilD Output

Tule Creek 10-Year 24-Hour
Tule Creek 100-Year 6-Hour
Tule Creek 100-Year 24-Hour
McCain 1 10-Year 24-Hour
McCain 1 100-Year 6-Hour
McCain 1 100-Year 24-Hour
McCain 2 10-Year 24-Hour
McCain 2 100-Year 6-Hour
McCain 2 100-Year 24-Hour
System 1 100-Year
System 2 100-Year
System 3 100-Year
System 4 100-Year
System 5 100-Year
System 6 100-Year
System 7 100-Year
System 8 100-Year
System 9 100-Year
System 10 100-Year
System 11 100-Year
System 12 100-Year
System 13 100-Year
System 14 100-Year
System 15 100-Year

U N I T H Y D R O G R A P H A N A L Y S I S

Study date 09/08/10 File: TULECREEK10YR24HR.out

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Program License Serial Number 4055

Tule Wind Project
Tule Creek Crossing
Proposed Conditions 10 Yr 24 Hr
Aug 18, 2010

++

Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
13851.00	4.47

Rainfall Distribution pattern used in study:
Type B for San Diego area of California

++

********* Area-Averaged SCS Curve Number and Fm *********

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
13851.00	1.000	69.0	69.0	0.050	B

Area-averaged catchment SCS Curve Number AMC(2) = 69.000
Area-averaged Fm value using values listed = 0.050(In/Hr)
++
Direct entry of lag time by user
Watershed area = 13851.00(Ac.)
Catchment Lag time = 1.460 hours
Unit interval = 15.000 minutes
Unit interval percentage of lag time = 17.1233
Hydrograph baseflow = 0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 69.000

Rainfall depth area reduction factors:
Using a total area of 13851.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 0.983
Rainfall entered for study = 4.470(In)
Adjusted rainfall = 4.393(In)

++

The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H
++

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 55865.70 (CFS))

0.17	0.250	0.016	158.799	0.003
0.34	0.500	0.060	603.506	0.014
0.51	0.750	0.154	1549.023	0.041
0.68	1.000	0.418	4209.423	0.117
0.86	1.250	0.829	8356.072	0.266
1.03	1.500	1.000	10080.482	0.447
1.20	1.750	0.817	8237.636	0.594
1.37	2.000	0.547	5509.267	0.693
1.54	2.250	0.419	4219.133	0.768
1.71	2.500	0.314	3165.938	0.825
1.88	2.750	0.243	2450.565	0.869
2.05	3.000	0.192	1934.570	0.903
2.23	3.250	0.151	1525.672	0.931
2.40	3.500	0.120	1206.712	0.952
2.57	3.750	0.090	908.788	0.969
2.74	4.000	0.068	683.892	0.981
2.91	4.250	0.048	484.176	0.990
3.08	4.500	0.035	351.342	0.996
3.25	4.750	0.018	185.744	0.999
3.42	5.000	0.004	44.958	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

Where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr-ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.25	0.0198	0.0000	0.0198	0.0000	0.0198	--------
0.50	0.0395	0.0000	0.0198	0.0000	0.0198	--------

0.75	0.0549	0.0000	0.0154	0.0000	0.0154	--------
1.00	0.0703	0.0000	0.0154	0.0000	0.0154	--------
1.25	0.0901	0.0000	0.0198	0.0000	0.0198	--------
1.50	0.1098	0.0000	0.0198	0.0000	0.0198	--------
1.75	0.1296	0.0000	0.0198	0.0000	0.0198	--------
2.00	0.1494	0.0000	0.0198	0.0000	0.0198	--------
2.25	0.1735	0.0000	0.0242	0.0000	0.0242	--------
2.50	0.1977	0.0000	0.0242	0.0000	0.0242	--------
2.75	0.2175	0.0000	0.0198	0.0000	0.0198	--------
3.00	0.2372	0.0000	0.0198	0.0000	0.0198	--------
3.25	0.2614	0.0000	0.0242	0.0000	0.0242	--------
3.50	0.2856	0.0000	0.0242	0.0000	0.0242	--------
3.75	0.3119	0.0000	0.0264	0.0000	0.0264	--------
4.00	0.3383	0.0000	0.0264	0.0000	0.0264	--------
4.25	0.3668	0.0000	0.0286	0.0000	0.0286	--------
4.50	0.3954	0.0000	0.0286	0.0000	0.0286	--------
4.75	0.4262	0.0000	0.0308	0.0000	0.0308	--------
5.00	0.4569	0.0000	0.0308	0.0000	0.0308	--------
5.25	0.4921	0.0000	0.0351	0.0000	0.0351	--------
5.50	0.5272	0.0000	0.0351	0.0000	0.0351	--------
5.75	0.5646	0.0000	0.0373	0.0000	0.0373	--------
6.00	0.6019	0.0000	0.0373	0.0000	0.0373	--------
6.25	0.6458	0.0000	0.0439	0.0000	0.0439	--------
6.50	0.6898	0.0000	0.0439	0.0000	0.0439	--------
6.75	0.7403	0.0000	0.0505	0.0000	0.0505	--------
7.00	0.7908	0.0000	0.0505	0.0000	0.0505	--------
7.25	0.8567	0.0000	0.0659	0.0000	0.0659	--------
7.50	0.9226	0.0001	0.0659	0.0001	0.0658	--------
7.75	1.0215	0.0033	0.0989	0.0031	0.0957	--------
8.00	1.1203	0.0104	0.0989	0.0072	0.0917	--------
8.25	1.2675	0.0280	0.1472	0.0176	0.1296	--------
8.50	1.4147	0.0532	0.1472	0.0252	0.1220	--------
8.75	1.6080	0.0967	0.1933	0.0436	0.1497	--------
9.00	1.8013	0.1510	0.1933	0.0543	0.1390	--------
9.25	2.0122	0.2212	0.2109	0.0702	0.1407	--------
9.50	2.2231	0.3016	0.2109	0.0804	0.1305	--------
9.75	2.4032	0.3775	0.1801	0.0759	0.1042	--------
10.00	2.5833	0.4595	0.1801	0.0820	0.0981	--------
10.25	2.6734	0.5026	0.0901	0.0431	0.0470	--------
10.50	2.7635	0.5470	0.0901	0.0444	0.0456	--------
10.75	2.8228	0.5770	0.0593	0.0300	0.0293	--------
11.00	2.8821	0.6075	0.0593	0.0305	0.0288	--------
11.25	2.9326	0.6339	0.0505	0.0264	0.0241	--------
11.50	2.9831	0.6607	0.0505	0.0268	0.0238	--------
11.75	3.0293	0.6854	0.0461	0.0248	0.0214	--------
12.00	3.0754	0.7105	0.0461	0.0251	0.0211	--------
12.25	3.1193	0.7346	0.0439	0.0241	0.0198	--------
12.50	3.1633	0.7590	0.0439	0.0244	0.0195	--------
12.75	3.2050	0.7824	0.0417	0.0234	0.0183	--------
13.00	3.2467	0.8060	0.0417	0.0236	0.0181	--------
13.25	3.2841	0.8273	0.0373	0.0213	0.0160	--------
13.50	3.3214	0.8488	0.0373	0.0215	0.0158	--------
13.75	3.3566	0.8692	0.0351	0.0204	0.0148	--------
14.00	3.3917	0.8898	0.0351	0.0205	0.0146	--------
14.25	3.4313	0.9130	0.0395	0.0233	0.0163	--------
14.50	3.4708	0.9365	0.0395	0.0235	0.0161	--------
14.75	3.4928	0.9496	0.0220	0.0131	0.0089	--------
15.00	3.5147	0.9628	0.0220	0.0132	0.0088	--------
15.25	3.5499	0.9840	0.0351	0.0212	0.0140	--------
15.50	3.5850	1.0053	0.0351	0.0213	0.0138	--------
15.75	3.6180	1.0254	0.0330	0.0201	0.0128	--------
16.00	3.6509	1.0456	0.0330	0.0202	0.0127	--------
16.25	3.6817	1.0646	0.0308	0.0190	0.0118	--------

```
  16.50   3.7124    1.0837    0.0308    0.0191    0.0117 --------
  16.75   3.7454    1.1042    0.0330    0.0205    0.0124 --------
  17.00   3.7783    1.1249    0.0330    0.0207    0.0123 --------
  17.25   3.8047    1.1415    0.0264    0.0166    0.0098 --------
  17.50   3.8311    1.1582    0.0264    0.0167    0.0097 --------
  17.75   3.8596    1.1763    0.0286    0.0181    0.0104 --------
  18.00   3.8882    1.1945    0.0286    0.0182    0.0103 --------
  18.25   3.9101    1.2086    0.0220    0.0141    0.0079 --------
  18.50   3.9321    1.2227    0.0220    0.0141    0.0079 --------
  18.75   3.9541    1.2369    0.0220    0.0142    0.0078 --------
  19.00   3.9760    1.2511    0.0220    0.0142    0.0078 --------
  19.25   3.9958    1.2639    0.0198    0.0128    0.0069 --------
  19.50   4.0156    1.2768    0.0198    0.0129    0.0069 --------
  19.75   4.0375    1.2911    0.0220    0.0143    0.0076 --------
  20.00   4.0595    1.3055    0.0220    0.0144    0.0076 --------
  20.25   4.0837    1.3213    0.0242    0.0159    0.0083 --------
  20.50   4.1078    1.3372    0.0242    0.0159    0.0082 --------
  20.75   4.1298    1.3518    0.0220    0.0145    0.0075 --------
  21.00   4.1518    1.3663    0.0220    0.0146    0.0074 --------
  21.25   4.1715    1.3795    0.0198    0.0131    0.0066 --------
  21.50   4.1913    1.3926    0.0198    0.0132    0.0066 --------
  21.75   4.2111    1.4058    0.0198    0.0132    0.0066 --------
  22.00   4.2309    1.4191    0.0198    0.0132    0.0065 --------
  22.25   4.2506    1.4323    0.0198    0.0133    0.0065 --------
  22.50   4.2704    1.4456    0.0198    0.0133    0.0065 --------
  22.75   4.2902    1.4590    0.0198    0.0133    0.0064 --------
  23.00   4.3099    1.4723    0.0198    0.0134    0.0064 --------
  23.25   4.3319    1.4872    0.0220    0.0149    0.0071 --------
  23.50   4.3539    1.5022    0.0220    0.0149    0.0070 --------
  23.75   4.3736    1.5156    0.0198    0.0135    0.0063 --------
  24.00   4.3934    1.5291    0.0198    0.0135    0.0063 --------
 --------------------------------------------------------------------
 --------------------------------------------------------------------
 Total soil rain loss =      2.86(In)
 Total effective runoff =      1.53(In)
 ---------------------------------------------------------------------
 Peak flow rate this hydrograph =        3249.76(CFS)
 Total runoff volume this hydrograph =      76882871.3(Ft3)
 ---------------------------------------------------------------------
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f    H y d r o g r a p h
 --------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

 --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0      825.0    1650.0    2475.0    3300.0
-----------------------------------------------------------------------
  0+15       0.0000      0.00  Q          |         |         |         |
  0+30       0.0000      0.00  Q          |         |         |         |
  0+45       0.0000      0.00  Q          |         |         |         |
  1+ 0       0.0000      0.00  Q          |         |         |         |
  1+15       0.0000      0.00  Q          |         |         |         |
  1+30       0.0000      0.00  Q          |         |         |         |
  1+45       0.0000      0.00  Q          |         |         |         |
  2+ 0       0.0000      0.00  Q          |         |         |         |
  2+15       0.0000      0.00  Q          |         |         |         |
  2+30       0.0000      0.00  Q          |         |         |         |
  2+45       0.0000      0.00  Q          |         |         |         |
  3+ 0       0.0000      0.00  Q          |         |         |         |
  3+15       0.0000      0.00  Q          |         |         |         |
  3+30       0.0000      0.00  Q          |         |         |         |
  3+45       0.0000      0.00  Q          |         |         |         |
```

```
 4+ 0       0.0000      0.00  Q         |         |         |         |
 4+15       0.0000      0.00  Q         |         |         |         |
 4+30       0.0000      0.00  Q         |         |         |         |
 4+45       0.0000      0.00  Q         |         |         |         |
 5+ 0       0.0000      0.00  Q         |         |         |         |
 5+15       0.0000      0.00  Q         |         |         |         |
 5+30       0.0000      0.00  Q         |         |         |         |
 5+45       0.0000      0.00  Q         |         |         |         |
 6+ 0       0.0000      0.00  Q         |         |         |         |
 6+15       0.0000      0.00  Q         |         |         |         |
 6+30       0.0000      0.00  Q         |         |         |         |
 6+45       0.0000      0.00  Q         |         |         |         |
 7+ 0       0.0000      0.00  Q         |         |         |         |
 7+15       0.0000      0.00  Q         |         |         |         |
 7+30       0.0004      0.02  Q         |         |         |         |
 7+45       0.0123      0.58  Q         |         |         |         |
 8+ 0       0.0791      3.23  Q         |         |         |         |
 8+15       0.3379     12.52  Q         |         |         |         |
 8+30       1.1643     40.00  Q         |         |         |         |
 8+45       3.3758    107.03  VQ        |         |         |         |
 9+ 0       8.3437    240.45  V Q       |         |         |         |
 9+15      17.9092    462.97  V    Q    |         |         |         |
 9+30      34.1686    786.95  V        Q|         |         |         |
 9+45      59.2412   1213.52   V        |   Q     |         |         |
10+ 0      94.7007   1716.24  | V       |         Q         |         |
10+15     141.1509   2248.19  |  V      |         |      Q  |         |
10+30     197.5858   2731.45  |   V     |         |         |  Q      |
10+45     261.4390   3090.49  |    V    |         |         |      Q  |
11+ 0     328.5828   3249.76  |      V  |         |         |        Q|
11+15     394.1361   3172.78  |       V |         |         |       Q |
11+30     454.8813   2940.07  |         V         |         |    Q    |
11+45     509.9562   2665.63  |         |V        |         | Q       |
12+ 0     560.0789   2425.94  |         | V       |        Q|         |
12+15     605.8169   2213.72  |         |  V      |     Q   |         |
12+30     648.0821   2045.64  |         |   V     |   Q     |         |
12+45     687.3817   1902.10  |         |    V    |  Q      |         |
13+ 0     724.2148   1782.72  |         |     V   |Q        |         |
13+15     758.9343   1680.42  |         |      V  Q         |         |
13+30     791.8321   1592.26  |         |      V Q|         |         |
13+45     823.1299   1514.81  |         |       Q |         |         |
14+ 0     852.9548   1443.52  |         |      Q V|         |         |
14+15     881.4114   1377.30  |         |     Q  V|         |         |
14+30     908.6495   1318.32  |         |    Q    V         |         |
14+45     934.9287   1271.91  |         |    Q     V        |         |
15+ 0     960.5941   1242.21  |         |    Q    |V        |         |
15+15     985.9351   1226.50  |         |   Q     | V       |         |
15+30    1010.7409   1200.60  |         |   Q     | V       |         |
15+45    1034.2769   1139.14  |         |  Q      |  V      |         |
16+ 0    1056.5139   1076.27  |         |  Q      |  V      |         |
16+15    1078.4785   1063.09  |         | Q       |   V     |         |
16+30    1100.9420   1087.23  |         |  Q      |   V     |         |
16+45    1123.7440   1103.62  |         |  Q      |    V    |         |
17+ 0    1146.5528   1103.94  |         |  Q      |    V    |         |
17+15    1169.2567   1098.87  |         |  Q      |     V   |         |
17+30    1191.8532   1093.67  |         |  Q      |      V  |         |
17+45    1214.4364   1093.02  |         |  Q      |      V  |         |
18+ 0    1236.9246   1088.43  |         |  Q      |       V |         |
18+15    1258.9683   1066.91  |         | Q       |       V |         |
18+30    1280.4095   1037.76  |         | Q       |        V|         |
18+45    1301.4174   1016.78  |         | Q       |        V|         |
19+ 0    1322.0152    996.93  |         | Q       |        V|         |
19+15    1341.8882    961.85  |         |Q        |         V         |
19+30    1360.8860    919.49  |         |Q        |         V         |
```

```
   19+45    1379.1471    883.84   |         Q         |          V        |
   20+ 0    1396.8296    855.83   |         Q         |         |V        |
   20+15    1413.9597    829.10   |         Q         |         | V       |
   20+30    1430.6795    809.24   |        Q|         |         | V       |
   20+45    1447.2624    802.61   |        Q|         |         | V       |
   21+ 0    1463.9591    808.12   |        Q|         |         |  V      |
   21+15    1480.8841    819.17   |        Q|         |         |  V      |
   21+30    1497.9747    827.19   |         Q         |         |  V      |
   21+45    1515.0390    825.91   |         Q         |         |   V     |
   22+ 0    1531.8742    814.83   |        Q|         |         |   V     |
   22+15    1548.3773    798.75   |        Q|         |         |    V    |
   22+30    1564.5455    782.54   |        Q|         |         |    V    |
   22+45    1580.4593    770.23   |        Q|         |         |    V    |
   23+ 0    1596.2248    763.05   |        Q|         |         |     V   |
   23+15    1611.8946    758.42   |        Q|         |         |     V   |
   23+30    1627.5163    756.09   |        Q|         |         |     V   |
   23+45    1643.1374    756.06   |        Q|         |         |      V  |
   24+ 0    1658.8440    760.20   |        Q|         |         |      V  |
   24+15    1674.7019    767.52   |        Q|         |         |      V  |
   24+30    1690.5662    767.83   |        Q|         |         |       V |
   24+45    1705.9959    746.80   |        Q|         |         |       V |
   25+ 0    1720.1150    683.37   |       Q |         |         |       V |
   25+15    1731.7875    564.95   |     Q   |         |         |        V|
   25+30    1740.5851    425.81   |    Q    |         |         |        V|
   25+45    1747.0404    312.43   |  Q      |         |         |        V|
   26+ 0    1751.9313    236.72   | Q       |         |         |        V|
   26+15    1755.6257    178.81   | Q       |         |         |        V|
   26+30    1758.4213    135.31   |Q        |         |         |        V|
   26+45    1760.5193    101.54   |Q        |         |         |        V|
   27+ 0    1762.0652     74.82   Q         |         |         |        V|
   27+15    1763.1752     53.72   Q         |         |         |        V|
   27+30    1763.9401     37.02   Q         |         |         |        V|
   27+45    1764.4435     24.37   Q         |         |         |        V|
   28+ 0    1764.7474     14.71   Q         |         |         |        V|
   28+15    1764.9110      7.92   Q         |         |         |        V|
   28+30    1764.9753      3.11   Q         |         |         |        V|
   28+45    1764.9879      0.61   Q         |         |         |         V
-----------------------------------------------------------------------
```

```
        U N I T   H Y D R O G R A P H   A N A L Y S I S
Copyright (c) CIVILCADD/CIVILDESIGN, 1990 - 2004, Version 7.0
                Study date  09/08/10  File: tulecreek100yr6hr.out

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Program License Serial Number 4055

----------------------------------------------------------------------
Tule Wind Project
Tule Creek Crossing
Proposed Conditions 100 Yr 6 Hr
Aug 18, 2010
----------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Storm Event Year = 100

Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
        Sub-Area(Ac.)       Rainfall (In)
         13851.00             3.47

Rainfall Distribution pattern used in study:
Type B for SCS (small dam) or San Diego 6 hour storms
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

********* Area-Averaged SCS Curve Number and Fm *********

Area       Area          SCS CN    SCS CN    Fm      Soil
(Ac.)      fract         (AMC2)    (AMC2)   (In/Hr)  Group
 13851.00   1.000         81.0      81.0     0.050    B

Area-averaged catchment SCS Curve Number AMC(2) = 81.000
Area-averaged Fm value using values listed =  0.050(In/Hr)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Direct entry of lag time by user
Watershed area =   13851.00(Ac.)
Catchment Lag time =   1.460 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 17.1233
Hydrograph baseflow =     0.00(CFS)
Minimum watershed loss rate(Fm) =  0.000(In/Hr)
Average adjusted SCS Curve Number = 81.000

Rainfall depth area reduction factors:
Using a total area of   13851.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 0.983
Rainfall entered for study =    3.470(In)
Adjusted rainfall =    3.411(In)
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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H
++

Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 55865.70 (CFS))

0.17	0.250	0.016	158.799	0.003
0.34	0.500	0.060	603.506	0.014
0.51	0.750	0.154	1549.023	0.041
0.68	1.000	0.418	4209.423	0.117
0.86	1.250	0.829	8356.072	0.266
1.03	1.500	1.000	10080.482	0.447
1.20	1.750	0.817	8237.636	0.594
1.37	2.000	0.547	5509.267	0.693
1.54	2.250	0.419	4219.133	0.768
1.71	2.500	0.314	3165.938	0.825
1.88	2.750	0.243	2450.565	0.869
2.05	3.000	0.192	1934.570	0.903
2.23	3.250	0.151	1525.672	0.931
2.40	3.500	0.120	1206.712	0.952
2.57	3.750	0.090	908.788	0.969
2.74	4.000	0.068	683.892	0.981
2.91	4.250	0.048	484.176	0.990
3.08	4.500	0.035	351.342	0.996
3.25	4.750	0.018	185.744	0.999
3.42	5.000	0.004	44.958	1.000

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For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

Where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltration (In) dP-dQ	Revised Runoff Min Loss Rate
0.25	0.0597	0.0000	0.0597	0.0000	0.0597	--------
0.50	0.1194	0.0000	0.0597	0.0000	0.0597	--------

```
        0.75   0.1995    0.0000    0.0801    0.0000    0.0801 --------
        1.00   0.2797    0.0000    0.0801    0.0000    0.0801 --------
        1.25   0.3786    0.0000    0.0989    0.0000    0.0989 --------
        1.50   0.4775    0.0000    0.0989    0.0000    0.0989 --------
        1.75   0.6310    0.0104    0.1535    0.0104    0.1431 --------
        2.00   0.7844    0.0374    0.1535    0.0269    0.1266 --------
        2.25   1.4154    0.2720    0.6310    0.2346    0.3963 --------
        2.50   2.0463    0.6341    0.6310    0.3621    0.2688 --------
        2.75   2.2169    0.7462    0.1705    0.1121    0.0584 --------
        3.00   2.3874    0.8630    0.1705    0.1168    0.0538 --------
        3.25   2.5255    0.9606    0.1381    0.0976    0.0405 --------
        3.50   2.6636    1.0607    0.1381    0.1001    0.0380 --------
        3.75   2.7557    1.1287    0.0921    0.0680    0.0241 --------
        4.00   2.8478    1.1976    0.0921    0.0689    0.0232 --------
        4.25   2.9245    1.2558    0.0767    0.0581    0.0186 --------
        4.50   3.0013    1.3145    0.0767    0.0587    0.0180 --------
        4.75   3.0746    1.3711    0.0733    0.0566    0.0167 --------
        5.00   3.1479    1.4282    0.0733    0.0571    0.0162 --------
        5.25   3.2110    1.4777    0.0631    0.0495    0.0136 --------
        5.50   3.2741    1.5276    0.0631    0.0498    0.0132 --------
        5.75   3.3423    1.5818    0.0682    0.0542    0.0140 --------
        6.00   3.4105    1.6364    0.0682    0.0546    0.0136 --------
      --------------------------------------------------------------------
      --------------------------------------------------------------------
      Total soil rain loss =      1.77(In)
      Total effective runoff =      1.64(In)
      ---------------------------------------------------------------------
      Peak flow rate this hydrograph =        7426.13(CFS)
      Total runoff volume this hydrograph =       82277572.2(Ft3)
      ---------------------------------------------------------------------
      ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                         6 - H O U R   S T O R M
                    R u n o f f    H y d r o g r a p h
      --------------------------------------------------------------------
                 Hydrograph in  15   Minute intervals ((CFS))

      --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0     1875.0    3750.0    5625.0    7500.0
-----------------------------------------------------------------------
  0+15       0.0000       0.00  Q         |         |         |         |
  0+30       0.0000       0.00  Q         |         |         |         |
  0+45       0.0000       0.00  Q         |         |         |         |
  1+ 0       0.0000       0.00  Q         |         |         |         |
  1+15       0.0000       0.00  Q         |         |         |         |
  1+30       0.0001       0.00  Q         |         |         |         |
  1+45       0.0346       1.67  Q         |         |         |         |
  2+ 0       0.2537      10.60  Q         |         |         |         |
  2+15       1.6950      69.76  Q         |         |         |         |
  2+30       7.5809     284.88  VQ        |         |         |         |
  2+45      24.1180     800.40  V   Q     |         |         |         |
  3+ 0      64.7152    1964.91   V        Q         |         |         |
  3+15     149.4630    4101.79  |  V      |         |Q        |         |
  3+30     281.6504    6397.87  |    V    |         |         |   Q     |
  3+45     435.0828    7426.13  |        V|         |         |        Q|
  4+ 0     582.7276    7146.01  |           V       |         |       Q |
  4+15     718.8769    6589.62  |         |    V    |         |    Q    |
  4+30     846.8591    6194.34  |         |      V  |         |  Q      |
  4+45     964.8719    5711.82  |         |         V         Q         |
  5+ 0    1073.2453    5245.27  |         |         | V    Q  |         |
  5+15    1172.9581    4826.10  |         |         |   VQ    |         |
  5+30    1265.6268    4485.17  |         |         |  Q  V   |         |
  5+45    1352.2573    4192.91  |         |         | Q     V |         |
  6+ 0    1433.6374    3938.80  |         |         |Q        V         |
```

```
  6+15    1509.9643   3694.22  |          |        Q|         V         |
  6+30    1581.4456   3459.70  |          |       Q |        |  V       |
  6+45    1648.1422   3228.12  |          |      Q  |        |   V      |
  7+ 0    1707.6832   2881.78  |          |    Q    |        |     V    |
  7+15    1756.0619   2341.53  |          | Q       |        |      V   |
  7+30    1792.0872   1743.62  |         Q|         |        |      V   |
  7+45    1818.2862   1268.03  |      Q   |         |        |       V  |
  8+ 0    1837.8915    948.90  |     Q    |         |        |       V  |
  8+15    1852.5157    707.81  |   Q      |         |        |        V|
  8+30    1863.4641    529.90  | Q        |         |        |        V|
  8+45    1871.6159    394.55  | Q        |         |        |        V|
  9+ 0    1877.5871    289.00  |Q         |         |        |        V|
  9+15    1881.8532    206.48  |Q         |         |        |        V|
  9+30    1884.7750    141.41  Q          |         |        |        V|
  9+45    1886.6942     92.89  Q          |         |        |        V|
 10+ 0    1887.8716     56.99  Q          |         |        |        V|
 10+15    1888.5225     31.50  Q          |         |        |        V|
 10+30    1888.7824     12.58  Q          |         |        |        V|
 10+45    1888.8332      2.46  Q          |         |        |         V
-----------------------------------------------------------------------
```

```
        U N I T   H Y D R O G R A P H   A N A L Y S I S
Copyright (c) CIVILCADD/CIVILDESIGN, 1990 - 2004, Version 7.0
                Study date  09/08/10  File: tulecreek100yr24hr.out

+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Program License Serial Number 4055

---------------------------------------------------------------------
Tule Wind Project
Tule Creek Crossing
Proposed Conditions 100 Yr 24 Hr
Aug 18, 2010
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Storm Event Year = 100

Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
        Sub-Area(Ac.)       Rainfall (In)
         13851.00             6.69

Rainfall Distribution pattern used in study:
Type B for San Diego area of California
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

********* Area-Averaged SCS Curve Number and Fm *********

Area       Area          SCS CN    SCS CN    Fm      Soil
(Ac.)      fract         (AMC2)    (AMC2)   (In/Hr)  Group
 13851.00   1.000         81.0      81.0     0.050    B

Area-averaged catchment SCS Curve Number AMC(2) = 81.000
Area-averaged Fm value using values listed =  0.050(In/Hr)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Direct entry of lag time by user
Watershed area =   13851.00(Ac.)
Catchment Lag time =   1.460 hours
Unit interval =  15.000 minutes
Unit interval percentage of lag time = 17.1233
Hydrograph baseflow =     0.00(CFS)
Minimum watershed loss rate(Fm) =  0.000(In/Hr)
Average adjusted SCS Curve Number = 81.000

Rainfall depth area reduction factors:
Using a total area of   13851.00(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 0.983
Rainfall entered for study =    6.690(In)
Adjusted rainfall =    6.575(In)
```

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval =   0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T   H Y D R O G R A P H
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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 55865.70 (CFS))

0.17	0.250	0.016	158.799	0.003
0.34	0.500	0.060	603.506	0.014
0.51	0.750	0.154	1549.023	0.041
0.68	1.000	0.418	4209.423	0.117
0.86	1.250	0.829	8356.072	0.266
1.03	1.500	1.000	10080.482	0.447
1.20	1.750	0.817	8237.636	0.594
1.37	2.000	0.547	5509.267	0.693
1.54	2.250	0.419	4219.133	0.768
1.71	2.500	0.314	3165.938	0.825
1.88	2.750	0.243	2450.565	0.869
2.05	3.000	0.192	1934.570	0.903
2.23	3.250	0.151	1525.672	0.931
2.40	3.500	0.120	1206.712	0.952
2.57	3.750	0.090	908.788	0.969
2.74	4.000	0.068	683.892	0.981
2.91	4.250	0.048	484.176	0.990
3.08	4.500	0.035	351.342	0.996
3.25	4.750	0.018	185.744	0.999
3.42	5.000	0.004	44.958	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

Where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr-ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.25	0.0296	0.0000	0.0296	0.0000	0.0296	--------
0.50	0.0592	0.0000	0.0296	0.0000	0.0296	--------

0.75	0.0822	0.0000	0.0230	0.0000	0.0230	--------
1.00	0.1052	0.0000	0.0230	0.0000	0.0230	--------
1.25	0.1348	0.0000	0.0296	0.0000	0.0296	--------
1.50	0.1644	0.0000	0.0296	0.0000	0.0296	--------
1.75	0.1940	0.0000	0.0296	0.0000	0.0296	--------
2.00	0.2236	0.0000	0.0296	0.0000	0.0296	--------
2.25	0.2597	0.0000	0.0362	0.0000	0.0362	--------
2.50	0.2959	0.0000	0.0362	0.0000	0.0362	--------
2.75	0.3255	0.0000	0.0296	0.0000	0.0296	--------
3.00	0.3551	0.0000	0.0296	0.0000	0.0296	--------
3.25	0.3912	0.0000	0.0362	0.0000	0.0362	--------
3.50	0.4274	0.0000	0.0362	0.0000	0.0362	--------
3.75	0.4669	0.0000	0.0395	0.0000	0.0395	--------
4.00	0.5063	0.0006	0.0395	0.0006	0.0389	--------
4.25	0.5490	0.0026	0.0427	0.0021	0.0407	--------
4.50	0.5918	0.0061	0.0427	0.0035	0.0393	--------
4.75	0.6378	0.0113	0.0460	0.0052	0.0408	--------
5.00	0.6838	0.0180	0.0460	0.0067	0.0393	--------
5.25	0.7364	0.0273	0.0526	0.0093	0.0433	--------
5.50	0.7890	0.0384	0.0526	0.0110	0.0416	--------
5.75	0.8449	0.0519	0.0559	0.0135	0.0424	--------
6.00	0.9008	0.0671	0.0559	0.0152	0.0407	--------
6.25	0.9666	0.0870	0.0658	0.0199	0.0458	--------
6.50	1.0323	0.1090	0.0658	0.0220	0.0437	--------
6.75	1.1079	0.1367	0.0756	0.0277	0.0479	--------
7.00	1.1836	0.1668	0.0756	0.0301	0.0456	--------
7.25	1.2822	0.2093	0.0986	0.0425	0.0561	--------
7.50	1.3808	0.2552	0.0986	0.0459	0.0527	--------
7.75	1.5288	0.3297	0.1479	0.0746	0.0734	--------
8.00	1.6767	0.4104	0.1479	0.0807	0.0673	--------
8.25	1.8970	0.5403	0.2203	0.1299	0.0904	--------
8.50	2.1173	0.6801	0.2203	0.1399	0.0804	--------
8.75	2.4066	0.8764	0.2893	0.1963	0.0931	--------
9.00	2.6959	1.0844	0.2893	0.2080	0.0813	--------
9.25	3.0115	1.3223	0.3156	0.2379	0.0777	--------
9.50	3.3271	1.5697	0.3156	0.2473	0.0683	--------
9.75	3.5967	1.7872	0.2696	0.2175	0.0521	--------
10.00	3.8663	2.0096	0.2696	0.2224	0.0472	--------
10.25	4.0011	2.1224	0.1348	0.1128	0.0220	--------
10.50	4.1359	2.2362	0.1348	0.1138	0.0210	--------
10.75	4.2247	2.3117	0.0888	0.0755	0.0133	--------
11.00	4.3134	2.3875	0.0888	0.0758	0.0129	--------
11.25	4.3891	2.4524	0.0756	0.0649	0.0107	--------
11.50	4.4647	2.5175	0.0756	0.0651	0.0105	--------
11.75	4.5337	2.5772	0.0690	0.0597	0.0093	--------
12.00	4.6028	2.6371	0.0690	0.0599	0.0091	--------
12.25	4.6685	2.6944	0.0658	0.0572	0.0085	--------
12.50	4.7343	2.7518	0.0658	0.0574	0.0084	--------
12.75	4.7967	2.8064	0.0625	0.0547	0.0078	--------
13.00	4.8592	2.8612	0.0625	0.0548	0.0076	--------
13.25	4.9151	2.9104	0.0559	0.0492	0.0067	--------
13.50	4.9710	2.9597	0.0559	0.0493	0.0066	--------
13.75	5.0236	3.0062	0.0526	0.0465	0.0061	--------
14.00	5.0762	3.0527	0.0526	0.0466	0.0060	--------
14.25	5.1354	3.1052	0.0592	0.0525	0.0067	--------
14.50	5.1945	3.1579	0.0592	0.0526	0.0066	--------
14.75	5.2274	3.1871	0.0329	0.0293	0.0036	--------
15.00	5.2603	3.2164	0.0329	0.0293	0.0036	--------
15.25	5.3129	3.2634	0.0526	0.0470	0.0056	--------
15.50	5.3655	3.3104	0.0526	0.0470	0.0056	--------
15.75	5.4148	3.3546	0.0493	0.0442	0.0051	--------
16.00	5.4641	3.3989	0.0493	0.0442	0.0051	--------
16.25	5.5102	3.4402	0.0460	0.0414	0.0047	--------

```
 16.50   5.5562    3.4816    0.0460    0.0414    0.0046 --------
 16.75   5.6055    3.5261    0.0493    0.0444    0.0049 --------
 17.00   5.6548    3.5706    0.0493    0.0445    0.0048 --------
 17.25   5.6943    3.6062    0.0395    0.0356    0.0038 --------
 17.50   5.7337    3.6419    0.0395    0.0357    0.0038 --------
 17.75   5.7765    3.6806    0.0427    0.0387    0.0040 --------
 18.00   5.8192    3.7194    0.0427    0.0387    0.0040 --------
 18.25   5.8521    3.7492    0.0329    0.0298    0.0030 --------
 18.50   5.8850    3.7791    0.0329    0.0299    0.0030 --------
 18.75   5.9178    3.8089    0.0329    0.0299    0.0030 --------
 19.00   5.9507    3.8388    0.0329    0.0299    0.0030 --------
 19.25   5.9803    3.8658    0.0296    0.0269    0.0026 --------
 19.50   6.0099    3.8928    0.0296    0.0270    0.0026 --------
 19.75   6.0428    3.9227    0.0329    0.0300    0.0029 --------
 20.00   6.0756    3.9527    0.0329    0.0300    0.0029 --------
 20.25   6.1118    3.9858    0.0362    0.0330    0.0031 --------
 20.50   6.1480    4.0188    0.0362    0.0331    0.0031 --------
 20.75   6.1808    4.0489    0.0329    0.0301    0.0028 --------
 21.00   6.2137    4.0790    0.0329    0.0301    0.0028 --------
 21.25   6.2433    4.1061    0.0296    0.0271    0.0025 --------
 21.50   6.2729    4.1332    0.0296    0.0271    0.0025 --------
 21.75   6.3025    4.1604    0.0296    0.0271    0.0024 --------
 22.00   6.3321    4.1876    0.0296    0.0272    0.0024 --------
 22.25   6.3617    4.2147    0.0296    0.0272    0.0024 --------
 22.50   6.3913    4.2419    0.0296    0.0272    0.0024 --------
 22.75   6.4208    4.2692    0.0296    0.0272    0.0024 --------
 23.00   6.4504    4.2964    0.0296    0.0272    0.0024 --------
 23.25   6.4833    4.3267    0.0329    0.0303    0.0026 --------
 23.50   6.5162    4.3570    0.0329    0.0303    0.0026 --------
 23.75   6.5458    4.3843    0.0296    0.0273    0.0023 --------
 24.00   6.5754    4.4116    0.0296    0.0273    0.0023 --------
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      2.16(In)
Total effective runoff =      4.41(In)
---------------------------------------------------------------------
Peak flow rate this hydrograph =       10607.44(CFS)
Total runoff volume this hydrograph =     221809144.3(Ft3)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                   24 - H O U R    S T O R M
              R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in  15   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0     2675.0    5350.0    8025.0   10700.0
-----------------------------------------------------------------------
  0+15       0.0000      0.00  Q         |         |         |         |
  0+30       0.0000      0.00  Q         |         |         |         |
  0+45       0.0000      0.00  Q         |         |         |         |
  1+ 0       0.0000      0.00  Q         |         |         |         |
  1+15       0.0000      0.00  Q         |         |         |         |
  1+30       0.0000      0.00  Q         |         |         |         |
  1+45       0.0000      0.00  Q         |         |         |         |
  2+ 0       0.0000      0.00  Q         |         |         |         |
  2+15       0.0000      0.00  Q         |         |         |         |
  2+30       0.0000      0.00  Q         |         |         |         |
  2+45       0.0000      0.00  Q         |         |         |         |
  3+ 0       0.0000      0.00  Q         |         |         |         |
  3+15       0.0000      0.00  Q         |         |         |         |
  3+30       0.0000      0.00  Q         |         |         |         |
  3+45       0.0000      0.00  Q         |         |         |         |
```

```
 4+ 0       0.0019      0.09  Q         |         |         |         |
 4+15       0.0159      0.68  Q         |         |         |         |
 4+30       0.0714      2.69  Q         |         |         |         |
 4+45       0.2478      8.54  Q         |         |         |         |
 5+ 0       0.7242     23.06  Q         |         |         |         |
 5+15       1.7816     51.18  Q         |         |         |         |
 5+30       3.7263     94.13  Q         |         |         |         |
 5+45       6.8269    150.06  Q         |         |         |         |
 6+ 0      11.3267    217.79  Q         |         |         |         |
 6+15      17.4799    297.82  VQ        |         |         |         |
 6+30      25.5125    388.78  VQ        |         |         |         |
 6+45      35.6298    489.68  VQ        |         |         |         |
 7+ 0      48.0926    603.20  V Q       |         |         |         |
 7+15      63.3048    736.27  V Q       |         |         |         |
 7+30      81.7247    891.52  V  Q      |         |         |         |
 7+45     103.9416   1075.30  V   Q     |         |         |         |
 8+ 0     130.8543   1302.57   V  Q     |         |         |         |
 8+15     163.9683   1602.72  |V   Q    |         |         |         |
 8+30     205.5170   2010.96  |V     Q  |         |         |         |
 8+45     258.6877   2573.46  | V      Q|         |         |         |
 9+ 0     327.3103   3321.34  | V       | Q       |         |         |
 9+15     415.8023   4283.01  |  V      |     Q   |         |         |
 9+30     528.0050   5430.61  |   V     |         Q         |         |
 9+45     666.9318   6724.06  |    V    |         |    Q    |         |
10+ 0     832.9258   8034.11  |     V   |         |         Q         |
10+15    1023.7679   9236.76  |       V |         |         |   Q     |
10+30    1233.2342  10138.17  |        V|         |         |      Q  |
10+45    1452.3962  10607.44  |          V        |         |        Q|
11+ 0    1669.6311  10514.17  |         |  V      |         |        Q|
11+15    1872.8736   9836.94  |         |   V     |         |     Q   |
11+30    2055.2682   8827.90  |         |     V   |         |  Q      |
11+45    2216.2191   7790.03  |         |      V  |        Q|         |
12+ 0    2359.0318   6912.14  |         |       V |    Q    |         |
12+15    2486.1796   6153.95  |         |        V|  Q      |         |
12+30    2600.8314   5549.15  |         |         Q         |         |
12+45    2704.9228   5038.03  |         |       Q  V        |         |
13+ 0    2800.2662   4614.62  |         |      Q  |V        |         |
13+15    2888.2216   4257.04  |         |    Q    | V       |         |
13+30    2969.9323   3954.80  |         |   Q     |  V      |         |
13+45    3046.3265   3697.48  |         |  Q      |  V      |         |
14+ 0    3118.0403   3470.95  |         | Q       |   V     |         |
14+15    3185.6122   3270.48  |         | Q       |    V    |         |
14+30    3249.6132   3097.65  |         |Q        |    V    |         |
14+45    3310.8196   2962.39  |         |Q        |     V   |         |
15+ 0    3370.1471   2871.45  |         Q         |     V   |         |
15+15    3428.3296   2816.03  |         Q         |     V   |         |
15+30    3484.9482   2740.34  |         Q         |      V  |         |
15+45    3538.4002   2587.08  |        Q|         |      V  |         |
16+ 0    3588.6542   2432.29  |        Q|         |       V |         |
16+15    3638.0270   2389.64  |       Q |         |       V |         |
16+30    3688.2523   2430.90  |        Q|         |       V |         |
16+45    3738.9835   2455.39  |        Q|         |        V|         |
17+ 0    3789.4956   2444.79  |        Q|         |        V|         |
17+15    3839.5546   2422.86  |        Q|         |         V         |
17+30    3889.1643   2401.11  |       Q |         |         V         |
17+45    3938.5381   2389.69  |       Q |         |         V         |
18+ 0    3987.5111   2370.30  |       Q |         |         |V        |
18+15    4035.3417   2315.00  |       Q |         |         |V        |
18+30    4081.7030   2243.89  |       Q |         |         | V       |
18+45    4126.9702   2190.93  |       Q |         |         | V       |
19+ 0    4171.2077   2141.10  |       Q |         |         | V       |
19+15    4213.7608   2059.57  |      Q  |         |         |  V      |
19+30    4254.3256   1963.34  |      Q  |         |         |  V      |
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   19+45    4293.2087   1881.94   |      Q  |         |         |  V      |
   20+ 0    4330.7551   1817.25   |     Q   |         |         |   V     |
   20+15    4367.0310   1755.75   |     Q   |         |         |   V     |
   20+30    4402.3438   1709.14   |     Q   |         |         |   V     |
   20+45    4437.2738   1690.61   |     Q   |         |         |   V     |
   21+ 0    4472.3504   1697.71   |     Q   |         |         |    V    |
   21+15    4507.8143   1716.45   |     Q   |         |         |    V    |
   21+30    4543.5366   1728.96   |     Q   |         |         |    V    |
   21+45    4579.1210   1722.29   |     Q   |         |         |    V    |
   22+ 0    4614.1508   1695.44   |     Q   |         |         |     V   |
   22+15    4648.4168   1658.48   |     Q   |         |         |     V   |
   22+30    4681.9183   1621.47   |     Q   |         |         |     V   |
   22+45    4714.8252   1592.70   |    Q    |         |         |      V  |
   23+ 0    4747.3600   1574.68   |    Q    |         |         |      V  |
   23+15    4779.6332   1562.03   |    Q    |         |         |      V  |
   23+30    4811.7443   1554.18   |    Q    |         |         |      V  |
   23+45    4843.7913   1551.07   |    Q    |         |         |       V |
   24+ 0    4875.9509   1556.52   |    Q    |         |         |       V |
   24+15    4908.3577   1568.49   |    Q    |         |         |       V |
   24+30    4940.7189   1566.28   |    Q    |         |         |       V |
   24+45    4972.1434   1520.95   |    Q    |         |         |        V|
   25+ 0    5000.8636   1390.06   |    Q    |         |         |        V|
   25+15    5024.5917   1148.44   |   Q     |         |         |        V|
   25+30    5042.4732    865.46   |  Q      |         |         |        V|
   25+45    5055.5937    635.03   | Q       |         |         |        V|
   26+ 0    5065.5326    481.05   |Q        |         |         |        V|
   26+15    5073.0383    363.28   |Q        |         |         |        V|
   26+30    5078.7160    274.80   |Q        |         |         |        V|
   26+45    5082.9754    206.15   Q         |         |         |        V|
   27+ 0    5086.1127    151.84   Q         |         |         |        V|
   27+15    5088.3641    108.97   Q         |         |         |        V|
   27+30    5089.9150     75.06   Q         |         |         |        V|
   27+45    5090.9352     49.38   Q         |         |         |        V|
   28+ 0    5091.5508     29.79   Q         |         |         |        V|
   28+15    5091.8818     16.02   Q         |         |         |        V|
   28+30    5092.0119      6.30   Q         |         |         |        V|
   28+45    5092.0373      1.23   Q         |         |         |         V
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U N I T   H Y D R O G R A P H   A N A L Y S I S

Study date 09/08/10 File: mccain110yr24hr.out

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Program License Serial Number 4055

Tule Wind Project
McCain Valley Crossing 1
Proposed Conditions 10 Yr 24 Hr
Aug 18, 2010

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Storm Event Year = 10

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
2185.54	3.50

Rainfall Distribution pattern used in study:
Type B for San Diego area of California

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********* Area-Averaged SCS Curve Number and Fm *********

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
2185.54	1.000	73.0	73.0	0.050	C

Area-averaged catchment SCS Curve Number AMC(2) = 73.000
Area-averaged Fm value using values listed = 0.050(In/Hr)
+++
Direct entry of lag time by user
Watershed area =   2185.54(Ac.)
Catchment Lag time =   0.740 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 11.2613
Hydrograph baseflow =   0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 73.000

Rainfall depth area reduction factors:
Using a total area of   2185.54(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study =   3.500(In)
Adjusted rainfall =   3.500(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval =   0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T   H Y D R O G R A P H
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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 26445.03 (CFS))

0.11	0.083	0.015	49.436	0.002
0.23	0.167	0.036	114.819	0.006
0.34	0.250	0.081	261.213	0.016
0.45	0.333	0.138	445.451	0.033
0.56	0.417	0.243	781.573	0.062
0.68	0.500	0.565	1817.277	0.131
0.79	0.583	0.773	2488.816	0.225
0.90	0.667	1.000	3219.152	0.347
1.01	0.750	0.946	3044.634	0.462
1.13	0.833	0.843	2712.922	0.565
1.24	0.917	0.600	1930.560	0.638
1.35	1.000	0.502	1616.625	0.699
1.46	1.083	0.419	1350.100	0.750
1.58	1.167	0.342	1101.054	0.792
1.69	1.250	0.294	945.183	0.827
1.80	1.333	0.241	775.154	0.857
1.91	1.417	0.209	673.014	0.882
2.03	1.500	0.181	581.741	0.904
2.14	1.583	0.150	483.763	0.922
2.25	1.667	0.133	428.230	0.939
2.36	1.750	0.112	361.739	0.952
2.48	1.833	0.091	293.676	0.963
2.59	1.917	0.078	250.893	0.973
2.70	2.000	0.063	202.425	0.981
2.82	2.083	0.051	163.225	0.987
2.93	2.167	0.040	128.845	0.992
3.04	2.250	0.032	104.310	0.995
3.15	2.333	0.024	76.321	0.998
3.27	2.417	0.010	33.079	1.000
3.38	2.500	0.003	9.801	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

Where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr-ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0052	0.0000	0.0052	0.0000	0.0052	--------
0.17	0.0105	0.0000	0.0052	0.0000	0.0052	--------
0.25	0.0158	0.0000	0.0053	0.0000	0.0053	--------
0.33	0.0210	0.0000	0.0052	0.0000	0.0052	--------
0.42	0.0262	0.0000	0.0052	0.0000	0.0052	--------
0.50	0.0315	0.0000	0.0053	0.0000	0.0053	--------
0.58	0.0356	0.0000	0.0041	0.0000	0.0041	--------
0.67	0.0397	0.0000	0.0041	0.0000	0.0041	--------
0.75	0.0438	0.0000	0.0041	0.0000	0.0041	--------
0.83	0.0478	0.0000	0.0041	0.0000	0.0041	--------
0.92	0.0519	0.0000	0.0041	0.0000	0.0041	--------
1.00	0.0560	0.0000	0.0041	0.0000	0.0041	--------
1.08	0.0613	0.0000	0.0053	0.0000	0.0053	--------
1.17	0.0665	0.0000	0.0052	0.0000	0.0052	--------
1.25	0.0718	0.0000	0.0053	0.0000	0.0053	--------
1.33	0.0770	0.0000	0.0052	0.0000	0.0052	--------
1.42	0.0823	0.0000	0.0053	0.0000	0.0053	--------
1.50	0.0875	0.0000	0.0053	0.0000	0.0053	--------
1.58	0.0928	0.0000	0.0053	0.0000	0.0053	--------
1.67	0.0980	0.0000	0.0052	0.0000	0.0052	--------
1.75	0.1033	0.0000	0.0053	0.0000	0.0053	--------
1.83	0.1085	0.0000	0.0052	0.0000	0.0052	--------
1.92	0.1138	0.0000	0.0053	0.0000	0.0053	--------
2.00	0.1190	0.0000	0.0053	0.0000	0.0053	--------
2.08	0.1254	0.0000	0.0064	0.0000	0.0064	--------
2.17	0.1318	0.0000	0.0064	0.0000	0.0064	--------
2.25	0.1383	0.0000	0.0064	0.0000	0.0064	--------
2.33	0.1447	0.0000	0.0064	0.0000	0.0064	--------
2.42	0.1511	0.0000	0.0064	0.0000	0.0064	--------
2.50	0.1575	0.0000	0.0064	0.0000	0.0064	--------
2.58	0.1628	0.0000	0.0053	0.0000	0.0053	--------
2.67	0.1680	0.0000	0.0053	0.0000	0.0053	--------
2.75	0.1733	0.0000	0.0053	0.0000	0.0053	--------
2.83	0.1785	0.0000	0.0052	0.0000	0.0052	--------
2.92	0.1838	0.0000	0.0053	0.0000	0.0053	--------
3.00	0.1890	0.0000	0.0053	0.0000	0.0053	--------
3.08	0.1954	0.0000	0.0064	0.0000	0.0064	--------
3.17	0.2018	0.0000	0.0064	0.0000	0.0064	--------
3.25	0.2082	0.0000	0.0064	0.0000	0.0064	--------
3.33	0.2147	0.0000	0.0064	0.0000	0.0064	--------
3.42	0.2211	0.0000	0.0064	0.0000	0.0064	--------
3.50	0.2275	0.0000	0.0064	0.0000	0.0064	--------
3.58	0.2345	0.0000	0.0070	0.0000	0.0070	--------
3.67	0.2415	0.0000	0.0070	0.0000	0.0070	--------
3.75	0.2485	0.0000	0.0070	0.0000	0.0070	--------
3.83	0.2555	0.0000	0.0070	0.0000	0.0070	--------
3.92	0.2625	0.0000	0.0070	0.0000	0.0070	--------
4.00	0.2695	0.0000	0.0070	0.0000	0.0070	--------
4.08	0.2771	0.0000	0.0076	0.0000	0.0076	--------
4.17	0.2847	0.0000	0.0076	0.0000	0.0076	--------
4.25	0.2922	0.0000	0.0076	0.0000	0.0076	--------
4.33	0.2998	0.0000	0.0076	0.0000	0.0076	--------
4.42	0.3074	0.0000	0.0076	0.0000	0.0076	--------
4.50	0.3150	0.0000	0.0076	0.0000	0.0076	--------
4.58	0.3232	0.0000	0.0082	0.0000	0.0082	--------

4.67	0.3313	0.0000	0.0082	0.0000	0.0082	--------
4.75	0.3395	0.0000	0.0082	0.0000	0.0082	--------
4.83	0.3477	0.0000	0.0082	0.0000	0.0082	--------
4.92	0.3558	0.0000	0.0082	0.0000	0.0082	--------
5.00	0.3640	0.0000	0.0082	0.0000	0.0082	--------
5.08	0.3733	0.0000	0.0093	0.0000	0.0093	--------
5.17	0.3827	0.0000	0.0093	0.0000	0.0093	--------
5.25	0.3920	0.0000	0.0093	0.0000	0.0093	--------
5.33	0.4013	0.0000	0.0093	0.0000	0.0093	--------
5.42	0.4107	0.0000	0.0093	0.0000	0.0093	--------
5.50	0.4200	0.0000	0.0093	0.0000	0.0093	--------
5.58	0.4299	0.0000	0.0099	0.0000	0.0099	--------
5.67	0.4398	0.0000	0.0099	0.0000	0.0099	--------
5.75	0.4497	0.0000	0.0099	0.0000	0.0099	--------
5.83	0.4597	0.0000	0.0099	0.0000	0.0099	--------
5.92	0.4696	0.0000	0.0099	0.0000	0.0099	--------
6.00	0.4795	0.0000	0.0099	0.0000	0.0099	--------
6.08	0.4912	0.0000	0.0117	0.0000	0.0117	--------
6.17	0.5028	0.0000	0.0117	0.0000	0.0117	--------
6.25	0.5145	0.0000	0.0117	0.0000	0.0117	--------
6.33	0.5262	0.0000	0.0117	0.0000	0.0117	--------
6.42	0.5378	0.0000	0.0117	0.0000	0.0117	--------
6.50	0.5495	0.0000	0.0117	0.0000	0.0117	--------
6.58	0.5629	0.0000	0.0134	0.0000	0.0134	--------
6.67	0.5763	0.0000	0.0134	0.0000	0.0134	--------
6.75	0.5898	0.0000	0.0134	0.0000	0.0134	--------
6.83	0.6032	0.0000	0.0134	0.0000	0.0134	--------
6.92	0.6166	0.0000	0.0134	0.0000	0.0134	--------
7.00	0.6300	0.0000	0.0134	0.0000	0.0134	--------
7.08	0.6475	0.0000	0.0175	0.0000	0.0175	--------
7.17	0.6650	0.0000	0.0175	0.0000	0.0175	--------
7.25	0.6825	0.0000	0.0175	0.0000	0.0175	--------
7.33	0.7000	0.0000	0.0175	0.0000	0.0175	--------
7.42	0.7175	0.0000	0.0175	0.0000	0.0175	--------
7.50	0.7350	0.0000	0.0175	0.0000	0.0175	--------
7.58	0.7612	0.0001	0.0262	0.0001	0.0261	--------
7.67	0.7875	0.0006	0.0262	0.0005	0.0258	--------
7.75	0.8137	0.0015	0.0262	0.0008	0.0254	--------
7.83	0.8400	0.0026	0.0262	0.0012	0.0251	--------
7.92	0.8662	0.0042	0.0262	0.0015	0.0247	--------
8.00	0.8925	0.0061	0.0263	0.0019	0.0244	--------
8.08	0.9316	0.0095	0.0391	0.0034	0.0357	--------
8.17	0.9707	0.0136	0.0391	0.0041	0.0350	--------
8.25	1.0097	0.0184	0.0391	0.0048	0.0343	--------
8.33	1.0488	0.0238	0.0391	0.0055	0.0336	--------
8.42	1.0879	0.0300	0.0391	0.0061	0.0330	--------
8.50	1.1270	0.0367	0.0391	0.0067	0.0323	--------
8.58	1.1783	0.0465	0.0513	0.0098	0.0415	--------
8.67	1.2297	0.0573	0.0513	0.0108	0.0405	--------
8.75	1.2810	0.0691	0.0513	0.0118	0.0395	--------
8.83	1.3323	0.0818	0.0513	0.0127	0.0386	--------
8.92	1.3837	0.0955	0.0513	0.0136	0.0377	--------
9.00	1.4350	0.1100	0.0513	0.0145	0.0368	--------
9.08	1.4910	0.1268	0.0560	0.0168	0.0392	--------
9.17	1.5470	0.1446	0.0560	0.0178	0.0382	--------
9.25	1.6030	0.1634	0.0560	0.0187	0.0373	--------
9.33	1.6590	0.1830	0.0560	0.0196	0.0364	--------
9.42	1.7150	0.2035	0.0560	0.0205	0.0355	--------
9.50	1.7710	0.2249	0.0560	0.0213	0.0347	--------
9.58	1.8188	0.2437	0.0478	0.0189	0.0290	--------
9.67	1.8667	0.2632	0.0478	0.0195	0.0284	--------
9.75	1.9145	0.2832	0.0478	0.0200	0.0278	--------
9.83	1.9623	0.3037	0.0478	0.0205	0.0273	--------

9.92	2.0102	0.3248	0.0478	0.0211	0.0268	--------
10.00	2.0580	0.3464	0.0478	0.0216	0.0262	--------
10.08	2.0819	0.3574	0.0239	0.0110	0.0129	--------
10.17	2.1058	0.3685	0.0239	0.0111	0.0128	--------
10.25	2.1298	0.3797	0.0239	0.0112	0.0127	--------
10.33	2.1537	0.3910	0.0239	0.0113	0.0126	--------
10.42	2.1776	0.4025	0.0239	0.0115	0.0125	--------
10.50	2.2015	0.4141	0.0239	0.0116	0.0123	--------
10.58	2.2172	0.4218	0.0157	0.0077	0.0081	--------
10.67	2.2330	0.4295	0.0158	0.0077	0.0080	--------
10.75	2.2488	0.4373	0.0158	0.0078	0.0080	--------
10.83	2.2645	0.4451	0.0157	0.0078	0.0079	--------
10.92	2.2802	0.4530	0.0157	0.0079	0.0079	--------
11.00	2.2960	0.4609	0.0158	0.0079	0.0078	--------
11.08	2.3094	0.4677	0.0134	0.0068	0.0066	--------
11.17	2.3228	0.4745	0.0134	0.0068	0.0066	--------
11.25	2.3362	0.4814	0.0134	0.0069	0.0066	--------
11.33	2.3497	0.4882	0.0134	0.0069	0.0065	--------
11.42	2.3631	0.4952	0.0134	0.0069	0.0065	--------
11.50	2.3765	0.5021	0.0134	0.0070	0.0065	--------
11.58	2.3887	0.5085	0.0122	0.0064	0.0059	--------
11.67	2.4010	0.5149	0.0123	0.0064	0.0058	--------
11.75	2.4133	0.5213	0.0122	0.0064	0.0058	--------
11.83	2.4255	0.5278	0.0122	0.0065	0.0058	--------
11.92	2.4377	0.5343	0.0122	0.0065	0.0058	--------
12.00	2.4500	0.5408	0.0122	0.0065	0.0057	--------
12.08	2.4617	0.5470	0.0117	0.0062	0.0054	--------
12.17	2.4733	0.5533	0.0117	0.0062	0.0054	--------
12.25	2.4850	0.5595	0.0117	0.0063	0.0054	--------
12.33	2.4967	0.5658	0.0117	0.0063	0.0054	--------
12.42	2.5083	0.5721	0.0117	0.0063	0.0054	--------
12.50	2.5200	0.5785	0.0117	0.0063	0.0053	--------
12.58	2.5311	0.5845	0.0111	0.0060	0.0050	--------
12.67	2.5422	0.5906	0.0111	0.0061	0.0050	--------
12.75	2.5533	0.5967	0.0111	0.0061	0.0050	--------
12.83	2.5643	0.6028	0.0111	0.0061	0.0050	--------
12.92	2.5754	0.6089	0.0111	0.0061	0.0050	--------
13.00	2.5865	0.6150	0.0111	0.0061	0.0049	--------
13.08	2.5964	0.6205	0.0099	0.0055	0.0044	--------
13.17	2.6063	0.6261	0.0099	0.0055	0.0044	--------
13.25	2.6163	0.6316	0.0099	0.0055	0.0044	--------
13.33	2.6262	0.6372	0.0099	0.0056	0.0044	--------
13.42	2.6361	0.6427	0.0099	0.0056	0.0043	--------
13.50	2.6460	0.6483	0.0099	0.0056	0.0043	--------
13.58	2.6553	0.6536	0.0093	0.0053	0.0041	--------
13.67	2.6647	0.6589	0.0093	0.0053	0.0040	--------
13.75	2.6740	0.6642	0.0093	0.0053	0.0040	--------
13.83	2.6833	0.6695	0.0093	0.0053	0.0040	--------
13.92	2.6927	0.6749	0.0093	0.0053	0.0040	--------
14.00	2.7020	0.6802	0.0093	0.0053	0.0040	--------
14.08	2.7125	0.6862	0.0105	0.0060	0.0045	--------
14.17	2.7230	0.6923	0.0105	0.0060	0.0045	--------
14.25	2.7335	0.6983	0.0105	0.0061	0.0044	--------
14.33	2.7440	0.7044	0.0105	0.0061	0.0044	--------
14.42	2.7545	0.7105	0.0105	0.0061	0.0044	--------
14.50	2.7650	0.7166	0.0105	0.0061	0.0044	--------
14.58	2.7708	0.7200	0.0058	0.0034	0.0024	--------
14.67	2.7767	0.7234	0.0058	0.0034	0.0024	--------
14.75	2.7825	0.7268	0.0058	0.0034	0.0024	--------
14.83	2.7883	0.7302	0.0058	0.0034	0.0024	--------
14.92	2.7942	0.7336	0.0058	0.0034	0.0024	--------
15.00	2.8000	0.7371	0.0058	0.0034	0.0024	--------
15.08	2.8093	0.7426	0.0093	0.0055	0.0038	--------

15.17	2.8187	0.7481	0.0093	0.0055	0.0038	--------
15.25	2.8280	0.7536	0.0093	0.0055	0.0038	--------
15.33	2.8373	0.7591	0.0093	0.0055	0.0038	--------
15.42	2.8467	0.7646	0.0093	0.0055	0.0038	--------
15.50	2.8560	0.7702	0.0093	0.0056	0.0038	--------
15.58	2.8647	0.7754	0.0088	0.0052	0.0035	--------
15.67	2.8735	0.7806	0.0088	0.0052	0.0035	--------
15.75	2.8822	0.7859	0.0087	0.0052	0.0035	--------
15.83	2.8910	0.7911	0.0088	0.0052	0.0035	--------
15.92	2.8997	0.7964	0.0087	0.0053	0.0035	--------
16.00	2.9085	0.8016	0.0088	0.0053	0.0035	--------
16.08	2.9167	0.8066	0.0082	0.0049	0.0032	--------
16.17	2.9248	0.8115	0.0082	0.0049	0.0032	--------
16.25	2.9330	0.8165	0.0082	0.0049	0.0032	--------
16.33	2.9412	0.8214	0.0082	0.0050	0.0032	--------
16.42	2.9493	0.8264	0.0082	0.0050	0.0032	--------
16.50	2.9575	0.8313	0.0082	0.0050	0.0032	--------
16.58	2.9662	0.8367	0.0087	0.0053	0.0034	--------
16.67	2.9750	0.8420	0.0088	0.0053	0.0034	--------
16.75	2.9838	0.8474	0.0088	0.0054	0.0034	--------
16.83	2.9925	0.8527	0.0087	0.0054	0.0034	--------
16.92	3.0012	0.8581	0.0088	0.0054	0.0034	--------
17.00	3.0100	0.8635	0.0088	0.0054	0.0034	--------
17.08	3.0170	0.8678	0.0070	0.0043	0.0027	--------
17.17	3.0240	0.8721	0.0070	0.0043	0.0027	--------
17.25	3.0310	0.8765	0.0070	0.0043	0.0027	--------
17.33	3.0380	0.8808	0.0070	0.0043	0.0027	--------
17.42	3.0450	0.8851	0.0070	0.0043	0.0027	--------
17.50	3.0520	0.8895	0.0070	0.0043	0.0027	--------
17.58	3.0596	0.8942	0.0076	0.0047	0.0029	--------
17.67	3.0672	0.8989	0.0076	0.0047	0.0029	--------
17.75	3.0748	0.9037	0.0076	0.0047	0.0029	--------
17.83	3.0823	0.9084	0.0076	0.0047	0.0028	--------
17.92	3.0899	0.9131	0.0076	0.0047	0.0028	--------
18.00	3.0975	0.9179	0.0076	0.0048	0.0028	--------
18.08	3.1033	0.9215	0.0058	0.0037	0.0022	--------
18.17	3.1092	0.9252	0.0058	0.0037	0.0022	--------
18.25	3.1150	0.9289	0.0058	0.0037	0.0022	--------
18.33	3.1208	0.9326	0.0058	0.0037	0.0022	--------
18.42	3.1267	0.9362	0.0058	0.0037	0.0022	--------
18.50	3.1325	0.9399	0.0058	0.0037	0.0022	--------
18.58	3.1383	0.9436	0.0058	0.0037	0.0021	--------
18.67	3.1442	0.9473	0.0058	0.0037	0.0021	--------
18.75	3.1500	0.9510	0.0058	0.0037	0.0021	--------
18.83	3.1558	0.9547	0.0058	0.0037	0.0021	--------
18.92	3.1617	0.9584	0.0058	0.0037	0.0021	--------
19.00	3.1675	0.9621	0.0058	0.0037	0.0021	--------
19.08	3.1728	0.9654	0.0053	0.0033	0.0019	--------
19.17	3.1780	0.9688	0.0052	0.0033	0.0019	--------
19.25	3.1833	0.9721	0.0053	0.0033	0.0019	--------
19.33	3.1885	0.9755	0.0053	0.0033	0.0019	--------
19.42	3.1938	0.9788	0.0052	0.0034	0.0019	--------
19.50	3.1990	0.9822	0.0053	0.0034	0.0019	--------
19.58	3.2048	0.9859	0.0058	0.0037	0.0021	--------
19.67	3.2107	0.9896	0.0058	0.0037	0.0021	--------
19.75	3.2165	0.9934	0.0058	0.0037	0.0021	--------
19.83	3.2223	0.9971	0.0058	0.0037	0.0021	--------
19.92	3.2282	1.0009	0.0058	0.0037	0.0021	--------
20.00	3.2340	1.0046	0.0058	0.0038	0.0021	--------
20.08	3.2404	1.0087	0.0064	0.0041	0.0023	--------
20.17	3.2468	1.0129	0.0064	0.0041	0.0023	--------
20.25	3.2533	1.0170	0.0064	0.0041	0.0023	--------
20.33	3.2597	1.0212	0.0064	0.0041	0.0023	--------

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  20.42   3.2661    1.0253    0.0064    0.0041    0.0023 --------
  20.50   3.2725    1.0295    0.0064    0.0042    0.0023 --------
  20.58   3.2783    1.0332    0.0058    0.0038    0.0021 --------
  20.67   3.2842    1.0370    0.0058    0.0038    0.0020 --------
  20.75   3.2900    1.0408    0.0058    0.0038    0.0020 --------
  20.83   3.2958    1.0446    0.0058    0.0038    0.0020 --------
  20.92   3.3017    1.0484    0.0058    0.0038    0.0020 --------
  21.00   3.3075    1.0522    0.0058    0.0038    0.0020 --------
  21.08   3.3127    1.0556    0.0052    0.0034    0.0018 --------
  21.17   3.3180    1.0590    0.0053    0.0034    0.0018 --------
  21.25   3.3232    1.0625    0.0053    0.0034    0.0018 --------
  21.33   3.3285    1.0659    0.0053    0.0034    0.0018 --------
  21.42   3.3337    1.0693    0.0052    0.0034    0.0018 --------
  21.50   3.3390    1.0728    0.0053    0.0034    0.0018 --------
  21.58   3.3443    1.0762    0.0053    0.0034    0.0018 --------
  21.67   3.3495    1.0797    0.0052    0.0034    0.0018 --------
  21.75   3.3547    1.0831    0.0052    0.0034    0.0018 --------
  21.83   3.3600    1.0866    0.0053    0.0034    0.0018 --------
  21.92   3.3652    1.0900    0.0052    0.0035    0.0018 --------
  22.00   3.3705    1.0935    0.0053    0.0035    0.0018 --------
  22.08   3.3757    1.0969    0.0052    0.0035    0.0018 --------
  22.17   3.3810    1.1004    0.0053    0.0035    0.0018 --------
  22.25   3.3863    1.1038    0.0053    0.0035    0.0018 --------
  22.33   3.3915    1.1073    0.0052    0.0035    0.0018 --------
  22.42   3.3967    1.1108    0.0053    0.0035    0.0018 --------
  22.50   3.4020    1.1143    0.0053    0.0035    0.0018 --------
  22.58   3.4073    1.1177    0.0053    0.0035    0.0018 --------
  22.67   3.4125    1.1212    0.0052    0.0035    0.0018 --------
  22.75   3.4177    1.1247    0.0052    0.0035    0.0018 --------
  22.83   3.4230    1.1282    0.0053    0.0035    0.0018 --------
  22.92   3.4282    1.1317    0.0052    0.0035    0.0018 --------
  23.00   3.4335    1.1352    0.0053    0.0035    0.0018 --------
  23.08   3.4393    1.1390    0.0058    0.0039    0.0020 --------
  23.17   3.4452    1.1429    0.0058    0.0039    0.0019 --------
  23.25   3.4510    1.1468    0.0058    0.0039    0.0019 --------
  23.33   3.4568    1.1507    0.0058    0.0039    0.0019 --------
  23.42   3.4627    1.1546    0.0058    0.0039    0.0019 --------
  23.50   3.4685    1.1585    0.0058    0.0039    0.0019 --------
  23.58   3.4737    1.1620    0.0052    0.0035    0.0017 --------
  23.67   3.4790    1.1655    0.0053    0.0035    0.0017 --------
  23.75   3.4843    1.1691    0.0053    0.0035    0.0017 --------
  23.83   3.4895    1.1726    0.0052    0.0035    0.0017 --------
  23.92   3.4947    1.1761    0.0052    0.0035    0.0017 --------
  24.00   3.5000    1.1796    0.0053    0.0035    0.0017 --------
 --------------------------------------------------------------------
 --------------------------------------------------------------------
 Total soil rain loss =      2.32(In)
 Total effective runoff =      1.18(In)
 ---------------------------------------------------------------------
 Peak flow rate this hydrograph =         487.34(CFS)
 Total runoff volume this hydrograph =        9358600.9(Ft3)
 ---------------------------------------------------------------------
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R    S T O R M
               R u n o f f     H y d r o g r a p h
 --------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

 --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0      125.0     250.0     375.0     500.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  Q         |         |         |         |
  0+10       0.0000      0.00  Q         |         |         |         |
```

```
 0+15          0.0000        0.00  Q           |           |           |           |
 0+20          0.0000        0.00  Q           |           |           |           |
 0+25          0.0000        0.00  Q           |           |           |           |
 0+30          0.0000        0.00  Q           |           |           |           |
 0+35          0.0000        0.00  Q           |           |           |           |
 0+40          0.0000        0.00  Q           |           |           |           |
 0+45          0.0000        0.00  Q           |           |           |           |
 0+50          0.0000        0.00  Q           |           |           |           |
 0+55          0.0000        0.00  Q           |           |           |           |
 1+ 0          0.0000        0.00  Q           |           |           |           |
 1+ 5          0.0000        0.00  Q           |           |           |           |
 1+10          0.0000        0.00  Q           |           |           |           |
 1+15          0.0000        0.00  Q           |           |           |           |
 1+20          0.0000        0.00  Q           |           |           |           |
 1+25          0.0000        0.00  Q           |           |           |           |
 1+30          0.0000        0.00  Q           |           |           |           |
 1+35          0.0000        0.00  Q           |           |           |           |
 1+40          0.0000        0.00  Q           |           |           |           |
 1+45          0.0000        0.00  Q           |           |           |           |
 1+50          0.0000        0.00  Q           |           |           |           |
 1+55          0.0000        0.00  Q           |           |           |           |
 2+ 0          0.0000        0.00  Q           |           |           |           |
 2+ 5          0.0000        0.00  Q           |           |           |           |
 2+10          0.0000        0.00  Q           |           |           |           |
 2+15          0.0000        0.00  Q           |           |           |           |
 2+20          0.0000        0.00  Q           |           |           |           |
 2+25          0.0000        0.00  Q           |           |           |           |
 2+30          0.0000        0.00  Q           |           |           |           |
 2+35          0.0000        0.00  Q           |           |           |           |
 2+40          0.0000        0.00  Q           |           |           |           |
 2+45          0.0000        0.00  Q           |           |           |           |
 2+50          0.0000        0.00  Q           |           |           |           |
 2+55          0.0000        0.00  Q           |           |           |           |
 3+ 0          0.0000        0.00  Q           |           |           |           |
 3+ 5          0.0000        0.00  Q           |           |           |           |
 3+10          0.0000        0.00  Q           |           |           |           |
 3+15          0.0000        0.00  Q           |           |           |           |
 3+20          0.0000        0.00  Q           |           |           |           |
 3+25          0.0000        0.00  Q           |           |           |           |
 3+30          0.0000        0.00  Q           |           |           |           |
 3+35          0.0000        0.00  Q           |           |           |           |
 3+40          0.0000        0.00  Q           |           |           |           |
 3+45          0.0000        0.00  Q           |           |           |           |
 3+50          0.0000        0.00  Q           |           |           |           |
 3+55          0.0000        0.00  Q           |           |           |           |
 4+ 0          0.0000        0.00  Q           |           |           |           |
 4+ 5          0.0000        0.00  Q           |           |           |           |
 4+10          0.0000        0.00  Q           |           |           |           |
 4+15          0.0000        0.00  Q           |           |           |           |
 4+20          0.0000        0.00  Q           |           |           |           |
 4+25          0.0000        0.00  Q           |           |           |           |
 4+30          0.0000        0.00  Q           |           |           |           |
 4+35          0.0000        0.00  Q           |           |           |           |
 4+40          0.0000        0.00  Q           |           |           |           |
 4+45          0.0000        0.00  Q           |           |           |           |
 4+50          0.0000        0.00  Q           |           |           |           |
 4+55          0.0000        0.00  Q           |           |           |           |
 5+ 0          0.0000        0.00  Q           |           |           |           |
 5+ 5          0.0000        0.00  Q           |           |           |           |
 5+10          0.0000        0.00  Q           |           |           |           |
 5+15          0.0000        0.00  Q           |           |           |           |
 5+20          0.0000        0.00  Q           |           |           |           |
 5+25          0.0000        0.00  Q           |           |           |           |
```

```
 5+30       0.0000      0.00  Q         |         |         |         |
 5+35       0.0000      0.00  Q         |         |         |         |
 5+40       0.0000      0.00  Q         |         |         |         |
 5+45       0.0000      0.00  Q         |         |         |         |
 5+50       0.0000      0.00  Q         |         |         |         |
 5+55       0.0000      0.00  Q         |         |         |         |
 6+ 0       0.0000      0.00  Q         |         |         |         |
 6+ 5       0.0000      0.00  Q         |         |         |         |
 6+10       0.0000      0.00  Q         |         |         |         |
 6+15       0.0000      0.00  Q         |         |         |         |
 6+20       0.0000      0.00  Q         |         |         |         |
 6+25       0.0000      0.00  Q         |         |         |         |
 6+30       0.0000      0.00  Q         |         |         |         |
 6+35       0.0000      0.00  Q         |         |         |         |
 6+40       0.0000      0.00  Q         |         |         |         |
 6+45       0.0000      0.00  Q         |         |         |         |
 6+50       0.0000      0.00  Q         |         |         |         |
 6+55       0.0000      0.00  Q         |         |         |         |
 7+ 0       0.0000      0.00  Q         |         |         |         |
 7+ 5       0.0000      0.00  Q         |         |         |         |
 7+10       0.0000      0.00  Q         |         |         |         |
 7+15       0.0000      0.00  Q         |         |         |         |
 7+20       0.0000      0.00  Q         |         |         |         |
 7+25       0.0000      0.00  Q         |         |         |         |
 7+30       0.0000      0.00  Q         |         |         |         |
 7+35       0.0000      0.01  Q         |         |         |         |
 7+40       0.0003      0.04  Q         |         |         |         |
 7+45       0.0012      0.13  Q         |         |         |         |
 7+50       0.0035      0.34  Q         |         |         |         |
 7+55       0.0087      0.75  Q         |         |         |         |
 8+ 0       0.0194      1.56  Q         |         |         |         |
 8+ 5       0.0412      3.17  Q         |         |         |         |
 8+10       0.0815      5.84  Q         |         |         |         |
 8+15       0.1493      9.84  Q         |         |         |         |
 8+20       0.2538     15.17  VQ        |         |         |         |
 8+25       0.4044     21.88  VQ        |         |         |         |
 8+30       0.6157     30.68  V Q       |         |         |         |
 8+35       0.9016     41.52  V  Q      |         |         |         |
 8+40       1.2781     54.67  V   Q     |         |         |         |
 8+45       1.7562     69.42  V    Q    |         |         |         |
 8+50       2.3455     85.57  V     Q   |         |         |         |
 8+55       3.0535    102.79  V       Q |         |         |         |
 9+ 0       3.9014    123.11  V        Q|         |         |         |
 9+ 5       4.9070    146.01  V         |Q        |         |         |
 9+10       6.0901    171.80  |V        |  Q      |         |         |
 9+15       7.4581    198.63  |V        |    Q    |         |         |
 9+20       9.0144    225.98  |V        |       Q |         |         |
 9+25      10.7553    252.77  | V       |         Q         |         |
 9+30      12.6892    280.80  | V       |         | Q       |         |
 9+35      14.8203    309.43  | V       |         |   Q     |         |
 9+40      17.1528    338.69  |  V      |         |      Q  |         |
 9+45      19.6815    367.16  |  V      |         |        Q|         |
 9+50      22.3968    394.27  |   V     |         |         |Q        |
 9+55      25.2815    418.86  |   V     |         |         |  Q      |
10+ 0      28.3053    439.06  |    V    |         |         |    Q    |
10+ 5      31.4408    455.27  |    V    |         |         |     Q   |
10+10      34.6572    467.02  |     V   |         |         |      Q  |
10+15      37.9373    476.27  |      V  |         |         |       Q |
10+20      41.2643    483.08  |      V  |         |         |       Q |
10+25      44.6206    487.34  |       V |         |         |       Q |
10+30      47.9253    479.83  |       V |         |         |       Q |
10+35      51.1206    463.96  |        V|         |         |      Q  |
10+40      54.1429    438.85  |         V         |         |    Q    |
```

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10+45      56.9924    413.75  |         V         |         |  Q      |
10+50      59.6813    390.42  |         |V        |         |Q        |
10+55      62.2515    373.20  |         |V        |        Q|         |
11+ 0      64.6923    354.40  |         | V       |       Q |         |
11+ 5      66.9999    335.06  |         | V       |     Q   |         |
11+10      69.1672    314.70  |         | V       |    Q    |         |
11+15      71.2054    295.95  |         |  V      |  Q      |         |
11+20      73.1314    279.66  |         |  V      | Q       |         |
11+25      74.9682    266.69  |         |  V      |Q        |         |
11+30      76.7201    254.38  |         |   V     Q         |         |
11+35      78.3942    243.07  |         |   V    Q|         |         |
11+40      79.9932    232.19  |         |   V   Q |         |         |
11+45      81.5258    222.53  |         |    V Q  |         |         |
11+50      83.0022    214.38  |         |    V Q  |         |         |
11+55      84.4329    207.74  |         |    VQ   |         |         |
12+ 0      85.8215    201.62  |         |    VQ   |         |         |
12+ 5      87.1720    196.09  |         |    QV   |         |         |
12+10      88.4865    190.86  |         |    QV   |         |         |
12+15      89.7695    186.30  |         |   Q V   |         |         |
12+20      91.0268    182.56  |         |   Q V   |         |         |
12+25      92.2656    179.88  |         |   Q  V  |         |         |
12+30      93.4886    177.58  |         |   Q  V  |         |         |
12+35      94.6976    175.55  |         |   Q  V  |         |         |
12+40      95.8931    173.59  |         |  Q   V  |         |         |
12+45      97.0769    171.88  |         |  Q    V |         |         |
12+50      98.2510    170.48  |         |  Q    V |         |         |
12+55      99.4181    169.47  |         |  Q    V |         |         |
13+ 0     100.5781    168.43  |         |  Q    V |         |         |
13+ 5     101.7306    167.34  |         |  Q    V |         |         |
13+10     102.8746    166.11  |         |  Q     V|         |         |
13+15     104.0106    164.95  |         |  Q     V|         |         |
13+20     105.1393    163.88  |         |  Q     V|         |         |
13+25     106.2614    162.94  |         |  Q     V|         |         |
13+30     107.3736    161.49  |         | Q      V|         |         |
13+35     108.4736    159.72  |         | Q       V         |         |
13+40     109.5588    157.56  |         | Q       V         |         |
13+45     110.6299    155.53  |         | Q       V         |         |
13+50     111.6887    153.73  |         | Q       V         |         |
13+55     112.7381    152.38  |         | Q       V         |         |
14+ 0     113.7776    150.93  |         | Q       |V        |         |
14+ 5     114.8073    149.51  |         |Q        |V        |         |
14+10     115.8270    148.07  |         |Q        |V        |         |
14+15     116.8387    146.89  |         |Q        |V        |         |
14+20     117.8448    146.08  |         |Q        |V        |         |
14+25     118.8492    145.84  |         |Q        | V       |         |
14+30     119.8580    146.48  |         |Q        | V       |         |
14+35     120.8744    147.59  |         |Q        | V       |         |
14+40     121.9016    149.15  |         |Q        | V       |         |
14+45     122.9367    150.29  |         | Q       | V       |         |
14+50     123.9755    150.83  |         | Q       |  V      |         |
14+55     125.0085    150.00  |         |Q        |  V      |         |
15+ 0     126.0154    146.20  |         |Q        |  V      |         |
15+ 5     126.9833    140.54  |         |Q        |  V      |         |
15+10     127.8983    132.87  |         Q         |  V      |         |
15+15     128.7652    125.87  |         Q         |  V      |         |
15+20     129.5921    120.06  |        Q|         |   V     |         |
15+25     130.3980    117.02  |        Q|         |   V     |         |
15+30     131.2032    116.92  |        Q|         |   V     |         |
15+35     132.0218    118.86  |        Q|         |   V     |         |
15+40     132.8685    122.94  |        Q|         |   V     |         |
15+45     133.7432    127.01  |         Q         |   V     |         |
15+50     134.6438    130.77  |         Q         |    V    |         |
15+55     135.5604    133.08  |         Q         |    V    |         |
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16+ 0     136.4875    134.61  |         Q         |    V    |         |
16+ 5     137.4213    135.59  |         Q         |    V    |         |
16+10     138.3572    135.90  |         Q         |    V    |         |
16+15     139.2943    136.07  |         Q         |    V    |         |
16+20     140.2317    136.10  |         Q         |     V   |         |
16+25     141.1694    136.16  |         Q         |     V   |         |
16+30     142.1052    135.88  |         Q         |     V   |         |
16+35     143.0376    135.38  |         Q         |     V   |         |
16+40     143.9653    134.70  |         Q         |     V   |         |
16+45     144.8890    134.12  |         Q         |     V   |         |
16+50     145.8098    133.71  |         Q         |      V  |         |
16+55     146.7310    133.75  |         Q         |      V  |         |
17+ 0     147.6557    134.27  |         Q         |      V  |         |
17+ 5     148.5858    135.05  |         Q         |      V  |         |
17+10     149.5228    136.05  |         Q         |      V  |         |
17+15     150.4654    136.87  |         Q         |       V |         |
17+20     151.4116    137.39  |         Q         |       V |         |
17+25     152.3567    137.23  |         Q         |       V |         |
17+30     153.2923    135.84  |         Q         |       V |         |
17+35     154.2129    133.67  |         Q         |       V |         |
17+40     155.1129    130.67  |         Q         |       V |         |
17+45     155.9936    127.88  |         Q         |        V|         |
17+50     156.8577    125.47  |         Q         |        V|         |
17+55     157.7118    124.02  |        Q|         |        V|         |
18+ 0     158.5607    123.26  |        Q|         |        V|         |
18+ 5     159.4076    122.96  |        Q|         |        V|         |
18+10     160.2555    123.12  |        Q|         |        V|         |
18+15     161.1040    123.20  |        Q|         |        V|         |
18+20     161.9519    123.13  |        Q|         |         V         |
18+25     162.7957    122.51  |        Q|         |         V         |
18+30     163.6271    120.72  |        Q|         |         V         |
18+35     164.4411    118.20  |        Q|         |         V         |
18+40     165.2319    114.81  |        Q|         |         V         |
18+45     166.0006    111.62  |       Q |         |         V         |
18+50     166.7498    108.78  |       Q |         |         |V        |
18+55     167.4853    106.79  |       Q |         |         |V        |
19+ 0     168.2094    105.15  |       Q |         |         |V        |
19+ 5     168.9242    103.78  |       Q |         |         |V        |
19+10     169.6313    102.67  |       Q |         |         |V        |
19+15     170.3316    101.68  |       Q |         |         |V        |
19+20     171.0258    100.81  |       Q |         |         |V        |
19+25     171.7142     99.95  |      Q  |         |         |V        |
19+30     172.3948     98.82  |      Q  |         |         | V       |
19+35     173.0666     97.55  |      Q  |         |         | V       |
19+40     173.7284     96.09  |      Q  |         |         | V       |
19+45     174.3813     94.80  |      Q  |         |         | V       |
19+50     175.0271     93.77  |      Q  |         |         | V       |
19+55     175.6688     93.18  |      Q  |         |         | V       |
20+ 0     176.3102     93.13  |      Q  |         |         | V       |
20+ 5     176.9541     93.50  |      Q  |         |         | V       |
20+10     177.6035     94.29  |      Q  |         |         |  V      |
20+15     178.2589     95.16  |      Q  |         |         |  V      |
20+20     178.9205     96.06  |      Q  |         |         |  V      |
20+25     179.5878     96.89  |      Q  |         |         |  V      |
20+30     180.2631     98.05  |      Q  |         |         |  V      |
20+35     180.9477     99.40  |      Q  |         |         |  V      |
20+40     181.6427    100.92  |       Q |         |         |  V      |
20+45     182.3472    102.29  |       Q |         |         |  V      |
20+50     183.0596    103.44  |       Q |         |         |   V     |
20+55     183.7768    104.14  |       Q |         |         |   V     |
21+ 0     184.4952    104.31  |       Q |         |         |   V     |
21+ 5     185.2121    104.09  |       Q |         |         |   V     |
21+10     185.9247    103.47  |       Q |         |         |   V     |
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21+15     186.6326    102.78  |       Q |         |         |   V     |
21+20     187.3355    102.07  |       Q |         |         |   V     |
21+25     188.0344    101.48  |       Q |         |         |    V    |
21+30     188.7271    100.57  |       Q |         |         |    V    |
21+35     189.4121     99.46  |      Q  |         |         |    V    |
21+40     190.0879     98.13  |      Q  |         |         |    V    |
21+45     190.7552     96.89  |      Q  |         |         |    V    |
21+50     191.4149     95.79  |      Q  |         |         |    V    |
21+55     192.0692     95.00  |      Q  |         |         |    V    |
22+ 0     192.7189     94.34  |      Q  |         |         |    V    |
22+ 5     193.3648     93.79  |      Q  |         |         |     V   |
22+10     194.0077     93.34  |      Q  |         |         |     V   |
22+15     194.6480     92.97  |      Q  |         |         |     V   |
22+20     195.2863     92.68  |      Q  |         |         |     V   |
22+25     195.9228     92.42  |      Q  |         |         |     V   |
22+30     196.5579     92.21  |      Q  |         |         |     V   |
22+35     197.1919     92.05  |      Q  |         |         |     V   |
22+40     197.8249     91.92  |      Q  |         |         |     V   |
22+45     198.4573     91.82  |      Q  |         |         |     V   |
22+50     199.0892     91.76  |      Q  |         |         |      V  |
22+55     199.7210     91.73  |      Q  |         |         |      V  |
23+ 0     200.3528     91.73  |      Q  |         |         |      V  |
23+ 5     200.9848     91.77  |      Q  |         |         |      V  |
23+10     201.6173     91.84  |      Q  |         |         |      V  |
23+15     202.2507     91.98  |      Q  |         |         |      V  |
23+20     202.8857     92.20  |      Q  |         |         |      V  |
23+25     203.5233     92.57  |      Q  |         |         |      V  |
23+30     204.1662     93.35  |      Q  |         |         |       V |
23+35     204.8162     94.38  |      Q  |         |         |       V |
23+40     205.4750     95.66  |      Q  |         |         |       V |
23+45     206.1419     96.83  |      Q  |         |         |       V |
23+50     206.8154     97.79  |      Q  |         |         |       V |
23+55     207.4925     98.32  |      Q  |         |         |       V |
24+ 0     208.1697     98.33  |      Q  |         |         |       V |
24+ 5     208.8432     97.79  |      Q  |         |         |       V |
24+10     209.5088     96.64  |      Q  |         |         |        V|
24+15     210.1629     94.98  |      Q  |         |         |        V|
24+20     210.8016     92.73  |      Q  |         |         |        V|
24+25     211.4184     89.56  |      Q  |         |         |        V|
24+30     211.9887     82.81  |     Q   |         |         |        V|
24+35     212.4966     73.76  |    Q    |         |         |        V|
24+40     212.9249     62.19  |   Q     |         |         |        V|
24+45     213.2780     51.27  |   Q     |         |         |        V|
24+50     213.5641     41.54  |  Q      |         |         |        V|
24+55     213.8024     34.60  | Q       |         |         |        V|
25+ 0     214.0006     28.77  | Q       |         |         |        V|
25+ 5     214.1652     23.90  |Q        |         |         |        V|
25+10     214.3024     19.92  |Q        |         |         |        V|
25+15     214.4160     16.50  |Q        |         |         |        V|
25+20     214.5103     13.69  |Q        |         |         |        V|
25+25     214.5878     11.24  Q         |         |         |        V|
25+30     214.6506      9.12  Q         |         |         |        V|
25+35     214.7013      7.36  Q         |         |         |        V|
25+40     214.7413      5.80  Q         |         |         |        V|
25+45     214.7722      4.49  Q         |         |         |        V|
25+50     214.7958      3.43  Q         |         |         |        V|
25+55     214.8133      2.53  Q         |         |         |        V|
26+ 0     214.8258      1.82  Q         |         |         |        V|
26+ 5     214.8343      1.24  Q         |         |         |        V|
26+10     214.8397      0.79  Q         |         |         |        V|
26+15     214.8426      0.42  Q         |         |         |        V|
26+20     214.8437      0.15  Q         |         |         |        V|
26+25     214.8439      0.03  Q         |         |         |        V|
```

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        U N I T   H Y D R O G R A P H   A N A L Y S I S
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                Study date  09/08/10  File: mccain1100yr6hr.out

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Program License Serial Number 4055

---------------------------------------------------------------------
Tule Wind Project
McCain Valley Crossing 1
Proposed Conditions 100 Yr 6 Hr
Aug 18, 2010
---------------------------------------------------------------------
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Storm Event Year = 100

Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
        Sub-Area(Ac.)       Rainfall (In)
          2185.54             3.00

Rainfall Distribution pattern used in study:
Type B for SCS (small dam) or San Diego 6 hour storms
--------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

********* Area-Averaged SCS Curve Number and Fm *********

Area       Area          SCS CN    SCS CN    Fm      Soil
(Ac.)      fract         (AMC2)    (AMC2)   (In/Hr)  Group
  2185.54   1.000         83.0      83.0     0.050    C

Area-averaged catchment SCS Curve Number AMC(2) = 83.000
Area-averaged Fm value using values listed =  0.050(In/Hr)
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Direct entry of lag time by user
Watershed area =    2185.54(Ac.)
Catchment Lag time =   0.741 hours
Unit interval =  10.000 minutes
Unit interval percentage of lag time = 22.4891
Hydrograph baseflow =     0.00(CFS)
Minimum watershed loss rate(Fm) =  0.000(In/Hr)
Average adjusted SCS Curve Number = 83.000

Rainfall depth area reduction factors:
Using a total area of    2185.54(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study =    3.000(In)
Adjusted rainfall =    3.000(In)
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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H
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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K =   13222.52 (CFS))

0.22	0.167	0.018	53.297	0.004
0.45	0.333	0.090	269.647	0.024
0.67	0.500	0.317	951.082	0.096
0.90	0.667	0.830	2493.845	0.285
1.12	0.833	1.000	3004.378	0.512
1.35	1.000	0.683	2051.942	0.667
1.57	1.167	0.452	1356.495	0.770
1.80	1.333	0.314	943.597	0.841
2.02	1.500	0.226	677.512	0.893
2.25	1.667	0.165	495.581	0.930
2.47	1.833	0.121	362.569	0.957
2.70	2.000	0.083	250.591	0.976
2.92	2.167	0.055	165.696	0.989
3.15	2.333	0.035	104.329	0.997
3.37	2.500	0.013	39.231	1.000
3.60	2.667	0.001	2.725	1.000

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr-ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.17	0.0350	0.0000	0.0350	0.0000	0.0350	--------
0.33	0.0700	0.0000	0.0350	0.0000	0.0350	--------
0.50	0.1050	0.0000	0.0350	0.0000	0.0350	--------
0.67	0.1520	0.0000	0.0470	0.0000	0.0470	--------
0.83	0.1990	0.0000	0.0470	0.0000	0.0470	--------
1.00	0.2460	0.0000	0.0470	0.0000	0.0470	--------

```
    1.17   0.3040    0.0000    0.0580    0.0000    0.0580 --------
    1.33   0.3620    0.0000    0.0580    0.0000    0.0580 --------
    1.50   0.4200    0.0001    0.0580    0.0001    0.0579 --------
    1.67   0.5100    0.0047    0.0900    0.0046    0.0854 --------
    1.83   0.6000    0.0162    0.0900    0.0115    0.0785 --------
    2.00   0.6900    0.0338    0.0900    0.0176    0.0724 --------
    2.17   1.0600    0.1567    0.3700    0.1230    0.2470 --------
    2.33   1.4300    0.3393    0.3700    0.1826    0.1874 --------
    2.50   1.8000    0.5622    0.3700    0.2229    0.1471 --------
    2.67   1.9000    0.6277    0.1000    0.0655    0.0345 --------
    2.83   2.0000    0.6951    0.1000    0.0674    0.0326 --------
    3.00   2.1000    0.7643    0.1000    0.0692    0.0308 --------
    3.17   2.1810    0.8215    0.0810    0.0572    0.0238 --------
    3.33   2.2620    0.8797    0.0810    0.0582    0.0228 --------
    3.50   2.3430    0.9388    0.0810    0.0591    0.0219 --------
    3.67   2.3970    0.9787    0.0540    0.0399    0.0141 --------
    3.83   2.4510    1.0190    0.0540    0.0403    0.0137 --------
    4.00   2.5050    1.0596    0.0540    0.0406    0.0134 --------
    4.17   2.5500    1.0937    0.0450    0.0341    0.0109 --------
    4.33   2.5950    1.1281    0.0450    0.0344    0.0106 --------
    4.50   2.6400    1.1627    0.0450    0.0346    0.0104 --------
    4.67   2.6830    1.1959    0.0430    0.0332    0.0098 --------
    4.83   2.7260    1.2293    0.0430    0.0334    0.0096 --------
    5.00   2.7690    1.2630    0.0430    0.0336    0.0094 --------
    5.17   2.8060    1.2920    0.0370    0.0291    0.0079 --------
    5.33   2.8430    1.3212    0.0370    0.0292    0.0078 --------
    5.50   2.8800    1.3506    0.0370    0.0293    0.0077 --------
    5.67   2.9200    1.3824    0.0400    0.0319    0.0081 --------
    5.83   2.9600    1.4144    0.0400    0.0320    0.0080 --------
    6.00   3.0000    1.4466    0.0400    0.0321    0.0079 --------
  --------------------------------------------------------------------
  --------------------------------------------------------------------
  Total soil rain loss =      1.55(In)
  Total effective runoff =      1.45(In)
  ---------------------------------------------------------------------
  Peak flow rate this hydrograph =        1486.97(CFS)
  Total runoff volume this hydrograph =      11476342.0(Ft3)
  ---------------------------------------------------------------------
  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                     6 - H O U R   S T O R M
                R u n o f f    H y d r o g r a p h
  --------------------------------------------------------------------
              Hydrograph in  10   Minute intervals ((CFS))

  --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0      375.0     750.0    1125.0    1500.0
-----------------------------------------------------------------------
  0+10       0.0000      0.00  Q         |         |         |         |
  0+20       0.0000      0.00  Q         |         |         |         |
  0+30       0.0000      0.00  Q         |         |         |         |
  0+40       0.0000      0.00  Q         |         |         |         |
  0+50       0.0000      0.00  Q         |         |         |         |
  1+ 0       0.0000      0.00  Q         |         |         |         |
  1+10       0.0000      0.00  Q         |         |         |         |
  1+20       0.0000      0.00  Q         |         |         |         |
  1+30       0.0000      0.00  Q         |         |         |         |
  1+40       0.0036      0.26  Q         |         |         |         |
  1+50       0.0300      1.91  Q         |         |         |         |
  2+ 0       0.1481      8.58  Q         |         |         |         |
  2+10       0.6157     33.95  Q         |         |         |         |
  2+20       2.0250    102.31  V Q       |         |         |         |
  2+30       5.6891    266.02  V      Q  |         |         |         |
  2+40      14.3205    626.64  | V       |      Q  |         |         |
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    2+50      29.6656   1114.06  |   V     |         |        Q|         |
    3+ 0      50.0334   1478.70  |      V  |         |         |        Q|
    3+10      70.5152   1486.97  |         V         |         |        Q|
    3+20      88.2786   1289.62  |         |  V      |         |   Q     |
    3+30     104.1835   1154.70  |         |    V    |         Q         |
    3+40     118.7296   1056.05  |         |       V |       Q |         |
    3+50     132.1479    974.17  |         |         V    Q    |         |
    4+ 0     144.6025    904.20  |         |         |V  Q     |         |
    4+10     155.8677    817.85  |         |         |Q V      |         |
    4+20     165.8938    727.89  |         |        Q|    V    |         |
    4+30     174.9518    657.61  |         |      Q  |     V   |         |
    4+40     183.1452    594.84  |         |    Q    |      V  |         |
    4+50     190.6065    541.69  |         |   Q     |       V |         |
    5+ 0     197.6098    508.44  |         |  Q      |         V         |
    5+10     204.3167    486.92  |         | Q       |         |V        |
    5+20     210.7860    469.66  |         | Q       |         | V       |
    5+30     217.0544    455.09  |         | Q       |         | V       |
    5+40     223.0802    437.47  |         |Q        |         |  V      |
    5+50     228.8712    420.43  |         |Q        |         |   V     |
    6+ 0     234.5419    411.69  |         Q         |         |    V    |
    6+10     240.1841    409.62  |         Q         |         |     V   |
    6+20     245.7533    404.33  |         Q         |         |      V  |
    6+30     250.9400    376.55  |         Q         |         |       V |
    6+40     255.0503    298.41  |      Q  |         |         |       V |
    6+50     257.8487    203.17  |    Q    |         |         |        V|
    7+ 0     259.7528    138.23  |  Q      |         |         |        V|
    7+10     261.0677     95.47  | Q       |         |         |        V|
    7+20     261.9742     65.81  |Q        |         |         |        V|
    7+30     262.5892     44.65  |Q        |         |         |        V|
    7+40     262.9918     29.23  Q         |         |         |        V|
    7+50     263.2385     17.91  Q         |         |         |        V|
    8+ 0     263.3761      9.99  Q         |         |         |        V|
    8+10     263.4408      4.69  Q         |         |         |        V|
    8+20     263.4594      1.35  Q         |         |         |        V|
    8+30     263.4606      0.09  Q         |         |         |         V
-----------------------------------------------------------------------
```

U N I T   H Y D R O G R A P H   A N A L Y S I S

Study date 09/08/10 File: mccain1100yr24hr.out

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Program License Serial Number 4055

----------------------------------------------------------------------
Tule Wind Project
McCain Valley Crossing 1
Proposed Conditions 100 Yr 24 Hr
Aug 18, 2010
----------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Storm Event Year = 100

Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
        Sub-Area(Ac.)       Rainfall (In)
          2185.54             5.07

Rainfall Distribution pattern used in study:
Type B for San Diego area of California
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

********* Area-Averaged SCS Curve Number and Fm *********

Area       Area          SCS CN    SCS CN    Fm      Soil
(Ac.)      fract         (AMC2)    (AMC2)   (In/Hr)  Group
  2185.54   1.000         83.0      83.0     0.050    C

Area-averaged catchment SCS Curve Number AMC(2) = 83.000
Area-averaged Fm value using values listed =  0.050(In/Hr)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Direct entry of lag time by user
Watershed area =    2185.54(Ac.)
Catchment Lag time =   0.740 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 11.2613
Hydrograph baseflow =     0.00(CFS)
Minimum watershed loss rate(Fm) =  0.000(In/Hr)
Average adjusted SCS Curve Number = 83.000

Rainfall depth area reduction factors:
Using a total area of    2185.54(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study =    5.070(In)
Adjusted rainfall =    5.070(In)
```

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval =   0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H
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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 26445.03 (CFS))

0.11	0.083	0.015	49.436	0.002
0.23	0.167	0.036	114.819	0.006
0.34	0.250	0.081	261.213	0.016
0.45	0.333	0.138	445.451	0.033
0.56	0.417	0.243	781.573	0.062
0.68	0.500	0.565	1817.277	0.131
0.79	0.583	0.773	2488.816	0.225
0.90	0.667	1.000	3219.152	0.347
1.01	0.750	0.946	3044.634	0.462
1.13	0.833	0.843	2712.922	0.565
1.24	0.917	0.600	1930.560	0.638
1.35	1.000	0.502	1616.625	0.699
1.46	1.083	0.419	1350.100	0.750
1.58	1.167	0.342	1101.054	0.792
1.69	1.250	0.294	945.183	0.827
1.80	1.333	0.241	775.154	0.857
1.91	1.417	0.209	673.014	0.882
2.03	1.500	0.181	581.741	0.904
2.14	1.583	0.150	483.763	0.922
2.25	1.667	0.133	428.230	0.939
2.36	1.750	0.112	361.739	0.952
2.48	1.833	0.091	293.676	0.963
2.59	1.917	0.078	250.893	0.973
2.70	2.000	0.063	202.425	0.981
2.82	2.083	0.051	163.225	0.987
2.93	2.167	0.040	128.845	0.992
3.04	2.250	0.032	104.310	0.995
3.15	2.333	0.024	76.321	0.998
3.27	2.417	0.010	33.079	1.000
3.38	2.500	0.003	9.801	1.000

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For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

Where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr-ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0076	0.0000	0.0076	0.0000	0.0076	--------
0.17	0.0152	0.0000	0.0076	0.0000	0.0076	--------
0.25	0.0228	0.0000	0.0076	0.0000	0.0076	--------
0.33	0.0304	0.0000	0.0076	0.0000	0.0076	--------
0.42	0.0380	0.0000	0.0076	0.0000	0.0076	--------
0.50	0.0456	0.0000	0.0076	0.0000	0.0076	--------
0.58	0.0515	0.0000	0.0059	0.0000	0.0059	--------
0.67	0.0575	0.0000	0.0059	0.0000	0.0059	--------
0.75	0.0634	0.0000	0.0059	0.0000	0.0059	--------
0.83	0.0693	0.0000	0.0059	0.0000	0.0059	--------
0.92	0.0752	0.0000	0.0059	0.0000	0.0059	--------
1.00	0.0811	0.0000	0.0059	0.0000	0.0059	--------
1.08	0.0887	0.0000	0.0076	0.0000	0.0076	--------
1.17	0.0963	0.0000	0.0076	0.0000	0.0076	--------
1.25	0.1039	0.0000	0.0076	0.0000	0.0076	--------
1.33	0.1115	0.0000	0.0076	0.0000	0.0076	--------
1.42	0.1191	0.0000	0.0076	0.0000	0.0076	--------
1.50	0.1268	0.0000	0.0076	0.0000	0.0076	--------
1.58	0.1344	0.0000	0.0076	0.0000	0.0076	--------
1.67	0.1420	0.0000	0.0076	0.0000	0.0076	--------
1.75	0.1496	0.0000	0.0076	0.0000	0.0076	--------
1.83	0.1572	0.0000	0.0076	0.0000	0.0076	--------
1.92	0.1648	0.0000	0.0076	0.0000	0.0076	--------
2.00	0.1724	0.0000	0.0076	0.0000	0.0076	--------
2.08	0.1817	0.0000	0.0093	0.0000	0.0093	--------
2.17	0.1910	0.0000	0.0093	0.0000	0.0093	--------
2.25	0.2003	0.0000	0.0093	0.0000	0.0093	--------
2.33	0.2096	0.0000	0.0093	0.0000	0.0093	--------
2.42	0.2189	0.0000	0.0093	0.0000	0.0093	--------
2.50	0.2281	0.0000	0.0093	0.0000	0.0093	--------
2.58	0.2358	0.0000	0.0076	0.0000	0.0076	--------
2.67	0.2434	0.0000	0.0076	0.0000	0.0076	--------
2.75	0.2510	0.0000	0.0076	0.0000	0.0076	--------
2.83	0.2586	0.0000	0.0076	0.0000	0.0076	--------
2.92	0.2662	0.0000	0.0076	0.0000	0.0076	--------
3.00	0.2738	0.0000	0.0076	0.0000	0.0076	--------
3.08	0.2831	0.0000	0.0093	0.0000	0.0093	--------
3.17	0.2924	0.0000	0.0093	0.0000	0.0093	--------
3.25	0.3017	0.0000	0.0093	0.0000	0.0093	--------
3.33	0.3110	0.0000	0.0093	0.0000	0.0093	--------
3.42	0.3203	0.0000	0.0093	0.0000	0.0093	--------
3.50	0.3296	0.0000	0.0093	0.0000	0.0093	--------
3.58	0.3397	0.0000	0.0101	0.0000	0.0101	--------
3.67	0.3498	0.0000	0.0101	0.0000	0.0101	--------
3.75	0.3600	0.0000	0.0101	0.0000	0.0101	--------
3.83	0.3701	0.0000	0.0101	0.0000	0.0101	--------
3.92	0.3803	0.0000	0.0101	0.0000	0.0101	--------
4.00	0.3904	0.0000	0.0101	0.0000	0.0101	--------
4.08	0.4014	0.0000	0.0110	0.0000	0.0110	--------
4.17	0.4124	0.0000	0.0110	0.0000	0.0110	--------
4.25	0.4233	0.0001	0.0110	0.0001	0.0109	--------
4.33	0.4343	0.0003	0.0110	0.0002	0.0108	--------
4.42	0.4453	0.0006	0.0110	0.0003	0.0107	--------
4.50	0.4563	0.0010	0.0110	0.0004	0.0106	--------
4.58	0.4681	0.0016	0.0118	0.0006	0.0112	--------

4.67	0.4800	0.0023	0.0118	0.0007	0.0111	--------
4.75	0.4918	0.0032	0.0118	0.0008	0.0110	--------
4.83	0.5036	0.0041	0.0118	0.0010	0.0109	--------
4.92	0.5154	0.0052	0.0118	0.0011	0.0108	--------
5.00	0.5273	0.0064	0.0118	0.0012	0.0106	--------
5.08	0.5408	0.0079	0.0135	0.0015	0.0120	--------
5.17	0.5543	0.0095	0.0135	0.0017	0.0119	--------
5.25	0.5678	0.0113	0.0135	0.0018	0.0117	--------
5.33	0.5814	0.0133	0.0135	0.0019	0.0116	--------
5.42	0.5949	0.0154	0.0135	0.0021	0.0114	--------
5.50	0.6084	0.0176	0.0135	0.0022	0.0113	--------
5.58	0.6228	0.0201	0.0144	0.0025	0.0119	--------
5.67	0.6371	0.0227	0.0144	0.0027	0.0117	--------
5.75	0.6515	0.0255	0.0144	0.0028	0.0116	--------
5.83	0.6659	0.0285	0.0144	0.0029	0.0114	--------
5.92	0.6802	0.0316	0.0144	0.0031	0.0113	--------
6.00	0.6946	0.0348	0.0144	0.0032	0.0111	--------
6.08	0.7115	0.0388	0.0169	0.0040	0.0129	--------
6.17	0.7284	0.0429	0.0169	0.0042	0.0127	--------
6.25	0.7453	0.0473	0.0169	0.0043	0.0126	--------
6.33	0.7622	0.0518	0.0169	0.0045	0.0124	--------
6.42	0.7791	0.0565	0.0169	0.0047	0.0122	--------
6.50	0.7960	0.0613	0.0169	0.0049	0.0120	--------
6.58	0.8154	0.0671	0.0194	0.0058	0.0136	--------
6.67	0.8349	0.0731	0.0194	0.0060	0.0134	--------
6.75	0.8543	0.0793	0.0194	0.0062	0.0132	--------
6.83	0.8737	0.0857	0.0194	0.0064	0.0130	--------
6.92	0.8932	0.0923	0.0194	0.0066	0.0128	--------
7.00	0.9126	0.0992	0.0194	0.0068	0.0126	--------
7.08	0.9380	0.1083	0.0254	0.0092	0.0162	--------
7.17	0.9633	0.1178	0.0253	0.0095	0.0159	--------
7.25	0.9887	0.1276	0.0254	0.0098	0.0156	--------
7.33	1.0140	0.1377	0.0253	0.0101	0.0153	--------
7.42	1.0394	0.1481	0.0253	0.0104	0.0150	--------
7.50	1.0647	0.1587	0.0253	0.0107	0.0147	--------
7.58	1.1027	0.1752	0.0380	0.0165	0.0215	--------
7.67	1.1408	0.1923	0.0380	0.0171	0.0209	--------
7.75	1.1788	0.2100	0.0380	0.0177	0.0204	--------
7.83	1.2168	0.2282	0.0380	0.0182	0.0198	--------
7.92	1.2548	0.2469	0.0380	0.0187	0.0193	--------
8.00	1.2929	0.2661	0.0380	0.0192	0.0188	--------
8.08	1.3495	0.2956	0.0566	0.0295	0.0271	--------
8.17	1.4061	0.3261	0.0566	0.0305	0.0261	--------
8.25	1.4627	0.3576	0.0566	0.0315	0.0252	--------
8.33	1.5193	0.3899	0.0566	0.0324	0.0243	--------
8.42	1.5759	0.4232	0.0566	0.0332	0.0234	--------
8.50	1.6325	0.4572	0.0566	0.0340	0.0226	--------
8.58	1.7069	0.5030	0.0744	0.0459	0.0285	--------
8.67	1.7813	0.5501	0.0744	0.0471	0.0273	--------
8.75	1.8556	0.5984	0.0744	0.0483	0.0261	--------
8.83	1.9300	0.6477	0.0744	0.0493	0.0250	--------
8.92	2.0043	0.6981	0.0744	0.0504	0.0240	--------
9.00	2.0787	0.7494	0.0744	0.0513	0.0230	--------
9.08	2.1598	0.8064	0.0811	0.0570	0.0241	--------
9.17	2.2409	0.8645	0.0811	0.0580	0.0231	--------
9.25	2.3221	0.9234	0.0811	0.0590	0.0221	--------
9.33	2.4032	0.9833	0.0811	0.0599	0.0213	--------
9.42	2.4843	1.0440	0.0811	0.0607	0.0204	--------
9.50	2.5654	1.1055	0.0811	0.0615	0.0196	--------
9.58	2.6347	1.1586	0.0693	0.0531	0.0162	--------
9.67	2.7040	1.2122	0.0693	0.0536	0.0157	--------
9.75	2.7733	1.2663	0.0693	0.0541	0.0152	--------
9.83	2.8426	1.3209	0.0693	0.0546	0.0147	--------

9.92	2.9119	1.3760	0.0693	0.0550	0.0143	--------
10.00	2.9812	1.4314	0.0693	0.0555	0.0138	--------
10.08	3.0158	1.4593	0.0346	0.0279	0.0068	--------
10.17	3.0505	1.4873	0.0346	0.0280	0.0067	--------
10.25	3.0851	1.5154	0.0346	0.0281	0.0066	--------
10.33	3.1197	1.5435	0.0346	0.0282	0.0065	--------
10.42	3.1544	1.5718	0.0346	0.0283	0.0064	--------
10.50	3.1890	1.6002	0.0346	0.0284	0.0063	--------
10.58	3.2118	1.6189	0.0228	0.0187	0.0041	--------
10.67	3.2347	1.6377	0.0228	0.0188	0.0040	--------
10.75	3.2575	1.6565	0.0228	0.0188	0.0040	--------
10.83	3.2803	1.6753	0.0228	0.0188	0.0040	--------
10.92	3.3031	1.6942	0.0228	0.0189	0.0039	--------
11.00	3.3259	1.7131	0.0228	0.0189	0.0039	--------
11.08	3.3454	1.7293	0.0194	0.0161	0.0033	--------
11.17	3.3648	1.7454	0.0194	0.0162	0.0033	--------
11.25	3.3842	1.7616	0.0194	0.0162	0.0032	--------
11.33	3.4037	1.7778	0.0194	0.0162	0.0032	--------
11.42	3.4231	1.7941	0.0194	0.0162	0.0032	--------
11.50	3.4425	1.8103	0.0194	0.0163	0.0032	--------
11.58	3.4603	1.8252	0.0177	0.0149	0.0029	--------
11.67	3.4780	1.8401	0.0177	0.0149	0.0029	--------
11.75	3.4958	1.8550	0.0177	0.0149	0.0028	--------
11.83	3.5135	1.8699	0.0177	0.0149	0.0028	--------
11.92	3.5313	1.8849	0.0177	0.0150	0.0028	--------
12.00	3.5490	1.8999	0.0177	0.0150	0.0028	--------
12.08	3.5659	1.9141	0.0169	0.0143	0.0026	--------
12.17	3.5828	1.9284	0.0169	0.0143	0.0026	--------
12.25	3.5997	1.9427	0.0169	0.0143	0.0026	--------
12.33	3.6166	1.9571	0.0169	0.0143	0.0026	--------
12.42	3.6335	1.9714	0.0169	0.0143	0.0026	--------
12.50	3.6504	1.9857	0.0169	0.0144	0.0025	--------
12.58	3.6665	1.9994	0.0161	0.0137	0.0024	--------
12.67	3.6825	2.0131	0.0161	0.0137	0.0024	--------
12.75	3.6986	2.0268	0.0161	0.0137	0.0024	--------
12.83	3.7146	2.0405	0.0161	0.0137	0.0024	--------
12.92	3.7307	2.0542	0.0161	0.0137	0.0023	--------
13.00	3.7467	2.0679	0.0161	0.0137	0.0023	--------
13.08	3.7611	2.0802	0.0144	0.0123	0.0021	--------
13.17	3.7755	2.0925	0.0144	0.0123	0.0021	--------
13.25	3.7898	2.1048	0.0144	0.0123	0.0021	--------
13.33	3.8042	2.1171	0.0144	0.0123	0.0020	--------
13.42	3.8186	2.1295	0.0144	0.0123	0.0020	--------
13.50	3.8329	2.1418	0.0144	0.0123	0.0020	--------
13.58	3.8464	2.1534	0.0135	0.0116	0.0019	--------
13.67	3.8600	2.1651	0.0135	0.0116	0.0019	--------
13.75	3.8735	2.1767	0.0135	0.0116	0.0019	--------
13.83	3.8870	2.1884	0.0135	0.0117	0.0019	--------
13.92	3.9005	2.2001	0.0135	0.0117	0.0019	--------
14.00	3.9140	2.2117	0.0135	0.0117	0.0018	--------
14.08	3.9293	2.2249	0.0152	0.0131	0.0021	--------
14.17	3.9445	2.2380	0.0152	0.0132	0.0021	--------
14.25	3.9597	2.2512	0.0152	0.0132	0.0020	--------
14.33	3.9749	2.2644	0.0152	0.0132	0.0020	--------
14.42	3.9901	2.2776	0.0152	0.0132	0.0020	--------
14.50	4.0053	2.2908	0.0152	0.0132	0.0020	--------
14.58	4.0138	2.2981	0.0085	0.0073	0.0011	--------
14.67	4.0222	2.3055	0.0084	0.0073	0.0011	--------
14.75	4.0307	2.3128	0.0084	0.0073	0.0011	--------
14.83	4.0391	2.3201	0.0084	0.0073	0.0011	--------
14.92	4.0476	2.3275	0.0084	0.0074	0.0011	--------
15.00	4.0560	2.3349	0.0084	0.0074	0.0011	--------
15.08	4.0695	2.3466	0.0135	0.0118	0.0017	--------

15.17	4.0830	2.3584	0.0135	0.0118	0.0017	--------
15.25	4.0966	2.3702	0.0135	0.0118	0.0017	--------
15.33	4.1101	2.3820	0.0135	0.0118	0.0017	--------
15.42	4.1236	2.3938	0.0135	0.0118	0.0017	--------
15.50	4.1371	2.4056	0.0135	0.0118	0.0017	--------
15.58	4.1498	2.4167	0.0127	0.0111	0.0016	--------
15.67	4.1625	2.4278	0.0127	0.0111	0.0016	--------
15.75	4.1751	2.4389	0.0127	0.0111	0.0016	--------
15.83	4.1878	2.4500	0.0127	0.0111	0.0016	--------
15.92	4.2005	2.4611	0.0127	0.0111	0.0016	--------
16.00	4.2132	2.4722	0.0127	0.0111	0.0016	--------
16.08	4.2250	2.4826	0.0118	0.0104	0.0014	--------
16.17	4.2368	2.4930	0.0118	0.0104	0.0014	--------
16.25	4.2487	2.5034	0.0118	0.0104	0.0014	--------
16.33	4.2605	2.5138	0.0118	0.0104	0.0014	--------
16.42	4.2723	2.5242	0.0118	0.0104	0.0014	--------
16.50	4.2842	2.5346	0.0118	0.0104	0.0014	--------
16.58	4.2968	2.5458	0.0127	0.0112	0.0015	--------
16.67	4.3095	2.5570	0.0127	0.0112	0.0015	--------
16.75	4.3222	2.5681	0.0127	0.0112	0.0015	--------
16.83	4.3349	2.5793	0.0127	0.0112	0.0015	--------
16.92	4.3475	2.5905	0.0127	0.0112	0.0015	--------
17.00	4.3602	2.6017	0.0127	0.0112	0.0015	--------
17.08	4.3703	2.6107	0.0101	0.0090	0.0012	--------
17.17	4.3805	2.6196	0.0101	0.0090	0.0012	--------
17.25	4.3906	2.6286	0.0101	0.0090	0.0012	--------
17.33	4.4008	2.6376	0.0101	0.0090	0.0012	--------
17.42	4.4109	2.6465	0.0101	0.0090	0.0012	--------
17.50	4.4210	2.6555	0.0101	0.0090	0.0012	--------
17.58	4.4320	2.6652	0.0110	0.0097	0.0013	--------
17.67	4.4430	2.6750	0.0110	0.0097	0.0012	--------
17.75	4.4540	2.6847	0.0110	0.0097	0.0012	--------
17.83	4.4650	2.6945	0.0110	0.0097	0.0012	--------
17.92	4.4760	2.7042	0.0110	0.0098	0.0012	--------
18.00	4.4870	2.7140	0.0110	0.0098	0.0012	--------
18.08	4.4954	2.7215	0.0084	0.0075	0.0009	--------
18.17	4.5038	2.7290	0.0084	0.0075	0.0009	--------
18.25	4.5123	2.7365	0.0085	0.0075	0.0009	--------
18.33	4.5208	2.7440	0.0084	0.0075	0.0009	--------
18.42	4.5292	2.7515	0.0084	0.0075	0.0009	--------
18.50	4.5377	2.7591	0.0084	0.0075	0.0009	--------
18.58	4.5461	2.7666	0.0085	0.0075	0.0009	--------
18.67	4.5545	2.7741	0.0084	0.0075	0.0009	--------
18.75	4.5630	2.7816	0.0085	0.0075	0.0009	--------
18.83	4.5715	2.7892	0.0084	0.0075	0.0009	--------
18.92	4.5799	2.7967	0.0084	0.0075	0.0009	--------
19.00	4.5884	2.8042	0.0084	0.0075	0.0009	--------
19.08	4.5960	2.8110	0.0076	0.0068	0.0008	--------
19.17	4.6036	2.8178	0.0076	0.0068	0.0008	--------
19.25	4.6112	2.8246	0.0076	0.0068	0.0008	--------
19.33	4.6188	2.8314	0.0076	0.0068	0.0008	--------
19.42	4.6264	2.8382	0.0076	0.0068	0.0008	--------
19.50	4.6340	2.8450	0.0076	0.0068	0.0008	--------
19.58	4.6424	2.8525	0.0085	0.0076	0.0009	--------
19.67	4.6509	2.8601	0.0084	0.0076	0.0009	--------
19.75	4.6593	2.8676	0.0085	0.0076	0.0009	--------
19.83	4.6678	2.8752	0.0084	0.0076	0.0009	--------
19.92	4.6762	2.8827	0.0084	0.0076	0.0009	--------
20.00	4.6847	2.8903	0.0084	0.0076	0.0009	--------
20.08	4.6940	2.8986	0.0093	0.0083	0.0010	--------
20.17	4.7033	2.9069	0.0093	0.0083	0.0010	--------
20.25	4.7126	2.9153	0.0093	0.0083	0.0010	--------
20.33	4.7219	2.9236	0.0093	0.0083	0.0010	--------

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 20.42   4.7312    2.9319    0.0093    0.0083    0.0010 --------
 20.50   4.7405    2.9403    0.0093    0.0083    0.0010 --------
 20.58   4.7489    2.9478    0.0084    0.0076    0.0009 --------
 20.67   4.7574    2.9554    0.0084    0.0076    0.0009 --------
 20.75   4.7658    2.9630    0.0084    0.0076    0.0009 --------
 20.83   4.7743    2.9706    0.0085    0.0076    0.0009 --------
 20.92   4.7827    2.9782    0.0084    0.0076    0.0009 --------
 21.00   4.7912    2.9858    0.0084    0.0076    0.0009 --------
 21.08   4.7988    2.9926    0.0076    0.0068    0.0008 --------
 21.17   4.8064    2.9994    0.0076    0.0068    0.0008 --------
 21.25   4.8140    3.0063    0.0076    0.0068    0.0008 --------
 21.33   4.8216    3.0131    0.0076    0.0068    0.0008 --------
 21.42   4.8292    3.0200    0.0076    0.0068    0.0008 --------
 21.50   4.8368    3.0268    0.0076    0.0068    0.0008 --------
 21.58   4.8444    3.0337    0.0076    0.0068    0.0008 --------
 21.67   4.8520    3.0405    0.0076    0.0068    0.0008 --------
 21.75   4.8596    3.0473    0.0076    0.0068    0.0008 --------
 21.83   4.8672    3.0542    0.0076    0.0069    0.0008 --------
 21.92   4.8748    3.0610    0.0076    0.0069    0.0008 --------
 22.00   4.8824    3.0679    0.0076    0.0069    0.0008 --------
 22.08   4.8900    3.0748    0.0076    0.0069    0.0007 --------
 22.17   4.8976    3.0816    0.0076    0.0069    0.0007 --------
 22.25   4.9052    3.0885    0.0076    0.0069    0.0007 --------
 22.33   4.9128    3.0953    0.0076    0.0069    0.0007 --------
 22.42   4.9204    3.1022    0.0076    0.0069    0.0007 --------
 22.50   4.9280    3.1091    0.0076    0.0069    0.0007 --------
 22.58   4.9356    3.1159    0.0076    0.0069    0.0007 --------
 22.67   4.9432    3.1228    0.0076    0.0069    0.0007 --------
 22.75   4.9509    3.1297    0.0076    0.0069    0.0007 --------
 22.83   4.9585    3.1365    0.0076    0.0069    0.0007 --------
 22.92   4.9661    3.1434    0.0076    0.0069    0.0007 --------
 23.00   4.9737    3.1503    0.0076    0.0069    0.0007 --------
 23.08   4.9821    3.1579    0.0084    0.0076    0.0008 --------
 23.17   4.9906    3.1656    0.0084    0.0076    0.0008 --------
 23.25   4.9990    3.1732    0.0084    0.0076    0.0008 --------
 23.33   5.0075    3.1809    0.0085    0.0076    0.0008 --------
 23.42   5.0159    3.1885    0.0084    0.0076    0.0008 --------
 23.50   5.0244    3.1962    0.0084    0.0077    0.0008 --------
 23.58   5.0320    3.2030    0.0076    0.0069    0.0007 --------
 23.67   5.0396    3.2099    0.0076    0.0069    0.0007 --------
 23.75   5.0472    3.2168    0.0076    0.0069    0.0007 --------
 23.83   5.0548    3.2237    0.0076    0.0069    0.0007 --------
 23.92   5.0624    3.2306    0.0076    0.0069    0.0007 --------
 24.00   5.0700    3.2375    0.0076    0.0069    0.0007 --------
----------------------------------------------------------------------
----------------------------------------------------------------------
Total soil rain loss =      1.83(In)
Total effective runoff =      3.24(In)
-----------------------------------------------------------------------
Peak flow rate this hydrograph =        1434.10(CFS)
Total runoff volume this hydrograph =       25684768.1(Ft3)
-----------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                     24 - H O U R   S T O R M
                R u n o f f     H y d r o g r a p h
----------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

----------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0      375.0     750.0    1125.0    1500.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  Q         |         |         |         |
  0+10       0.0000      0.00  Q         |         |         |         |
```

0+15	0.0000	0.00	Q	|	|	|	|
0+20	0.0000	0.00	Q	|	|	|	|
0+25	0.0000	0.00	Q	|	|	|	|
0+30	0.0000	0.00	Q	|	|	|	|
0+35	0.0000	0.00	Q	|	|	|	|
0+40	0.0000	0.00	Q	|	|	|	|
0+45	0.0000	0.00	Q	|	|	|	|
0+50	0.0000	0.00	Q	|	|	|	|
0+55	0.0000	0.00	Q	|	|	|	|
1+ 0	0.0000	0.00	Q	|	|	|	|
1+ 5	0.0000	0.00	Q	|	|	|	|
1+10	0.0000	0.00	Q	|	|	|	|
1+15	0.0000	0.00	Q	|	|	|	|
1+20	0.0000	0.00	Q	|	|	|	|
1+25	0.0000	0.00	Q	|	|	|	|
1+30	0.0000	0.00	Q	|	|	|	|
1+35	0.0000	0.00	Q	|	|	|	|
1+40	0.0000	0.00	Q	|	|	|	|
1+45	0.0000	0.00	Q	|	|	|	|
1+50	0.0000	0.00	Q	|	|	|	|
1+55	0.0000	0.00	Q	|	|	|	|
2+ 0	0.0000	0.00	Q	|	|	|	|
2+ 5	0.0000	0.00	Q	|	|	|	|
2+10	0.0000	0.00	Q	|	|	|	|
2+15	0.0000	0.00	Q	|	|	|	|
2+20	0.0000	0.00	Q	|	|	|	|
2+25	0.0000	0.00	Q	|	|	|	|
2+30	0.0000	0.00	Q	|	|	|	|
2+35	0.0000	0.00	Q	|	|	|	|
2+40	0.0000	0.00	Q	|	|	|	|
2+45	0.0000	0.00	Q	|	|	|	|
2+50	0.0000	0.00	Q	|	|	|	|
2+55	0.0000	0.00	Q	|	|	|	|
3+ 0	0.0000	0.00	Q	|	|	|	|
3+ 5	0.0000	0.00	Q	|	|	|	|
3+10	0.0000	0.00	Q	|	|	|	|
3+15	0.0000	0.00	Q	|	|	|	|
3+20	0.0000	0.00	Q	|	|	|	|
3+25	0.0000	0.00	Q	|	|	|	|
3+30	0.0000	0.00	Q	|	|	|	|
3+35	0.0000	0.00	Q	|	|	|	|
3+40	0.0000	0.00	Q	|	|	|	|
3+45	0.0000	0.00	Q	|	|	|	|
3+50	0.0000	0.00	Q	|	|	|	|
3+55	0.0000	0.00	Q	|	|	|	|
4+ 0	0.0000	0.00	Q	|	|	|	|
4+ 5	0.0000	0.00	Q	|	|	|	|
4+10	0.0000	0.00	Q	|	|	|	|
4+15	0.0000	0.00	Q	|	|	|	|
4+20	0.0002	0.02	Q	|	|	|	|
4+25	0.0006	0.06	Q	|	|	|	|
4+30	0.0017	0.15	Q	|	|	|	|
4+35	0.0039	0.33	Q	|	|	|	|
4+40	0.0086	0.68	Q	|	|	|	|
4+45	0.0176	1.31	Q	|	|	|	|
4+50	0.0335	2.30	Q	|	|	|	|
4+55	0.0586	3.65	Q	|	|	|	|
5+ 0	0.0956	5.37	Q	|	|	|	|
5+ 5	0.1464	7.38	Q	|	|	|	|
5+10	0.2130	9.66	Q	|	|	|	|
5+15	0.2966	12.14	Q	|	|	|	|
5+20	0.3986	14.81	Q	|	|	|	|
5+25	0.5201	17.65	Q	|	|	|	|

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 5+30       0.6633      20.78 Q         |         |         |         |
 5+35       0.8297      24.17 Q         |         |         |         |
 5+40       1.0215      27.84 Q         |         |         |         |
 5+45       1.2393      31.63 Q         |         |         |         |
 5+50       1.4838      35.50 Q         |         |         |         |
 5+55       1.7548      39.36 VQ        |         |         |         |
 6+ 0       2.0536      43.38 VQ        |         |         |         |
 6+ 5       2.3811      47.55 VQ        |         |         |         |
 6+10       2.7384      51.88 VQ        |         |         |         |
 6+15       3.1261      56.30 VQ        |         |         |         |
 6+20       3.5448      60.80 VQ        |         |         |         |
 6+25       3.9952      65.41 VQ        |         |         |         |
 6+30       4.4816      70.62 VQ        |         |         |         |
 6+35       5.0071      76.30 V Q       |         |         |         |
 6+40       5.5754      82.52 V Q       |         |         |         |
 6+45       6.1872      88.84 V Q       |         |         |         |
 6+50       6.8428      95.18 V Q       |         |         |         |
 6+55       7.5410     101.39 V Q       |         |         |         |
 7+ 0       8.2865     108.24 V Q       |         |         |         |
 7+ 5       9.0829     115.64 V  Q      |         |         |         |
 7+10       9.9348     123.70 V  Q      |         |         |         |
 7+15      10.8438     131.98 V  Q      |         |         |         |
 7+20      11.8110     140.44 V  Q      |         |         |         |
 7+25      12.8378     149.09 V  Q      |         |         |         |
 7+30      13.9384     159.81 V   Q     |         |         |         |
 7+35      15.1245     172.22 |V  Q     |         |         |         |
 7+40      16.4100     186.65 |V  Q     |         |         |         |
 7+45      17.7995     201.75 |V   Q    |         |         |         |
 7+50      19.2966     217.38 |V   Q    |         |         |         |
 7+55      20.9043     233.44 |V    Q   |         |         |         |
 8+ 0      22.6594     254.85 |V    Q   |         |         |         |
 8+ 5      24.5908     280.44 |V     Q  |         |         |         |
 8+10      26.7322     310.93 |V      Q |         |         |         |
 8+15      29.0909     342.48 |V       Q|         |         |         |
 8+20      31.6700     374.49 | V      Q|         |         |         |
 8+25      34.4663     406.03 | V       Q         |         |         |
 8+30      37.5410     446.44 | V       |Q        |         |         |
 8+35      40.9389     493.38 | V       |  Q      |         |         |
 8+40      44.7131     548.01 |  V      |   Q     |         |         |
 8+45      48.8667     603.11 |  V      |     Q   |         |         |
 8+50      53.3935     657.29 |  V      |      Q  |         |         |
 8+55      58.2694     707.98 |  V      |       Q |         |         |
 9+ 0      63.5531     767.20 |   V     |         Q         |         |
 9+ 5      69.2822     831.86 |   V     |         | Q       |         |
 9+10      75.5027     903.22 |    V    |         |   Q     |         |
 9+15      82.2014     972.64 |    V    |         |    Q    |         |
 9+20      89.3512    1038.15 |     V   |         |      Q  |         |
 9+25      96.8988    1095.91 |     V   |         |        Q|         |
 9+30     104.8472    1154.10 |      V  |         |         Q         |
 9+35     113.1873    1210.98 |      V  |         |         | Q       |
 9+40     121.9147    1267.22 |       V |         |         |  Q      |
 9+45     130.9964    1318.66 |       V |         |         |    Q    |
 9+50     140.3891    1363.83 |        V|         |         |     Q   |
 9+55     150.0302    1399.89 |         V         |         |      Q  |
10+ 0     159.8281    1422.65 |         V         |         |      Q  |
10+ 5     169.7048    1434.10 |         |V        |         |       Q |
10+10     179.5789    1433.71 |         | V       |         |       Q |
10+15     189.4119    1427.75 |         | V       |         |       Q |
10+20     199.1673    1416.48 |         |  V      |         |      Q  |
10+25     208.8109    1400.25 |         |   V     |         |      Q  |
10+30     218.1459    1355.45 |         |   V     |         |     Q   |
10+35     227.0396    1291.37 |         |    V    |         |   Q     |
10+40     235.3474    1206.28 |         |    V    |         | Q       |
```

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10+45     243.0873   1123.84  |         |     V   |        Q|         |
10+50     250.3070   1048.30  |         |     V   |      Q  |         |
10+55     257.1273    990.31  |         |      V  |     Q   |         |
11+ 0     263.5345    930.32  |         |      V  |   Q     |         |
11+ 5     269.5314    870.75  |         |       V |  Q      |         |
11+10     275.1124    810.37  |         |       V |Q        |         |
11+15     280.3146    755.35  |         |        VQ         |         |
11+20     285.1880    707.62  |         |       QV|         |         |
11+25     289.7957    669.03  |         |      Q V|         |         |
11+30     294.1552    633.01  |         |     Q  V|         |         |
11+35     298.2893    600.26  |         |     Q   V         |         |
11+40     302.2102    569.32  |         |    Q    V         |         |
11+45     305.9427    541.96  |         |   Q     V         |         |
11+50     309.5158    518.82  |         |  Q      V         |         |
11+55     312.9578    499.78  |         |  Q      |V        |         |
12+ 0     316.2805    482.45  |         | Q       |V        |         |
12+ 5     319.4958    466.87  |         | Q       |V        |         |
12+10     322.6108    452.30  |         | Q       |V        |         |
12+15     325.6380    439.54  |         |Q        | V       |         |
12+20     328.5923    428.97  |         |Q        | V       |         |
12+25     331.4925    421.10  |         |Q        | V       |         |
12+30     334.3456    414.28  |         |Q        | V       |         |
12+35     337.1570    408.21  |         Q         | V       |         |
12+40     339.9283    402.39  |         Q         |  V      |         |
12+45     342.6638    397.20  |         Q         |  V      |         |
12+50     345.3691    392.80  |         Q         |  V      |         |
12+55     348.0508    389.39  |         Q         |  V      |         |
13+ 0     350.7087    385.92  |         Q         |  V      |         |
13+ 5     353.3424    382.43  |         Q         |  V      |         |
13+10     355.9502    378.65  |         Q         |   V     |         |
13+15     358.5331    375.04  |         Q         |   V     |         |
13+20     361.0930    371.69  |        Q|         |   V     |         |
13+25     363.6319    368.66  |        Q|         |   V     |         |
13+30     366.1426    364.54  |        Q|         |   V     |         |
13+35     368.6202    359.75  |        Q|         |    V    |         |
13+40     371.0589    354.10  |        Q|         |    V    |         |
13+45     373.4610    348.78  |        Q|         |    V    |         |
13+50     375.8302    344.01  |        Q|         |    V    |         |
13+55     378.1736    340.27  |        Q|         |    V    |         |
14+ 0     380.4901    336.36  |       Q |         |    V    |         |
14+ 5     382.7802    332.51  |       Q |         |    V    |         |
14+10     385.0436    328.65  |       Q |         |     V   |         |
14+15     387.2847    325.41  |       Q |         |     V   |         |
14+20     389.5092    322.99  |       Q |         |     V   |         |
14+25     391.7256    321.82  |       Q |         |     V   |         |
14+30     393.9472    322.58  |       Q |         |     V   |         |
14+35     396.1814    324.40  |       Q |         |     V   |         |
14+40     398.4347    327.19  |       Q |         |      V  |         |
14+45     400.7012    329.09  |       Q |         |      V  |         |
14+50     402.9716    329.67  |       Q |         |      V  |         |
14+55     405.2257    327.29  |       Q |         |      V  |         |
15+ 0     407.4194    318.53  |       Q |         |      V  |         |
15+ 5     409.5252    305.77  |       Q |         |      V  |         |
15+10     411.5136    288.71  |      Q  |         |      V  |         |
15+15     413.3949    273.17  |      Q  |         |       V |         |
15+20     415.1869    260.20  |     Q   |         |       V |         |
15+25     416.9310    253.24  |     Q   |         |       V |         |
15+30     418.6709    252.62  |     Q   |         |       V |         |
15+35     420.4367    256.40  |     Q   |         |       V |         |
15+40     422.2601    264.76  |      Q  |         |       V |         |
15+45     424.1409    273.09  |      Q  |         |       V |         |
15+50     426.0744    280.74  |      Q  |         |       V |         |
15+55     428.0390    285.26  |      Q  |         |        V|         |
```

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16+ 0     430.0233    288.12   |      Q  |         |        V|         |
16+ 5     432.0191    289.79   |      Q  |         |        V|         |
16+10     434.0167    290.06   |      Q  |         |        V|         |
16+15     436.0140    290.00   |      Q  |         |        V|         |
16+20     438.0089    289.66   |      Q  |         |        V|         |
16+25     440.0019    289.39   |      Q  |         |        V|         |
16+30     441.9883    288.42   |      Q  |         |        V|         |
16+35     443.9646    286.97   |      Q  |         |         V         |
16+40     445.9286    285.16   |      Q  |         |         V         |
16+45     447.8814    283.55   |      Q  |         |         V         |
16+50     449.8257    282.32   |      Q  |         |         V         |
16+55     451.7682    282.05   |      Q  |         |         V         |
17+ 0     453.7157    282.77   |      Q  |         |         V         |
17+ 5     455.6719    284.04   |      Q  |         |         V         |
17+10     457.6400    285.78   |      Q  |         |         |V        |
17+15     459.6174    287.11   |      Q  |         |         |V        |
17+20     461.5998    287.84   |      Q  |         |         |V        |
17+25     463.5774    287.15   |      Q  |         |         |V        |
17+30     465.5327    283.91   |      Q  |         |         |V        |
17+35     467.4546    279.05   |      Q  |         |         |V        |
17+40     469.3312    272.49   |      Q  |         |         |V        |
17+45     471.1657    266.36   |      Q  |         |         |V        |
17+50     472.9636    261.06   |     Q   |         |         | V       |
17+55     474.7386    257.74   |     Q   |         |         | V       |
18+ 0     476.5009    255.88   |     Q   |         |         | V       |
18+ 5     478.2569    254.97   |     Q   |         |         | V       |
18+10     480.0131    255.00   |     Q   |         |         | V       |
18+15     481.7685    254.89   |     Q   |         |         | V       |
18+20     483.5209    254.46   |     Q   |         |         | V       |
18+25     485.2628    252.92   |     Q   |         |         | V       |
18+30     486.9776    248.99   |     Q   |         |         |  V      |
18+35     488.6549    243.55   |     Q   |         |         |  V      |
18+40     490.2828    236.36   |     Q   |         |         |  V      |
18+45     491.8639    229.58   |     Q   |         |         |  V      |
18+50     493.4035    223.55   |    Q    |         |         |  V      |
18+55     494.9135    219.25   |    Q    |         |         |  V      |
19+ 0     496.3990    215.69   |    Q    |         |         |  V      |
19+ 5     497.8638    212.69   |    Q    |         |         |  V      |
19+10     499.3116    210.23   |    Q    |         |         |  V      |
19+15     500.7443    208.02   |    Q    |         |         |  V      |
19+20     502.1635    206.06   |    Q    |         |         |   V     |
19+25     503.5694    204.15   |    Q    |         |         |   V     |
19+30     504.9583    201.67   |    Q    |         |         |   V     |
19+35     506.3284    198.93   |    Q    |         |         |   V     |
19+40     507.6768    195.79   |    Q    |         |         |   V     |
19+45     509.0061    193.02   |    Q    |         |         |   V     |
19+50     510.3200    190.77   |    Q    |         |         |   V     |
19+55     511.6246    189.43   |    Q    |         |         |   V     |
20+ 0     512.9275    189.19   |    Q    |         |         |   V     |
20+ 5     514.2346    189.78   |    Q    |         |         |   V     |
20+10     515.5516    191.24   |    Q    |         |         |   V     |
20+15     516.8798    192.85   |    Q    |         |         |    V    |
20+20     518.2195    194.54   |    Q    |         |         |    V    |
20+25     519.5698    196.06   |    Q    |         |         |    V    |
20+30     520.9353    198.26   |    Q    |         |         |    V    |
20+35     522.3184    200.82   |    Q    |         |         |    V    |
20+40     523.7216    203.75   |    Q    |         |         |    V    |
20+45     525.1428    206.36   |    Q    |         |         |    V    |
20+50     526.5788    208.50   |    Q    |         |         |    V    |
20+55     528.0234    209.76   |    Q    |         |         |    V    |
21+ 0     529.4694    209.96   |    Q    |         |         |    V    |
21+ 5     530.9113    209.37   |    Q    |         |         |     V   |
21+10     532.3436    207.97   |    Q    |         |         |     V   |
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21+15     533.7654    206.44   |    Q    |         |         |     V   |
21+20     535.1762    204.86   |    Q    |         |         |     V   |
21+25     536.5780    203.54   |    Q    |         |         |     V   |
21+30     537.9663    201.58   |    Q    |         |         |     V   |
21+35     539.3384    199.22   |    Q    |         |         |     V   |
21+40     540.6911    196.42   |    Q    |         |         |     V   |
21+45     542.0258    193.80   |    Q    |         |         |     V   |
21+50     543.3446    191.49   |    Q    |         |         |     V   |
21+55     544.6517    189.78   |    Q    |         |         |     V   |
22+ 0     545.9487    188.33   |    Q    |         |         |      V  |
22+ 5     547.2374    187.11   |   Q     |         |         |      V  |
22+10     548.5191    186.10   |   Q     |         |         |      V  |
22+15     549.7948    185.24   |   Q     |         |         |      V  |
22+20     551.0657    184.53   |   Q     |         |         |      V  |
22+25     552.3323    183.91   |   Q     |         |         |      V  |
22+30     553.5952    183.37   |   Q     |         |         |      V  |
22+35     554.8550    182.93   |   Q     |         |         |      V  |
22+40     556.1122    182.55   |   Q     |         |         |      V  |
22+45     557.3674    182.24   |   Q     |         |         |      V  |
22+50     558.6209    182.01   |   Q     |         |         |      V  |
22+55     559.8732    181.84   |   Q     |         |         |      V  |
23+ 0     561.1248    181.73   |   Q     |         |         |       V |
23+ 5     562.3761    181.69   |   Q     |         |         |       V |
23+10     563.6276    181.72   |   Q     |         |         |       V |
23+15     564.8803    181.89   |   Q     |         |         |       V |
23+20     566.1353    182.22   |   Q     |         |         |       V |
23+25     567.3944    182.84   |   Q     |         |         |       V |
23+30     568.6635    184.26   |   Q     |         |         |       V |
23+35     569.9457    186.17   |   Q     |         |         |       V |
23+40     571.2445    188.59   |    Q    |         |         |       V |
23+45     572.5583    190.77   |    Q    |         |         |       V |
23+50     573.8844    192.55   |    Q    |         |         |       V |
23+55     575.2169    193.47   |    Q    |         |         |        V|
24+ 0     576.5486    193.37   |    Q    |         |         |        V|
24+ 5     577.8723    192.20   |    Q    |         |         |        V|
24+10     579.1798    189.84   |    Q    |         |         |        V|
24+15     580.4641    186.48   |   Q     |         |         |        V|
24+20     581.7173    181.97   |   Q     |         |         |        V|
24+25     582.9271    175.66   |   Q     |         |         |        V|
24+30     584.0454    162.38   |   Q     |         |         |        V|
24+35     585.0411    144.59   |  Q      |         |         |        V|
24+40     585.8807    121.91   |  Q      |         |         |        V|
24+45     586.5728    100.49   | Q       |         |         |        V|
24+50     587.1336     81.43   | Q       |         |         |        V|
24+55     587.6007     67.82   |Q        |         |         |        V|
25+ 0     587.9891     56.39   |Q        |         |         |        V|
25+ 5     588.3117     46.85   |Q        |         |         |        V|
25+10     588.5806     39.04   |Q        |         |         |        V|
25+15     588.8032     32.33   Q         |         |         |        V|
25+20     588.9880     26.83   Q         |         |         |        V|
25+25     589.1397     22.02   Q         |         |         |        V|
25+30     589.2627     17.87   Q         |         |         |        V|
25+35     589.3620     14.41   Q         |         |         |        V|
25+40     589.4403     11.36   Q         |         |         |        V|
25+45     589.5008      8.79   Q         |         |         |        V|
25+50     589.5470      6.71   Q         |         |         |        V|
25+55     589.5812      4.96   Q         |         |         |        V|
26+ 0     589.6056      3.55   Q         |         |         |        V|
26+ 5     589.6224      2.43   Q         |         |         |        V|
26+10     589.6330      1.54   Q         |         |         |        V|
26+15     589.6386      0.82   Q         |         |         |        V|
26+20     589.6407      0.30   Q         |         |         |        V|
26+25     589.6411      0.07   Q         |         |         |         V
```

```
        U N I T   H Y D R O G R A P H   A N A L Y S I S

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                Study date  09/08/10  File: mccain210yr24hr.out

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Program License Serial Number 4055

----------------------------------------------------------------------
Tule Wind Project
McCain Valley Crossing 2
Proposed Conditions 10 Yr 24 Hr
Aug 18, 2010
----------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Storm Event Year = 10

Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
        Sub-Area(Ac.)       Rainfall (In)
          2256.19             3.50

Rainfall Distribution pattern used in study:
Type B for San Diego area of California
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

********* Area-Averaged SCS Curve Number and Fm *********

Area       Area          SCS CN    SCS CN    Fm      Soil
(Ac.)      fract         (AMC2)    (AMC2)   (In/Hr)  Group
  2256.19   1.000         73.0      73.0     0.050    C

Area-averaged catchment SCS Curve Number AMC(2) = 73.000
Area-averaged Fm value using values listed =  0.050(In/Hr)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Direct entry of lag time by user
Watershed area =    2256.19(Ac.)
Catchment Lag time =   0.770 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 10.8225
Hydrograph baseflow =     0.00(CFS)
Minimum watershed loss rate(Fm) =  0.000(In/Hr)
Average adjusted SCS Curve Number = 73.000

Rainfall depth area reduction factors:
Using a total area of    2256.19(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study =    3.500(In)
Adjusted rainfall =    3.500(In)
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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H
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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 27299.90 (CFS))

0.11	0.083	0.016	49.046	0.002
0.22	0.167	0.035	109.219	0.006
0.32	0.250	0.080	251.132	0.015
0.43	0.333	0.126	398.128	0.030
0.54	0.417	0.231	727.738	0.056
0.65	0.500	0.487	1536.327	0.113
0.76	0.583	0.744	2347.940	0.199
0.87	0.667	0.970	3060.728	0.311
0.97	0.750	1.000	3155.005	0.426
1.08	0.833	0.889	2803.538	0.529
1.19	0.917	0.708	2234.582	0.611
1.30	1.000	0.541	1707.873	0.673
1.41	1.083	0.451	1421.553	0.725
1.52	1.167	0.397	1253.877	0.771
1.62	1.250	0.316	997.605	0.808
1.73	1.333	0.272	859.451	0.839
1.84	1.417	0.235	740.970	0.866
1.95	1.500	0.197	621.203	0.889
2.06	1.583	0.176	556.068	0.910
2.16	1.667	0.147	463.377	0.927
2.27	1.750	0.128	404.721	0.941
2.38	1.833	0.112	352.648	0.954
2.49	1.917	0.089	280.530	0.965
2.60	2.000	0.078	244.854	0.974
2.71	2.083	0.063	198.748	0.981
2.81	2.167	0.051	160.175	0.987
2.92	2.250	0.041	128.318	0.991
3.03	2.333	0.033	104.199	0.995
3.14	2.417	0.026	80.877	0.998
3.25	2.500	0.011	35.096	0.999
3.35	2.583	0.005	14.372	1.000

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For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

Where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the

revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr-ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0052	0.0000	0.0052	0.0000	0.0052	--------
0.17	0.0105	0.0000	0.0052	0.0000	0.0052	--------
0.25	0.0158	0.0000	0.0053	0.0000	0.0053	--------
0.33	0.0210	0.0000	0.0052	0.0000	0.0052	--------
0.42	0.0262	0.0000	0.0052	0.0000	0.0052	--------
0.50	0.0315	0.0000	0.0053	0.0000	0.0053	--------
0.58	0.0356	0.0000	0.0041	0.0000	0.0041	--------
0.67	0.0397	0.0000	0.0041	0.0000	0.0041	--------
0.75	0.0438	0.0000	0.0041	0.0000	0.0041	--------
0.83	0.0478	0.0000	0.0041	0.0000	0.0041	--------
0.92	0.0519	0.0000	0.0041	0.0000	0.0041	--------
1.00	0.0560	0.0000	0.0041	0.0000	0.0041	--------
1.08	0.0613	0.0000	0.0053	0.0000	0.0053	--------
1.17	0.0665	0.0000	0.0052	0.0000	0.0052	--------
1.25	0.0718	0.0000	0.0053	0.0000	0.0053	--------
1.33	0.0770	0.0000	0.0052	0.0000	0.0052	--------
1.42	0.0823	0.0000	0.0053	0.0000	0.0053	--------
1.50	0.0875	0.0000	0.0053	0.0000	0.0053	--------
1.58	0.0928	0.0000	0.0053	0.0000	0.0053	--------
1.67	0.0980	0.0000	0.0052	0.0000	0.0052	--------
1.75	0.1033	0.0000	0.0053	0.0000	0.0053	--------
1.83	0.1085	0.0000	0.0052	0.0000	0.0052	--------
1.92	0.1138	0.0000	0.0053	0.0000	0.0053	--------
2.00	0.1190	0.0000	0.0053	0.0000	0.0053	--------
2.08	0.1254	0.0000	0.0064	0.0000	0.0064	--------
2.17	0.1318	0.0000	0.0064	0.0000	0.0064	--------
2.25	0.1383	0.0000	0.0064	0.0000	0.0064	--------
2.33	0.1447	0.0000	0.0064	0.0000	0.0064	--------
2.42	0.1511	0.0000	0.0064	0.0000	0.0064	--------
2.50	0.1575	0.0000	0.0064	0.0000	0.0064	--------
2.58	0.1628	0.0000	0.0053	0.0000	0.0053	--------
2.67	0.1680	0.0000	0.0053	0.0000	0.0053	--------
2.75	0.1733	0.0000	0.0053	0.0000	0.0053	--------
2.83	0.1785	0.0000	0.0052	0.0000	0.0052	--------
2.92	0.1838	0.0000	0.0053	0.0000	0.0053	--------
3.00	0.1890	0.0000	0.0053	0.0000	0.0053	--------
3.08	0.1954	0.0000	0.0064	0.0000	0.0064	--------
3.17	0.2018	0.0000	0.0064	0.0000	0.0064	--------
3.25	0.2082	0.0000	0.0064	0.0000	0.0064	--------
3.33	0.2147	0.0000	0.0064	0.0000	0.0064	--------
3.42	0.2211	0.0000	0.0064	0.0000	0.0064	--------
3.50	0.2275	0.0000	0.0064	0.0000	0.0064	--------
3.58	0.2345	0.0000	0.0070	0.0000	0.0070	--------
3.67	0.2415	0.0000	0.0070	0.0000	0.0070	--------
3.75	0.2485	0.0000	0.0070	0.0000	0.0070	--------
3.83	0.2555	0.0000	0.0070	0.0000	0.0070	--------
3.92	0.2625	0.0000	0.0070	0.0000	0.0070	--------
4.00	0.2695	0.0000	0.0070	0.0000	0.0070	--------
4.08	0.2771	0.0000	0.0076	0.0000	0.0076	--------
4.17	0.2847	0.0000	0.0076	0.0000	0.0076	--------
4.25	0.2922	0.0000	0.0076	0.0000	0.0076	--------
4.33	0.2998	0.0000	0.0076	0.0000	0.0076	--------
4.42	0.3074	0.0000	0.0076	0.0000	0.0076	--------
4.50	0.3150	0.0000	0.0076	0.0000	0.0076	--------

4.58	0.3232	0.0000	0.0082	0.0000	0.0082	--------
4.67	0.3313	0.0000	0.0082	0.0000	0.0082	--------
4.75	0.3395	0.0000	0.0082	0.0000	0.0082	--------
4.83	0.3477	0.0000	0.0082	0.0000	0.0082	--------
4.92	0.3558	0.0000	0.0082	0.0000	0.0082	--------
5.00	0.3640	0.0000	0.0082	0.0000	0.0082	--------
5.08	0.3733	0.0000	0.0093	0.0000	0.0093	--------
5.17	0.3827	0.0000	0.0093	0.0000	0.0093	--------
5.25	0.3920	0.0000	0.0093	0.0000	0.0093	--------
5.33	0.4013	0.0000	0.0093	0.0000	0.0093	--------
5.42	0.4107	0.0000	0.0093	0.0000	0.0093	--------
5.50	0.4200	0.0000	0.0093	0.0000	0.0093	--------
5.58	0.4299	0.0000	0.0099	0.0000	0.0099	--------
5.67	0.4398	0.0000	0.0099	0.0000	0.0099	--------
5.75	0.4497	0.0000	0.0099	0.0000	0.0099	--------
5.83	0.4597	0.0000	0.0099	0.0000	0.0099	--------
5.92	0.4696	0.0000	0.0099	0.0000	0.0099	--------
6.00	0.4795	0.0000	0.0099	0.0000	0.0099	--------
6.08	0.4912	0.0000	0.0117	0.0000	0.0117	--------
6.17	0.5028	0.0000	0.0117	0.0000	0.0117	--------
6.25	0.5145	0.0000	0.0117	0.0000	0.0117	--------
6.33	0.5262	0.0000	0.0117	0.0000	0.0117	--------
6.42	0.5378	0.0000	0.0117	0.0000	0.0117	--------
6.50	0.5495	0.0000	0.0117	0.0000	0.0117	--------
6.58	0.5629	0.0000	0.0134	0.0000	0.0134	--------
6.67	0.5763	0.0000	0.0134	0.0000	0.0134	--------
6.75	0.5898	0.0000	0.0134	0.0000	0.0134	--------
6.83	0.6032	0.0000	0.0134	0.0000	0.0134	--------
6.92	0.6166	0.0000	0.0134	0.0000	0.0134	--------
7.00	0.6300	0.0000	0.0134	0.0000	0.0134	--------
7.08	0.6475	0.0000	0.0175	0.0000	0.0175	--------
7.17	0.6650	0.0000	0.0175	0.0000	0.0175	--------
7.25	0.6825	0.0000	0.0175	0.0000	0.0175	--------
7.33	0.7000	0.0000	0.0175	0.0000	0.0175	--------
7.42	0.7175	0.0000	0.0175	0.0000	0.0175	--------
7.50	0.7350	0.0000	0.0175	0.0000	0.0175	--------
7.58	0.7612	0.0001	0.0262	0.0001	0.0261	--------
7.67	0.7875	0.0006	0.0262	0.0005	0.0258	--------
7.75	0.8137	0.0015	0.0262	0.0008	0.0254	--------
7.83	0.8400	0.0026	0.0262	0.0012	0.0251	--------
7.92	0.8662	0.0042	0.0262	0.0015	0.0247	--------
8.00	0.8925	0.0061	0.0263	0.0019	0.0244	--------
8.08	0.9316	0.0095	0.0391	0.0034	0.0357	--------
8.17	0.9707	0.0136	0.0391	0.0041	0.0350	--------
8.25	1.0097	0.0184	0.0391	0.0048	0.0343	--------
8.33	1.0488	0.0238	0.0391	0.0055	0.0336	--------
8.42	1.0879	0.0300	0.0391	0.0061	0.0330	--------
8.50	1.1270	0.0367	0.0391	0.0067	0.0323	--------
8.58	1.1783	0.0465	0.0513	0.0098	0.0415	--------
8.67	1.2297	0.0573	0.0513	0.0108	0.0405	--------
8.75	1.2810	0.0691	0.0513	0.0118	0.0395	--------
8.83	1.3323	0.0818	0.0513	0.0127	0.0386	--------
8.92	1.3837	0.0955	0.0513	0.0136	0.0377	--------
9.00	1.4350	0.1100	0.0513	0.0145	0.0368	--------
9.08	1.4910	0.1268	0.0560	0.0168	0.0392	--------
9.17	1.5470	0.1446	0.0560	0.0178	0.0382	--------
9.25	1.6030	0.1634	0.0560	0.0187	0.0373	--------
9.33	1.6590	0.1830	0.0560	0.0196	0.0364	--------
9.42	1.7150	0.2035	0.0560	0.0205	0.0355	--------
9.50	1.7710	0.2249	0.0560	0.0213	0.0347	--------
9.58	1.8188	0.2437	0.0478	0.0189	0.0290	--------
9.67	1.8667	0.2632	0.0478	0.0195	0.0284	--------
9.75	1.9145	0.2832	0.0478	0.0200	0.0278	--------

9.83	1.9623	0.3037	0.0478	0.0205	0.0273	--------
9.92	2.0102	0.3248	0.0478	0.0211	0.0268	--------
10.00	2.0580	0.3464	0.0478	0.0216	0.0262	--------
10.08	2.0819	0.3574	0.0239	0.0110	0.0129	--------
10.17	2.1058	0.3685	0.0239	0.0111	0.0128	--------
10.25	2.1298	0.3797	0.0239	0.0112	0.0127	--------
10.33	2.1537	0.3910	0.0239	0.0113	0.0126	--------
10.42	2.1776	0.4025	0.0239	0.0115	0.0125	--------
10.50	2.2015	0.4141	0.0239	0.0116	0.0123	--------
10.58	2.2172	0.4218	0.0157	0.0077	0.0081	--------
10.67	2.2330	0.4295	0.0158	0.0077	0.0080	--------
10.75	2.2488	0.4373	0.0158	0.0078	0.0080	--------
10.83	2.2645	0.4451	0.0157	0.0078	0.0079	--------
10.92	2.2802	0.4530	0.0157	0.0079	0.0079	--------
11.00	2.2960	0.4609	0.0158	0.0079	0.0078	--------
11.08	2.3094	0.4677	0.0134	0.0068	0.0066	--------
11.17	2.3228	0.4745	0.0134	0.0068	0.0066	--------
11.25	2.3362	0.4814	0.0134	0.0069	0.0066	--------
11.33	2.3497	0.4882	0.0134	0.0069	0.0065	--------
11.42	2.3631	0.4952	0.0134	0.0069	0.0065	--------
11.50	2.3765	0.5021	0.0134	0.0070	0.0065	--------
11.58	2.3887	0.5085	0.0122	0.0064	0.0059	--------
11.67	2.4010	0.5149	0.0123	0.0064	0.0058	--------
11.75	2.4133	0.5213	0.0122	0.0064	0.0058	--------
11.83	2.4255	0.5278	0.0122	0.0065	0.0058	--------
11.92	2.4377	0.5343	0.0122	0.0065	0.0058	--------
12.00	2.4500	0.5408	0.0122	0.0065	0.0057	--------
12.08	2.4617	0.5470	0.0117	0.0062	0.0054	--------
12.17	2.4733	0.5533	0.0117	0.0062	0.0054	--------
12.25	2.4850	0.5595	0.0117	0.0063	0.0054	--------
12.33	2.4967	0.5658	0.0117	0.0063	0.0054	--------
12.42	2.5083	0.5721	0.0117	0.0063	0.0054	--------
12.50	2.5200	0.5785	0.0117	0.0063	0.0053	--------
12.58	2.5311	0.5845	0.0111	0.0060	0.0050	--------
12.67	2.5422	0.5906	0.0111	0.0061	0.0050	--------
12.75	2.5533	0.5967	0.0111	0.0061	0.0050	--------
12.83	2.5643	0.6028	0.0111	0.0061	0.0050	--------
12.92	2.5754	0.6089	0.0111	0.0061	0.0050	--------
13.00	2.5865	0.6150	0.0111	0.0061	0.0049	--------
13.08	2.5964	0.6205	0.0099	0.0055	0.0044	--------
13.17	2.6063	0.6261	0.0099	0.0055	0.0044	--------
13.25	2.6163	0.6316	0.0099	0.0055	0.0044	--------
13.33	2.6262	0.6372	0.0099	0.0056	0.0044	--------
13.42	2.6361	0.6427	0.0099	0.0056	0.0043	--------
13.50	2.6460	0.6483	0.0099	0.0056	0.0043	--------
13.58	2.6553	0.6536	0.0093	0.0053	0.0041	--------
13.67	2.6647	0.6589	0.0093	0.0053	0.0040	--------
13.75	2.6740	0.6642	0.0093	0.0053	0.0040	--------
13.83	2.6833	0.6695	0.0093	0.0053	0.0040	--------
13.92	2.6927	0.6749	0.0093	0.0053	0.0040	--------
14.00	2.7020	0.6802	0.0093	0.0053	0.0040	--------
14.08	2.7125	0.6862	0.0105	0.0060	0.0045	--------
14.17	2.7230	0.6923	0.0105	0.0060	0.0045	--------
14.25	2.7335	0.6983	0.0105	0.0061	0.0044	--------
14.33	2.7440	0.7044	0.0105	0.0061	0.0044	--------
14.42	2.7545	0.7105	0.0105	0.0061	0.0044	--------
14.50	2.7650	0.7166	0.0105	0.0061	0.0044	--------
14.58	2.7708	0.7200	0.0058	0.0034	0.0024	--------
14.67	2.7767	0.7234	0.0058	0.0034	0.0024	--------
14.75	2.7825	0.7268	0.0058	0.0034	0.0024	--------
14.83	2.7883	0.7302	0.0058	0.0034	0.0024	--------
14.92	2.7942	0.7336	0.0058	0.0034	0.0024	--------
15.00	2.8000	0.7371	0.0058	0.0034	0.0024	--------

15.08	2.8093	0.7426	0.0093	0.0055	0.0038	--------
15.17	2.8187	0.7481	0.0093	0.0055	0.0038	--------
15.25	2.8280	0.7536	0.0093	0.0055	0.0038	--------
15.33	2.8373	0.7591	0.0093	0.0055	0.0038	--------
15.42	2.8467	0.7646	0.0093	0.0055	0.0038	--------
15.50	2.8560	0.7702	0.0093	0.0056	0.0038	--------
15.58	2.8647	0.7754	0.0088	0.0052	0.0035	--------
15.67	2.8735	0.7806	0.0088	0.0052	0.0035	--------
15.75	2.8822	0.7859	0.0087	0.0052	0.0035	--------
15.83	2.8910	0.7911	0.0088	0.0052	0.0035	--------
15.92	2.8997	0.7964	0.0087	0.0053	0.0035	--------
16.00	2.9085	0.8016	0.0088	0.0053	0.0035	--------
16.08	2.9167	0.8066	0.0082	0.0049	0.0032	--------
16.17	2.9248	0.8115	0.0082	0.0049	0.0032	--------
16.25	2.9330	0.8165	0.0082	0.0049	0.0032	--------
16.33	2.9412	0.8214	0.0082	0.0050	0.0032	--------
16.42	2.9493	0.8264	0.0082	0.0050	0.0032	--------
16.50	2.9575	0.8313	0.0082	0.0050	0.0032	--------
16.58	2.9662	0.8367	0.0087	0.0053	0.0034	--------
16.67	2.9750	0.8420	0.0088	0.0053	0.0034	--------
16.75	2.9838	0.8474	0.0088	0.0054	0.0034	--------
16.83	2.9925	0.8527	0.0087	0.0054	0.0034	--------
16.92	3.0012	0.8581	0.0088	0.0054	0.0034	--------
17.00	3.0100	0.8635	0.0088	0.0054	0.0034	--------
17.08	3.0170	0.8678	0.0070	0.0043	0.0027	--------
17.17	3.0240	0.8721	0.0070	0.0043	0.0027	--------
17.25	3.0310	0.8765	0.0070	0.0043	0.0027	--------
17.33	3.0380	0.8808	0.0070	0.0043	0.0027	--------
17.42	3.0450	0.8851	0.0070	0.0043	0.0027	--------
17.50	3.0520	0.8895	0.0070	0.0043	0.0027	--------
17.58	3.0596	0.8942	0.0076	0.0047	0.0029	--------
17.67	3.0672	0.8989	0.0076	0.0047	0.0029	--------
17.75	3.0748	0.9037	0.0076	0.0047	0.0029	--------
17.83	3.0823	0.9084	0.0076	0.0047	0.0028	--------
17.92	3.0899	0.9131	0.0076	0.0047	0.0028	--------
18.00	3.0975	0.9179	0.0076	0.0048	0.0028	--------
18.08	3.1033	0.9215	0.0058	0.0037	0.0022	--------
18.17	3.1092	0.9252	0.0058	0.0037	0.0022	--------
18.25	3.1150	0.9289	0.0058	0.0037	0.0022	--------
18.33	3.1208	0.9326	0.0058	0.0037	0.0022	--------
18.42	3.1267	0.9362	0.0058	0.0037	0.0022	--------
18.50	3.1325	0.9399	0.0058	0.0037	0.0022	--------
18.58	3.1383	0.9436	0.0058	0.0037	0.0021	--------
18.67	3.1442	0.9473	0.0058	0.0037	0.0021	--------
18.75	3.1500	0.9510	0.0058	0.0037	0.0021	--------
18.83	3.1558	0.9547	0.0058	0.0037	0.0021	--------
18.92	3.1617	0.9584	0.0058	0.0037	0.0021	--------
19.00	3.1675	0.9621	0.0058	0.0037	0.0021	--------
19.08	3.1728	0.9654	0.0053	0.0033	0.0019	--------
19.17	3.1780	0.9688	0.0052	0.0033	0.0019	--------
19.25	3.1833	0.9721	0.0053	0.0033	0.0019	--------
19.33	3.1885	0.9755	0.0053	0.0033	0.0019	--------
19.42	3.1938	0.9788	0.0052	0.0034	0.0019	--------
19.50	3.1990	0.9822	0.0053	0.0034	0.0019	--------
19.58	3.2048	0.9859	0.0058	0.0037	0.0021	--------
19.67	3.2107	0.9896	0.0058	0.0037	0.0021	--------
19.75	3.2165	0.9934	0.0058	0.0037	0.0021	--------
19.83	3.2223	0.9971	0.0058	0.0037	0.0021	--------
19.92	3.2282	1.0009	0.0058	0.0037	0.0021	--------
20.00	3.2340	1.0046	0.0058	0.0038	0.0021	--------
20.08	3.2404	1.0087	0.0064	0.0041	0.0023	--------
20.17	3.2468	1.0129	0.0064	0.0041	0.0023	--------
20.25	3.2533	1.0170	0.0064	0.0041	0.0023	--------

20.33	3.2597	1.0212	0.0064	0.0041	0.0023	--------
20.42	3.2661	1.0253	0.0064	0.0041	0.0023	--------
20.50	3.2725	1.0295	0.0064	0.0042	0.0023	--------
20.58	3.2783	1.0332	0.0058	0.0038	0.0021	--------
20.67	3.2842	1.0370	0.0058	0.0038	0.0020	--------
20.75	3.2900	1.0408	0.0058	0.0038	0.0020	--------
20.83	3.2958	1.0446	0.0058	0.0038	0.0020	--------
20.92	3.3017	1.0484	0.0058	0.0038	0.0020	--------
21.00	3.3075	1.0522	0.0058	0.0038	0.0020	--------
21.08	3.3127	1.0556	0.0052	0.0034	0.0018	--------
21.17	3.3180	1.0590	0.0053	0.0034	0.0018	--------
21.25	3.3232	1.0625	0.0053	0.0034	0.0018	--------
21.33	3.3285	1.0659	0.0053	0.0034	0.0018	--------
21.42	3.3337	1.0693	0.0052	0.0034	0.0018	--------
21.50	3.3390	1.0728	0.0053	0.0034	0.0018	--------
21.58	3.3443	1.0762	0.0053	0.0034	0.0018	--------
21.67	3.3495	1.0797	0.0052	0.0034	0.0018	--------
21.75	3.3547	1.0831	0.0052	0.0034	0.0018	--------
21.83	3.3600	1.0866	0.0053	0.0034	0.0018	--------
21.92	3.3652	1.0900	0.0052	0.0035	0.0018	--------
22.00	3.3705	1.0935	0.0053	0.0035	0.0018	--------
22.08	3.3757	1.0969	0.0052	0.0035	0.0018	--------
22.17	3.3810	1.1004	0.0053	0.0035	0.0018	--------
22.25	3.3863	1.1038	0.0053	0.0035	0.0018	--------
22.33	3.3915	1.1073	0.0052	0.0035	0.0018	--------
22.42	3.3967	1.1108	0.0053	0.0035	0.0018	--------
22.50	3.4020	1.1143	0.0053	0.0035	0.0018	--------
22.58	3.4073	1.1177	0.0053	0.0035	0.0018	--------
22.67	3.4125	1.1212	0.0052	0.0035	0.0018	--------
22.75	3.4177	1.1247	0.0052	0.0035	0.0018	--------
22.83	3.4230	1.1282	0.0053	0.0035	0.0018	--------
22.92	3.4282	1.1317	0.0052	0.0035	0.0018	--------
23.00	3.4335	1.1352	0.0053	0.0035	0.0018	--------
23.08	3.4393	1.1390	0.0058	0.0039	0.0020	--------
23.17	3.4452	1.1429	0.0058	0.0039	0.0019	--------
23.25	3.4510	1.1468	0.0058	0.0039	0.0019	--------
23.33	3.4568	1.1507	0.0058	0.0039	0.0019	--------
23.42	3.4627	1.1546	0.0058	0.0039	0.0019	--------
23.50	3.4685	1.1585	0.0058	0.0039	0.0019	--------
23.58	3.4737	1.1620	0.0052	0.0035	0.0017	--------
23.67	3.4790	1.1655	0.0053	0.0035	0.0017	--------
23.75	3.4843	1.1691	0.0053	0.0035	0.0017	--------
23.83	3.4895	1.1726	0.0052	0.0035	0.0017	--------
23.92	3.4947	1.1761	0.0052	0.0035	0.0017	--------
24.00	3.5000	1.1796	0.0053	0.0035	0.0017	--------

```
--------------------------------------------------------------------
--------------------------------------------------------------------
Total soil rain loss =      2.32(In)
Total effective runoff =      1.18(In)
---------------------------------------------------------------------
Peak flow rate this hydrograph =         498.09(CFS)
Total runoff volume this hydrograph =       9661128.0(Ft3)
---------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                    24 - H O U R   S T O R M
               R u n o f f     H y d r o g r a p h
--------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

--------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0      125.0     250.0     375.0     500.0
-----------------------------------------------------------------------
  0+ 5       0.0000       0.00  Q         |         |         |         |
```

0+10	0.0000	0.00	Q	|	|	|	|
0+15	0.0000	0.00	Q	|	|	|	|
0+20	0.0000	0.00	Q	|	|	|	|
0+25	0.0000	0.00	Q	|	|	|	|
0+30	0.0000	0.00	Q	|	|	|	|
0+35	0.0000	0.00	Q	|	|	|	|
0+40	0.0000	0.00	Q	|	|	|	|
0+45	0.0000	0.00	Q	|	|	|	|
0+50	0.0000	0.00	Q	|	|	|	|
0+55	0.0000	0.00	Q	|	|	|	|
1+ 0	0.0000	0.00	Q	|	|	|	|
1+ 5	0.0000	0.00	Q	|	|	|	|
1+10	0.0000	0.00	Q	|	|	|	|
1+15	0.0000	0.00	Q	|	|	|	|
1+20	0.0000	0.00	Q	|	|	|	|
1+25	0.0000	0.00	Q	|	|	|	|
1+30	0.0000	0.00	Q	|	|	|	|
1+35	0.0000	0.00	Q	|	|	|	|
1+40	0.0000	0.00	Q	|	|	|	|
1+45	0.0000	0.00	Q	|	|	|	|
1+50	0.0000	0.00	Q	|	|	|	|
1+55	0.0000	0.00	Q	|	|	|	|
2+ 0	0.0000	0.00	Q	|	|	|	|
2+ 5	0.0000	0.00	Q	|	|	|	|
2+10	0.0000	0.00	Q	|	|	|	|
2+15	0.0000	0.00	Q	|	|	|	|
2+20	0.0000	0.00	Q	|	|	|	|
2+25	0.0000	0.00	Q	|	|	|	|
2+30	0.0000	0.00	Q	|	|	|	|
2+35	0.0000	0.00	Q	|	|	|	|
2+40	0.0000	0.00	Q	|	|	|	|
2+45	0.0000	0.00	Q	|	|	|	|
2+50	0.0000	0.00	Q	|	|	|	|
2+55	0.0000	0.00	Q	|	|	|	|
3+ 0	0.0000	0.00	Q	|	|	|	|
3+ 5	0.0000	0.00	Q	|	|	|	|
3+10	0.0000	0.00	Q	|	|	|	|
3+15	0.0000	0.00	Q	|	|	|	|
3+20	0.0000	0.00	Q	|	|	|	|
3+25	0.0000	0.00	Q	|	|	|	|
3+30	0.0000	0.00	Q	|	|	|	|
3+35	0.0000	0.00	Q	|	|	|	|
3+40	0.0000	0.00	Q	|	|	|	|
3+45	0.0000	0.00	Q	|	|	|	|
3+50	0.0000	0.00	Q	|	|	|	|
3+55	0.0000	0.00	Q	|	|	|	|
4+ 0	0.0000	0.00	Q	|	|	|	|
4+ 5	0.0000	0.00	Q	|	|	|	|
4+10	0.0000	0.00	Q	|	|	|	|
4+15	0.0000	0.00	Q	|	|	|	|
4+20	0.0000	0.00	Q	|	|	|	|
4+25	0.0000	0.00	Q	|	|	|	|
4+30	0.0000	0.00	Q	|	|	|	|
4+35	0.0000	0.00	Q	|	|	|	|
4+40	0.0000	0.00	Q	|	|	|	|
4+45	0.0000	0.00	Q	|	|	|	|
4+50	0.0000	0.00	Q	|	|	|	|
4+55	0.0000	0.00	Q	|	|	|	|
5+ 0	0.0000	0.00	Q	|	|	|	|
5+ 5	0.0000	0.00	Q	|	|	|	|
5+10	0.0000	0.00	Q	|	|	|	|
5+15	0.0000	0.00	Q	|	|	|	|
5+20	0.0000	0.00	Q	|	|	|	|

```
 5+25       0.0000      0.00  Q         |         |         |         |
 5+30       0.0000      0.00  Q         |         |         |         |
 5+35       0.0000      0.00  Q         |         |         |         |
 5+40       0.0000      0.00  Q         |         |         |         |
 5+45       0.0000      0.00  Q         |         |         |         |
 5+50       0.0000      0.00  Q         |         |         |         |
 5+55       0.0000      0.00  Q         |         |         |         |
 6+ 0       0.0000      0.00  Q         |         |         |         |
 6+ 5       0.0000      0.00  Q         |         |         |         |
 6+10       0.0000      0.00  Q         |         |         |         |
 6+15       0.0000      0.00  Q         |         |         |         |
 6+20       0.0000      0.00  Q         |         |         |         |
 6+25       0.0000      0.00  Q         |         |         |         |
 6+30       0.0000      0.00  Q         |         |         |         |
 6+35       0.0000      0.00  Q         |         |         |         |
 6+40       0.0000      0.00  Q         |         |         |         |
 6+45       0.0000      0.00  Q         |         |         |         |
 6+50       0.0000      0.00  Q         |         |         |         |
 6+55       0.0000      0.00  Q         |         |         |         |
 7+ 0       0.0000      0.00  Q         |         |         |         |
 7+ 5       0.0000      0.00  Q         |         |         |         |
 7+10       0.0000      0.00  Q         |         |         |         |
 7+15       0.0000      0.00  Q         |         |         |         |
 7+20       0.0000      0.00  Q         |         |         |         |
 7+25       0.0000      0.00  Q         |         |         |         |
 7+30       0.0000      0.00  Q         |         |         |         |
 7+35       0.0000      0.01  Q         |         |         |         |
 7+40       0.0003      0.04  Q         |         |         |         |
 7+45       0.0012      0.13  Q         |         |         |         |
 7+50       0.0034      0.32  Q         |         |         |         |
 7+55       0.0082      0.70  Q         |         |         |         |
 8+ 0       0.0181      1.44  Q         |         |         |         |
 8+ 5       0.0380      2.88  Q         |         |         |         |
 8+10       0.0748      5.34  Q         |         |         |         |
 8+15       0.1374      9.10  Q         |         |         |         |
 8+20       0.2350     14.17  VQ        |         |         |         |
 8+25       0.3773     20.66  VQ        |         |         |         |
 8+30       0.5773     29.04  V Q       |         |         |         |
 8+35       0.8497     39.56  V  Q      |         |         |         |
 8+40       1.2101     52.33  V   Q     |         |         |         |
 8+45       1.6716     67.01  V    Q    |         |         |         |
 8+50       2.2434     83.04  V     Q   |         |         |         |
 8+55       2.9351    100.43  V       Q |         |         |         |
 9+ 0       3.7631    120.23  V        Q|         |         |         |
 9+ 5       4.7470    142.87  V         |Q        |         |         |
 9+10       5.9070    168.43  |V        |  Q      |         |         |
 9+15       7.2539    195.58  |V        |    Q    |         |         |
 9+20       8.7915    223.26  |V        |      Q  |         |         |
 9+25      10.5199    250.97  |V        |         Q         |         |
 9+30      12.4427    279.19  | V       |         | Q       |         |
 9+35      14.5655    308.22  | V       |         |   Q     |         |
 9+40      16.8938    338.07  |  V      |         |      Q  |         |
 9+45      19.4237    367.35  |  V      |         |        Q|         |
 9+50      22.1476    395.51  |  V      |         |         |Q        |
 9+55      25.0505    421.50  |   V     |         |         |  Q      |
10+ 0      28.1054    443.57  |    V    |         |         |    Q    |
10+ 5      31.2826    461.33  |    V    |         |         |     Q   |
10+10      34.5527    474.82  |     V   |         |         |      Q  |
10+15      37.8924    484.92  |     V   |         |         |       Q |
10+20      41.2885    493.11  |      V  |         |         |        Q|
10+25      44.7188    498.09  |       V |         |         |        Q|
10+30      48.1240    494.43  |       V |         |         |        Q|
10+35      51.4368    481.02  |        V|         |         |       Q |
```

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10+40      54.5931    458.29  |        V|         |         |     Q   |
10+45      57.5747    432.93  |         V         |         |   Q     |
10+50      60.3954    409.57  |         V         |         | Q       |
10+55      63.0812    389.98  |         |V        |         |Q        |
11+ 0      65.6434    372.02  |         |V        |        Q|         |
11+ 5      68.0745    352.99  |         | V       |       Q |         |
11+10      70.3621    332.17  |         | V       |     Q   |         |
11+15      72.5170    312.89  |         |  V      |    Q    |         |
11+20      74.5538    295.74  |         |  V      |  Q      |         |
11+25      76.4912    281.32  |         |  V      | Q       |         |
11+30      78.3429    268.86  |         |   V     |Q        |         |
11+35      80.1123    256.92  |         |   V     Q         |         |
11+40      81.8028    245.46  |         |   V    Q|         |         |
11+45      83.4227    235.22  |         |    V  Q |         |         |
11+50      84.9804    226.18  |         |    V  Q |         |         |
11+55      86.4865    218.68  |         |    V Q  |         |         |
12+ 0      87.9474    212.12  |         |    VQ   |         |         |
12+ 5      89.3663    206.03  |         |     Q   |         |         |
12+10      90.7462    200.37  |         |     Q   |         |         |
12+15      92.0917    195.36  |         |    QV   |         |         |
12+20      93.4075    191.05  |         |    QV   |         |         |
12+25      94.6993    187.57  |         |    Q V  |         |         |
12+30      95.9726    184.87  |         |   Q  V  |         |         |
12+35      97.2295    182.51  |         |   Q  V  |         |         |
12+40      98.4719    180.40  |         |   Q  V  |         |         |
12+45      99.7014    178.52  |         |   Q  V  |         |         |
12+50     100.9198    176.91  |         |   Q   V |         |         |
12+55     102.1292    175.60  |         |   Q   V |         |         |
13+ 0     103.3308    174.47  |         |  Q    V |         |         |
13+ 5     104.5244    173.30  |         |  Q    V |         |         |
13+10     105.7093    172.05  |         |  Q     V|         |         |
13+15     106.8857    170.82  |         |  Q     V|         |         |
13+20     108.0543    169.68  |         |  Q     V|         |         |
13+25     109.2155    168.60  |         |  Q     V|         |         |
13+30     110.3675    167.27  |         |  Q     V|         |         |
13+35     111.5075    165.54  |         |  Q      V         |         |
13+40     112.6331    163.43  |         |  Q      V         |         |
13+45     113.7440    161.31  |         | Q       V         |         |
13+50     114.8419    159.42  |         | Q       V         |         |
13+55     115.9291    157.85  |         | Q       V         |         |
14+ 0     117.0064    156.42  |         | Q       |V        |         |
14+ 5     118.0737    154.98  |         | Q       |V        |         |
14+10     119.1307    153.48  |         | Q       |V        |         |
14+15     120.1791    152.23  |         | Q       |V        |         |
14+20     121.2211    151.30  |         | Q       |V        |         |
14+25     122.2602    150.87  |         | Q       | V       |         |
14+30     123.3018    151.25  |         | Q       | V       |         |
14+35     124.3501    152.20  |         | Q       | V       |         |
14+40     125.4079    153.60  |         | Q       | V       |         |
14+45     126.4740    154.81  |         | Q       | V       |         |
14+50     127.5448    155.47  |         | Q       |  V      |         |
14+55     128.6119    154.94  |         | Q       |  V      |         |
15+ 0     129.6583    151.94  |         | Q       |  V      |         |
15+ 5     130.6684    146.67  |         |Q        |  V      |         |
15+10     131.6292    139.51  |         |Q        |  V      |         |
15+15     132.5399    132.22  |         Q         |  V      |         |
15+20     133.4084    126.10  |         Q         |   V     |         |
15+25     134.2496    122.15  |        Q|         |   V     |         |
15+30     135.0845    121.23  |        Q|         |   V     |         |
15+35     135.9297    122.73  |        Q|         |   V     |         |
15+40     136.7981    126.09  |         Q         |   V     |         |
15+45     137.6953    130.28  |         Q         |   V     |         |
15+50     138.6185    134.05  |         Q         |    V    |         |
```

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15+55     139.5608    136.83   |         Q         |    V    |         |
16+ 0     140.5151    138.56   |         |Q        |    V    |         |
16+ 5     141.4764    139.57   |         |Q        |    V    |         |
16+10     142.4419    140.19   |         |Q        |    V    |         |
16+15     143.4084    140.34   |         |Q        |    V    |         |
16+20     144.3753    140.39   |         |Q        |     V   |         |
16+25     145.3427    140.47   |         |Q        |     V   |         |
16+30     146.3086    140.25   |         |Q        |     V   |         |
16+35     147.2717    139.85   |         |Q        |     V   |         |
16+40     148.2302    139.17   |         |Q        |     V   |         |
16+45     149.1844    138.56   |         |Q        |     V   |         |
16+50     150.1357    138.12   |         |Q        |      V  |         |
16+55     151.0858    137.96   |         |Q        |      V  |         |
17+ 0     152.0387    138.36   |         |Q        |      V  |         |
17+ 5     152.9965    139.08   |         |Q        |      V  |         |
17+10     153.9610    140.04   |         |Q        |      V  |         |
17+15     154.9315    140.92   |         |Q        |      V  |         |
17+20     155.9063    141.54   |         |Q        |       V |         |
17+25     156.8817    141.63   |         |Q        |       V |         |
17+30     157.8501    140.61   |         |Q        |       V |         |
17+35     158.8047    138.62   |         |Q        |       V |         |
17+40     159.7402    135.83   |         Q         |       V |         |
17+45     160.6556    132.92   |         Q         |       V |         |
17+50     161.5537    130.40   |         Q         |        V|         |
17+55     162.4394    128.61   |         Q         |        V|         |
18+ 0     163.3185    127.65   |         Q         |        V|         |
18+ 5     164.1949    127.24   |         Q         |        V|         |
18+10     165.0708    127.19   |         Q         |        V|         |
18+15     165.9474    127.28   |         Q         |        V|         |
18+20     166.8236    127.22   |         Q         |         V         |
18+25     167.6962    126.70   |         Q         |         V         |
18+30     168.5586    125.23   |         Q         |         V         |
18+35     169.4045    122.82   |        Q|         |         V         |
18+40     170.2285    119.65   |        Q|         |         V         |
18+45     171.0296    116.32   |        Q|         |         V         |
18+50     171.8104    113.37   |        Q|         |         V         |
18+55     172.5753    111.06   |       Q |         |         |V        |
19+ 0     173.3281    109.30   |       Q |         |         |V        |
19+ 5     174.0709    107.86   |       Q |         |         |V        |
19+10     174.8048    106.57   |       Q |         |         |V        |
19+15     175.5315    105.52   |       Q |         |         |V        |
19+20     176.2517    104.57   |       Q |         |         |V        |
19+25     176.9653    103.62   |       Q |         |         |V        |
19+30     177.6715    102.54   |       Q |         |         | V       |
19+35     178.3689    101.25   |       Q |         |         | V       |
19+40     179.0563     99.82   |      Q  |         |         | V       |
19+45     179.7344     98.46   |      Q  |         |         | V       |
19+50     180.4047     97.32   |      Q  |         |         | V       |
19+55     181.0699     96.59   |      Q  |         |         | V       |
20+ 0     181.7336     96.37   |      Q  |         |         | V       |
20+ 5     182.3991     96.63   |      Q  |         |         | V       |
20+10     183.0690     97.27   |      Q  |         |         |  V      |
20+15     183.7448     98.13   |      Q  |         |         |  V      |
20+20     184.4266     99.00   |      Q  |         |         |  V      |
20+25     185.1143     99.84   |      Q  |         |         |  V      |
20+30     185.8091    100.90   |       Q |         |         |  V      |
20+35     186.5128    102.17   |       Q |         |         |  V      |
20+40     187.2269    103.69   |       Q |         |         |  V      |
20+45     187.9508    105.11   |       Q |         |         |  V      |
20+50     188.6830    106.32   |       Q |         |         |   V     |
20+55     189.4211    107.17   |       Q |         |         |   V     |
21+ 0     190.1614    107.49   |       Q |         |         |   V     |
21+ 5     190.9008    107.37   |       Q |         |         |   V     |
```

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21+10      191.6368     106.87  |       Q |         |         |   V     |
21+15      192.3680     106.17  |       Q |         |         |   V     |
21+20      193.0946     105.49  |       Q |         |         |   V     |
21+25      193.8165     104.83  |       Q |         |         |   V     |
21+30      194.5329     104.02  |       Q |         |         |    V    |
21+35      195.2421     102.97  |       Q |         |         |    V    |
21+40      195.9423     101.67  |       Q |         |         |    V    |
21+45      196.6338     100.40  |       Q |         |         |    V    |
21+50      197.3175      99.27  |      Q  |         |         |    V    |
21+55      197.9950      98.38  |      Q  |         |         |    V    |
22+ 0      198.6678      97.69  |      Q  |         |         |    V    |
22+ 5      199.3366      97.11  |      Q  |         |         |    V    |
22+10      200.0019      96.61  |      Q  |         |         |     V   |
22+15      200.6646      96.21  |      Q  |         |         |     V   |
22+20      201.3249      95.88  |      Q  |         |         |     V   |
22+25      201.9833      95.61  |      Q  |         |         |     V   |
22+30      202.6402      95.38  |      Q  |         |         |     V   |
22+35      203.2957      95.18  |      Q  |         |         |     V   |
22+40      203.9502      95.03  |      Q  |         |         |     V   |
22+45      204.6039      94.91  |      Q  |         |         |     V   |
22+50      205.2569      94.82  |      Q  |         |         |      V  |
22+55      205.9095      94.76  |      Q  |         |         |      V  |
23+ 0      206.5620      94.74  |      Q  |         |         |      V  |
23+ 5      207.2146      94.76  |      Q  |         |         |      V  |
23+10      207.8676      94.82  |      Q  |         |         |      V  |
23+15      208.5216      94.95  |      Q  |         |         |      V  |
23+20      209.1769      95.15  |      Q  |         |         |      V  |
23+25      209.8344      95.48  |      Q  |         |         |      V  |
23+30      210.4966      96.14  |      Q  |         |         |      V  |
23+35      211.1654      97.11  |      Q  |         |         |       V |
23+40      211.8427      98.34  |      Q  |         |         |       V |
23+45      212.5283      99.55  |      Q  |         |         |       V |
23+50      213.2210     100.57  |       Q |         |         |       V |
23+55      213.9183     101.25  |       Q |         |         |       V |
24+ 0      214.6166     101.40  |       Q |         |         |       V |
24+ 5      215.3118     100.95  |       Q |         |         |       V |
24+10      216.0001      99.94  |      Q  |         |         |       V |
24+15      216.6771      98.30  |      Q  |         |         |        V|
24+20      217.3398      96.22  |      Q  |         |         |        V|
24+25      217.9812      93.14  |      Q  |         |         |        V|
24+30      218.5830      87.37  |     Q   |         |         |        V|
24+35      219.1258      78.82  |     Q   |         |         |        V|
24+40      219.5925      67.77  |    Q    |         |         |        V|
24+45      219.9813      56.46  |   Q     |         |         |        V|
24+50      220.3010      46.41  |  Q      |         |         |        V|
24+55      220.5653      38.38  |  Q      |         |         |        V|
25+ 0      220.7873      32.24  | Q       |         |         |        V|
25+ 5      220.9740      27.10  | Q       |         |         |        V|
25+10      221.1295      22.58  |Q        |         |         |        V|
25+15      221.2601      18.97  |Q        |         |         |        V|
25+20      221.3693      15.86  |Q        |         |         |        V|
25+25      221.4601      13.18  |Q        |         |         |        V|
25+30      221.5352      10.91  Q         |         |         |        V|
25+35      221.5964       8.89  Q         |         |         |        V|
25+40      221.6460       7.19  Q         |         |         |        V|
25+45      221.6854       5.72  Q         |         |         |        V|
25+50      221.7160       4.44  Q         |         |         |        V|
25+55      221.7395       3.42  Q         |         |         |        V|
26+ 0      221.7571       2.55  Q         |         |         |        V|
26+ 5      221.7698       1.84  Q         |         |         |        V|
26+10      221.7786       1.28  Q         |         |         |        V|
26+15      221.7843       0.83  Q         |         |         |        V|
26+20      221.7874       0.46  Q         |         |         |        V|
```

```
   26+25     221.7886      0.17  Q          |         |         |        V|
   26+30     221.7890      0.05  Q          |         |         |        V|
-----------------------------------------------------------------------
```

```
        U N I T   H Y D R O G R A P H   A N A L Y S I S
Copyright (c) CIVILCADD/CIVILDESIGN, 1990 - 2004, Version 7.0
                Study date  09/08/10  File: mccain2100yr6hr.out

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Program License Serial Number 4055

----------------------------------------------------------------------
Tule Wind Project
McCain Valley Crossing 2
Proposed Conditions 100 Yr 6 Hr
Aug 18, 2010
----------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

Storm Event Year = 100

Antecedent Moisture Condition = 2

 English (in-lb) Input Units Used

 English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:
        Sub-Area(Ac.)       Rainfall (In)
          2256.19             3.00

Rainfall Distribution pattern used in study:
Type B for SCS (small dam) or San Diego 6 hour storms
---------------------------------------------------------------------
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

********* Area-Averaged SCS Curve Number and Fm *********

Area       Area          SCS CN    SCS CN    Fm      Soil
(Ac.)      fract         (AMC2)    (AMC2)   (In/Hr)  Group
  2256.19   1.000         83.0      83.0     0.050    C

Area-averaged catchment SCS Curve Number AMC(2) = 83.000
Area-averaged Fm value using values listed =  0.050(In/Hr)
+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Direct entry of lag time by user
Watershed area =    2256.19(Ac.)
Catchment Lag time =   0.770 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 10.8253
Hydrograph baseflow =     0.00(CFS)
Minimum watershed loss rate(Fm) =  0.000(In/Hr)
Average adjusted SCS Curve Number = 83.000

Rainfall depth area reduction factors:
Using a total area of    2256.19(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study =    3.000(In)
Adjusted rainfall =    3.000(In)
```

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H
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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 27299.90 (CFS))

0.11	0.083	0.016	49.059	0.002
0.22	0.167	0.035	109.276	0.006
0.32	0.250	0.080	251.254	0.015
0.43	0.333	0.126	398.498	0.030
0.54	0.417	0.231	728.078	0.056
0.65	0.500	0.488	1538.696	0.113
0.76	0.583	0.745	2349.140	0.199
0.87	0.667	0.971	3062.629	0.311
0.97	0.750	1.000	3155.098	0.426
1.08	0.833	0.889	2803.873	0.529
1.19	0.917	0.708	2232.509	0.611
1.30	1.000	0.541	1707.891	0.673
1.41	1.083	0.450	1421.162	0.726
1.52	1.167	0.397	1253.337	0.771
1.62	1.250	0.316	997.457	0.808
1.73	1.333	0.272	858.813	0.839
1.84	1.417	0.235	740.901	0.867
1.95	1.500	0.197	620.919	0.889
2.06	1.583	0.176	555.773	0.910
2.17	1.667	0.147	463.293	0.927
2.27	1.750	0.128	404.340	0.941
2.38	1.833	0.112	352.530	0.954
2.49	1.917	0.089	280.262	0.965
2.60	2.000	0.078	244.633	0.974
2.71	2.083	0.063	198.665	0.981
2.81	2.167	0.051	159.816	0.987
2.92	2.250	0.041	128.263	0.991
3.03	2.333	0.033	104.089	0.995
3.14	2.417	0.026	80.548	0.998
3.25	2.500	0.011	34.958	0.999
3.36	2.583	0.004	14.138	1.000

++

For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

Where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the

revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr-ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0175	0.0000	0.0175	0.0000	0.0175	--------
0.17	0.0350	0.0000	0.0175	0.0000	0.0175	--------
0.25	0.0525	0.0000	0.0175	0.0000	0.0175	--------
0.33	0.0700	0.0000	0.0175	0.0000	0.0175	--------
0.42	0.0875	0.0000	0.0175	0.0000	0.0175	--------
0.50	0.1050	0.0000	0.0175	0.0000	0.0175	--------
0.58	0.1285	0.0000	0.0235	0.0000	0.0235	--------
0.67	0.1520	0.0000	0.0235	0.0000	0.0235	--------
0.75	0.1755	0.0000	0.0235	0.0000	0.0235	--------
0.83	0.1990	0.0000	0.0235	0.0000	0.0235	--------
0.92	0.2225	0.0000	0.0235	0.0000	0.0235	--------
1.00	0.2460	0.0000	0.0235	0.0000	0.0235	--------
1.08	0.2750	0.0000	0.0290	0.0000	0.0290	--------
1.17	0.3040	0.0000	0.0290	0.0000	0.0290	--------
1.25	0.3330	0.0000	0.0290	0.0000	0.0290	--------
1.33	0.3620	0.0000	0.0290	0.0000	0.0290	--------
1.42	0.3910	0.0000	0.0290	0.0000	0.0290	--------
1.50	0.4200	0.0001	0.0290	0.0001	0.0289	--------
1.58	0.4650	0.0015	0.0450	0.0014	0.0436	--------
1.67	0.5100	0.0047	0.0450	0.0032	0.0418	--------
1.75	0.5550	0.0096	0.0450	0.0049	0.0401	--------
1.83	0.6000	0.0162	0.0450	0.0066	0.0384	--------
1.92	0.6450	0.0243	0.0450	0.0081	0.0369	--------
2.00	0.6900	0.0338	0.0450	0.0095	0.0355	--------
2.08	0.8750	0.0862	0.1850	0.0524	0.1326	--------
2.17	1.0600	0.1567	0.1850	0.0706	0.1144	--------
2.25	1.2450	0.2420	0.1850	0.0853	0.0997	--------
2.33	1.4300	0.3393	0.1850	0.0973	0.0877	--------
2.42	1.6150	0.4466	0.1850	0.1073	0.0777	--------
2.50	1.8000	0.5622	0.1850	0.1156	0.0694	--------
2.58	1.8500	0.5947	0.0500	0.0325	0.0175	--------
2.67	1.9000	0.6277	0.0500	0.0330	0.0170	--------
2.75	1.9500	0.6612	0.0500	0.0335	0.0165	--------
2.83	2.0000	0.6951	0.0500	0.0339	0.0161	--------
2.92	2.0500	0.7295	0.0500	0.0344	0.0156	--------
3.00	2.1000	0.7643	0.0500	0.0348	0.0152	--------
3.08	2.1405	0.7928	0.0405	0.0285	0.0120	--------
3.17	2.1810	0.8215	0.0405	0.0287	0.0118	--------
3.25	2.2215	0.8505	0.0405	0.0290	0.0115	--------
3.33	2.2620	0.8797	0.0405	0.0292	0.0113	--------
3.42	2.3025	0.9091	0.0405	0.0294	0.0111	--------
3.50	2.3430	0.9388	0.0405	0.0297	0.0108	--------
3.58	2.3700	0.9587	0.0270	0.0199	0.0071	--------
3.67	2.3970	0.9787	0.0270	0.0200	0.0070	--------
3.75	2.4240	0.9988	0.0270	0.0201	0.0069	--------
3.83	2.4510	1.0190	0.0270	0.0202	0.0068	--------
3.92	2.4780	1.0392	0.0270	0.0203	0.0067	--------
4.00	2.5050	1.0596	0.0270	0.0204	0.0066	--------
4.08	2.5275	1.0766	0.0225	0.0170	0.0055	--------
4.17	2.5500	1.0937	0.0225	0.0171	0.0054	--------
4.25	2.5725	1.1109	0.0225	0.0171	0.0054	--------
4.33	2.5950	1.1281	0.0225	0.0172	0.0053	--------
4.42	2.6175	1.1453	0.0225	0.0173	0.0052	--------
4.50	2.6400	1.1627	0.0225	0.0173	0.0052	--------

```
    4.58   2.6615    1.1793    0.0215    0.0166    0.0049 --------
    4.67   2.6830    1.1959    0.0215    0.0166    0.0049 --------
    4.75   2.7045    1.2126    0.0215    0.0167    0.0048 --------
    4.83   2.7260    1.2293    0.0215    0.0167    0.0048 --------
    4.92   2.7475    1.2461    0.0215    0.0168    0.0047 --------
    5.00   2.7690    1.2630    0.0215    0.0168    0.0047 --------
    5.08   2.7875    1.2775    0.0185    0.0145    0.0040 --------
    5.17   2.8060    1.2920    0.0185    0.0146    0.0039 --------
    5.25   2.8245    1.3066    0.0185    0.0146    0.0039 --------
    5.33   2.8430    1.3212    0.0185    0.0146    0.0039 --------
    5.42   2.8615    1.3359    0.0185    0.0147    0.0038 --------
    5.50   2.8800    1.3506    0.0185    0.0147    0.0038 --------
    5.58   2.9000    1.3665    0.0200    0.0159    0.0041 --------
    5.67   2.9200    1.3824    0.0200    0.0159    0.0041 --------
    5.75   2.9400    1.3984    0.0200    0.0160    0.0040 --------
    5.83   2.9600    1.4144    0.0200    0.0160    0.0040 --------
    5.92   2.9800    1.4305    0.0200    0.0160    0.0040 --------
    6.00   3.0000    1.4466    0.0200    0.0161    0.0039 --------
  --------------------------------------------------------------------
  --------------------------------------------------------------------
  Total soil rain loss =      1.55(In)
  Total effective runoff =      1.45(In)
  ---------------------------------------------------------------------
  Peak flow rate this hydrograph =        1561.68(CFS)
  Total runoff volume this hydrograph =       11847327.4(Ft3)
  ---------------------------------------------------------------------
  ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                     6 - H O U R   S T O R M
                  R u n o f f     H y d r o g r a p h
  --------------------------------------------------------------------
              Hydrograph in   5   Minute intervals ((CFS))

  --------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0      400.0     800.0    1200.0    1600.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  Q         |         |         |         |
  0+10       0.0000      0.00  Q         |         |         |         |
  0+15       0.0000      0.00  Q         |         |         |         |
  0+20       0.0000      0.00  Q         |         |         |         |
  0+25       0.0000      0.00  Q         |         |         |         |
  0+30       0.0000      0.00  Q         |         |         |         |
  0+35       0.0000      0.00  Q         |         |         |         |
  0+40       0.0000      0.00  Q         |         |         |         |
  0+45       0.0000      0.00  Q         |         |         |         |
  0+50       0.0000      0.00  Q         |         |         |         |
  0+55       0.0000      0.00  Q         |         |         |         |
  1+ 0       0.0000      0.00  Q         |         |         |         |
  1+ 5       0.0000      0.00  Q         |         |         |         |
  1+10       0.0000      0.00  Q         |         |         |         |
  1+15       0.0000      0.00  Q         |         |         |         |
  1+20       0.0000      0.00  Q         |         |         |         |
  1+25       0.0000      0.00  Q         |         |         |         |
  1+30       0.0000      0.00  Q         |         |         |         |
  1+35       0.0005      0.07  Q         |         |         |         |
  1+40       0.0028      0.33  Q         |         |         |         |
  1+45       0.0094      0.97  Q         |         |         |         |
  1+50       0.0251      2.27  Q         |         |         |         |
  1+55       0.0578      4.75  Q         |         |         |         |
  2+ 0       0.1239      9.60  Q         |         |         |         |
  2+ 5       0.2636     20.28  Q         |         |         |         |
  2+10       0.5337     39.23  Q         |         |         |         |
  2+15       1.0220     70.90  VQ        |         |         |         |
  2+20       1.8267    116.83  V Q       |         |         |         |
```

```
2+25       3.1017    185.13  V   Q     |         |         |         |
2+30       5.1615    299.10  V      Q  |         |         |         |
2+35       8.3660    465.28  |V        |Q        |         |         |
2+40      13.0999    687.37  |V        |      Q  |         |         |
2+45      19.5562    937.45  | V       |         |  Q      |         |
2+50      27.7523   1190.07  |   V     |         |        Q|         |
2+55      37.4430   1407.08  |    V    |         |         |    Q    |
3+ 0      47.9961   1532.32  |      V  |         |         |       Q |
3+ 5      58.7515   1561.68  |       V |         |         |        Q|
3+10      69.0923   1501.48  |         V         |         |      Q  |
3+15      78.7337   1399.93  |         |V        |         |   Q     |
3+20      87.6911   1300.62  |         | V       |         | Q       |
3+25      96.1373   1226.39  |         |   V     |         Q         |
3+30     104.2226   1173.99  |         |    V    |        Q|         |
3+35     111.9840   1126.95  |         |     V   |       Q |         |
3+40     119.3960   1076.23  |         |      V  |     Q   |         |
3+45     126.5260   1035.27  |         |       V |    Q    |         |
3+50     133.4025    998.47  |         |        V|   Q     |         |
3+55     140.0401    963.78  |         |         V   Q     |         |
4+ 0     146.4322    928.13  |         |         |V Q      |         |
4+ 5     152.5290    885.26  |         |         | Q       |         |
4+10     158.3024    838.31  |         |         Q  V      |         |
4+15     163.7539    791.55  |         |        Q|   V     |         |
4+20     168.9101    748.69  |         |       Q |   V     |         |
4+25     173.8242    713.53  |         |      Q  |    V    |         |
4+30     178.5094    680.28  |         |      Q  |     V   |         |
4+35     182.9723    648.01  |         |     Q   |     V   |         |
4+40     187.2149    616.03  |         |    Q    |      V  |         |
4+45     191.2600    587.34  |         |   Q     |       V |         |
4+50     195.1312    562.10  |         |   Q     |       V |         |
4+55     198.8582    541.16  |         |  Q      |        V|         |
5+ 0     202.4814    526.09  |         |  Q      |        V|         |
5+ 5     206.0187    513.62  |         | Q       |         V         |
5+10     209.4844    503.21  |         | Q       |         V         |
5+15     212.8858    493.89  |         | Q       |         |V        |
5+20     216.2295    485.51  |         | Q       |         |V        |
5+25     219.5211    477.93  |         |Q        |         | V       |
5+30     222.7567    469.81  |         |Q        |         | V       |
5+35     225.9301    460.78  |         |Q        |         |  V      |
5+40     229.0360    450.97  |         |Q        |         |  V      |
5+45     232.0782    441.73  |         |Q        |         |   V     |
5+50     235.0667    433.93  |         Q         |         |   V     |
5+55     238.0168    428.37  |         Q         |         |    V    |
6+ 0     240.9481    425.62  |         Q         |         |    V    |
6+ 5     243.8690    424.11  |         Q         |         |    V    |
6+10     246.7835    423.19  |         Q         |         |     V   |
6+15     249.6817    420.82  |         Q         |         |     V   |
6+20     252.5473    416.09  |         Q         |         |      V  |
6+25     255.3417    405.75  |         Q         |         |      V  |
6+30     257.9736    382.15  |        Q|         |         |      V  |
6+35     260.3519    345.34  |       Q |         |         |       V |
6+40     262.3976    297.03  |      Q  |         |         |       V |
6+45     264.0986    246.99  |     Q   |         |         |       V |
6+50     265.4929    202.46  |    Q    |         |         |        V|
6+55     266.6437    167.09  |   Q     |         |         |        V|
7+ 0     267.6084    140.08  |  Q      |         |         |        V|
7+ 5     268.4188    117.66  | Q       |         |         |        V|
7+10     269.0930     97.90  | Q       |         |         |        V|
7+15     269.6593     82.22  | Q       |         |         |        V|
7+20     270.1327     68.73  |Q        |         |         |        V|
7+25     270.5258     57.09  |Q        |         |         |        V|
7+30     270.8524     47.41  |Q        |         |         |        V|
7+35     271.1193     38.76  Q         |         |         |        V|
```

```
     7+40      271.3368      31.57  Q          |         |         |       V|
     7+45      271.5108      25.28  Q          |         |         |       V|
     7+50      271.6470      19.77  Q          |         |         |       V|
     7+55      271.7530      15.39  Q          |         |         |       V|
     8+ 0      271.8324      11.53  Q          |         |         |       V|
     8+ 5      271.8900       8.37  Q          |         |         |       V|
     8+10      271.9300       5.81  Q          |         |         |       V|
     8+15      271.9559       3.75  Q          |         |         |       V|
     8+20      271.9702       2.08  Q          |         |         |       V|
     8+25      271.9756       0.79  Q          |         |         |       V|
     8+30      271.9772       0.23  Q          |         |         |        V
-----------------------------------------------------------------------
```

U N I T   H Y D R O G R A P H   A N A L Y S I S

Study date 09/08/10 File: mccain2100yr24hr.out

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Program License Serial Number 4055

Tule Wind Project
McCain Valley Crossing 2
Proposed Conditions 100 Yr 24 Hr
Aug 18, 2010

++

Storm Event Year = 100

Antecedent Moisture Condition = 2

English (in-lb) Input Units Used

English Rainfall Data (Inches) Input Values Used

Area averaged rainfall isohyetal data:

Sub-Area(Ac.)	Rainfall (In)
2256.19	5.07

Rainfall Distribution pattern used in study:
Type B for San Diego area of California

+++

********* Area-Averaged SCS Curve Number and Fm *********

Area (Ac.)	Area fract	SCS CN (AMC2)	SCS CN (AMC2)	Fm (In/Hr)	Soil Group
2256.19	1.000	83.0	83.0	0.050	C

Area-averaged catchment SCS Curve Number AMC(2) = 83.000
Area-averaged Fm value using values listed = 0.050(In/Hr)
+++
Direct entry of lag time by user
Watershed area =   2256.19(Ac.)
Catchment Lag time =   0.770 hours
Unit interval =   5.000 minutes
Unit interval percentage of lag time = 10.8225
Hydrograph baseflow =   0.00(CFS)
Minimum watershed loss rate(Fm) = 0.000(In/Hr)
Average adjusted SCS Curve Number = 83.000

Rainfall depth area reduction factors:
Using a total area of   2256.19(Ac.) (Ref: SCS Sup A, Sec.4)

Pacific Coastal Climate ratio used
Areal factor ratio (rainfall reduction) = 1.000
Rainfall entered for study =   5.070(In)
Adjusted rainfall =   5.070(In)

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The following unit hydrograph was developed using an S-Graph interpolated by time percentage of lag time vs. percentage of peak flow. The S-Graphs for Valley, Foothill, and Mountain were developed by the U.S. Army Corps of Engineers for use in the respective type of basins located in Southern California. (Hydrology San Gabrial River ... U.S. Engineer Office, Dec 1944, revised Jul 1946) The Desert S-Graph is from Report ... on ... Tahquitz Creek, California, same U.S. offfice, Corps of Engineers, June 1963. The Valley Developed S-Graph is used by Orange and San Bernardino counties in California to represent the characteristics of valley areas with a large amount of development. Because of the wide variety in topography in Southern California, these synthetic unit hydrographs were included for use as options in any geographic location.

The SCS(Soil Conservation Service Dimensionless S-Graph, SCS handbook, of 1972, applies to a broad cross section of geographic locations and hydrologic regions.

The User Defined hydrograph converts the user Q/Qp vs. T/Tp values into an S-Graph based on lag = Tp/0.9. Then, for the lag time used, the S-Graph in interpolated in time % of lag.

The following S-Graph or S-Graph combination is used in this study:

SAN DIEGO CO. HYDROGRAPH

San Deigo Co. Unit Hydrograph Data (III-A-2):
using a constant T/Tp step interval = 0.200

t/tp	q/qp	Sum q/qp
0.000	0.000	0.000
0.200	0.030	0.000
0.400	0.090	0.030
0.600	0.230	0.120
0.800	0.700	0.350
1.000	1.000	1.050
1.200	0.850	2.050
1.400	0.530	2.900
1.600	0.410	3.430
1.800	0.300	3.840
2.000	0.230	4.140
2.200	0.180	4.370
2.400	0.140	4.550
2.600	0.110	4.690
2.800	0.080	4.800
3.000	0.060	4.880
3.200	0.040	4.940
3.400	0.030	4.980
3.600	0.010	5.010
3.800	0.000	5.020

U N I T H Y D R O G R A P H
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Time Ratio (t/Lag)	Time (hrs)	Discharge Ratios (Q/Qp)	Q (CFS)	Mass Curve Ratios (Qa/Q)

(K = 27299.90 (CFS))

0.11	0.083	0.016	49.046	0.002
0.22	0.167	0.035	109.219	0.006
0.32	0.250	0.080	251.132	0.015
0.43	0.333	0.126	398.128	0.030
0.54	0.417	0.231	727.738	0.056
0.65	0.500	0.487	1536.327	0.113
0.76	0.583	0.744	2347.940	0.199
0.87	0.667	0.970	3060.728	0.311
0.97	0.750	1.000	3155.005	0.426
1.08	0.833	0.889	2803.538	0.529
1.19	0.917	0.708	2234.582	0.611
1.30	1.000	0.541	1707.873	0.673
1.41	1.083	0.451	1421.553	0.725
1.52	1.167	0.397	1253.877	0.771
1.62	1.250	0.316	997.605	0.808
1.73	1.333	0.272	859.451	0.839
1.84	1.417	0.235	740.970	0.866
1.95	1.500	0.197	621.203	0.889
2.06	1.583	0.176	556.068	0.910
2.16	1.667	0.147	463.377	0.927
2.27	1.750	0.128	404.721	0.941
2.38	1.833	0.112	352.648	0.954
2.49	1.917	0.089	280.530	0.965
2.60	2.000	0.078	244.854	0.974
2.71	2.083	0.063	198.748	0.981
2.81	2.167	0.051	160.175	0.987
2.92	2.250	0.041	128.318	0.991
3.03	2.333	0.033	104.199	0.995
3.14	2.417	0.026	80.877	0.998
3.25	2.500	0.011	35.096	0.999
3.35	2.583	0.005	14.372	1.000

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For each time interval of the 6 or 24 hour storm, the total rainfall up to that storm time is calculated. Then the Soil Conservation Service SCS (report 1972, 1975) area averaged Curve Number (CN) is used to determine the amount of direct runoff in (In) using the following equations:

$$Q = \frac{(P - Ia)^2}{P - Ia + S}$$

Where:
Q = direct runoff, P = depth of precipitation, Ia = Initial Abstraction and S is the watershed storage in inches. S and Ia are given by the following equations:

$$S = \frac{1000}{CN} - 10 \quad \text{and} \quad Ia = 0.2\ S$$

Note: If Metric (SI) Units are used, rainfall data is converted by the program internally into inches for these calculations.

Note: In the following printout, the revised runoff column is only used when the minimum soil loss rate, fm, exceeds the normal loss rate of delta P(dP) - delta Q(dQ) then the dP-dQ column equals fm = 0.000(In) (for time interval = 0.000(In)) and the

revised runoff is shown in the last column.

Time Period (hours)	Total Rainfall (In) P	Total SCS Runoff (In) Q	Rainfall Amount (In) dP	Runoff Amount (In) dQ	Infiltr-ation (In) dP-dQ	Revised Runoff Min Loss Rate
0.08	0.0076	0.0000	0.0076	0.0000	0.0076	--------
0.17	0.0152	0.0000	0.0076	0.0000	0.0076	--------
0.25	0.0228	0.0000	0.0076	0.0000	0.0076	--------
0.33	0.0304	0.0000	0.0076	0.0000	0.0076	--------
0.42	0.0380	0.0000	0.0076	0.0000	0.0076	--------
0.50	0.0456	0.0000	0.0076	0.0000	0.0076	--------
0.58	0.0515	0.0000	0.0059	0.0000	0.0059	--------
0.67	0.0575	0.0000	0.0059	0.0000	0.0059	--------
0.75	0.0634	0.0000	0.0059	0.0000	0.0059	--------
0.83	0.0693	0.0000	0.0059	0.0000	0.0059	--------
0.92	0.0752	0.0000	0.0059	0.0000	0.0059	--------
1.00	0.0811	0.0000	0.0059	0.0000	0.0059	--------
1.08	0.0887	0.0000	0.0076	0.0000	0.0076	--------
1.17	0.0963	0.0000	0.0076	0.0000	0.0076	--------
1.25	0.1039	0.0000	0.0076	0.0000	0.0076	--------
1.33	0.1115	0.0000	0.0076	0.0000	0.0076	--------
1.42	0.1191	0.0000	0.0076	0.0000	0.0076	--------
1.50	0.1268	0.0000	0.0076	0.0000	0.0076	--------
1.58	0.1344	0.0000	0.0076	0.0000	0.0076	--------
1.67	0.1420	0.0000	0.0076	0.0000	0.0076	--------
1.75	0.1496	0.0000	0.0076	0.0000	0.0076	--------
1.83	0.1572	0.0000	0.0076	0.0000	0.0076	--------
1.92	0.1648	0.0000	0.0076	0.0000	0.0076	--------
2.00	0.1724	0.0000	0.0076	0.0000	0.0076	--------
2.08	0.1817	0.0000	0.0093	0.0000	0.0093	--------
2.17	0.1910	0.0000	0.0093	0.0000	0.0093	--------
2.25	0.2003	0.0000	0.0093	0.0000	0.0093	--------
2.33	0.2096	0.0000	0.0093	0.0000	0.0093	--------
2.42	0.2189	0.0000	0.0093	0.0000	0.0093	--------
2.50	0.2281	0.0000	0.0093	0.0000	0.0093	--------
2.58	0.2358	0.0000	0.0076	0.0000	0.0076	--------
2.67	0.2434	0.0000	0.0076	0.0000	0.0076	--------
2.75	0.2510	0.0000	0.0076	0.0000	0.0076	--------
2.83	0.2586	0.0000	0.0076	0.0000	0.0076	--------
2.92	0.2662	0.0000	0.0076	0.0000	0.0076	--------
3.00	0.2738	0.0000	0.0076	0.0000	0.0076	--------
3.08	0.2831	0.0000	0.0093	0.0000	0.0093	--------
3.17	0.2924	0.0000	0.0093	0.0000	0.0093	--------
3.25	0.3017	0.0000	0.0093	0.0000	0.0093	--------
3.33	0.3110	0.0000	0.0093	0.0000	0.0093	--------
3.42	0.3203	0.0000	0.0093	0.0000	0.0093	--------
3.50	0.3296	0.0000	0.0093	0.0000	0.0093	--------
3.58	0.3397	0.0000	0.0101	0.0000	0.0101	--------
3.67	0.3498	0.0000	0.0101	0.0000	0.0101	--------
3.75	0.3600	0.0000	0.0101	0.0000	0.0101	--------
3.83	0.3701	0.0000	0.0101	0.0000	0.0101	--------
3.92	0.3803	0.0000	0.0101	0.0000	0.0101	--------
4.00	0.3904	0.0000	0.0101	0.0000	0.0101	--------
4.08	0.4014	0.0000	0.0110	0.0000	0.0110	--------
4.17	0.4124	0.0000	0.0110	0.0000	0.0110	--------
4.25	0.4233	0.0001	0.0110	0.0001	0.0109	--------
4.33	0.4343	0.0003	0.0110	0.0002	0.0108	--------
4.42	0.4453	0.0006	0.0110	0.0003	0.0107	--------
4.50	0.4563	0.0010	0.0110	0.0004	0.0106	--------

4.58	0.4681	0.0016	0.0118	0.0006	0.0112	--------
4.67	0.4800	0.0023	0.0118	0.0007	0.0111	--------
4.75	0.4918	0.0032	0.0118	0.0008	0.0110	--------
4.83	0.5036	0.0041	0.0118	0.0010	0.0109	--------
4.92	0.5154	0.0052	0.0118	0.0011	0.0108	--------
5.00	0.5273	0.0064	0.0118	0.0012	0.0106	--------
5.08	0.5408	0.0079	0.0135	0.0015	0.0120	--------
5.17	0.5543	0.0095	0.0135	0.0017	0.0119	--------
5.25	0.5678	0.0113	0.0135	0.0018	0.0117	--------
5.33	0.5814	0.0133	0.0135	0.0019	0.0116	--------
5.42	0.5949	0.0154	0.0135	0.0021	0.0114	--------
5.50	0.6084	0.0176	0.0135	0.0022	0.0113	--------
5.58	0.6228	0.0201	0.0144	0.0025	0.0119	--------
5.67	0.6371	0.0227	0.0144	0.0027	0.0117	--------
5.75	0.6515	0.0255	0.0144	0.0028	0.0116	--------
5.83	0.6659	0.0285	0.0144	0.0029	0.0114	--------
5.92	0.6802	0.0316	0.0144	0.0031	0.0113	--------
6.00	0.6946	0.0348	0.0144	0.0032	0.0111	--------
6.08	0.7115	0.0388	0.0169	0.0040	0.0129	--------
6.17	0.7284	0.0429	0.0169	0.0042	0.0127	--------
6.25	0.7453	0.0473	0.0169	0.0043	0.0126	--------
6.33	0.7622	0.0518	0.0169	0.0045	0.0124	--------
6.42	0.7791	0.0565	0.0169	0.0047	0.0122	--------
6.50	0.7960	0.0613	0.0169	0.0049	0.0120	--------
6.58	0.8154	0.0671	0.0194	0.0058	0.0136	--------
6.67	0.8349	0.0731	0.0194	0.0060	0.0134	--------
6.75	0.8543	0.0793	0.0194	0.0062	0.0132	--------
6.83	0.8737	0.0857	0.0194	0.0064	0.0130	--------
6.92	0.8932	0.0923	0.0194	0.0066	0.0128	--------
7.00	0.9126	0.0992	0.0194	0.0068	0.0126	--------
7.08	0.9380	0.1083	0.0254	0.0092	0.0162	--------
7.17	0.9633	0.1178	0.0253	0.0095	0.0159	--------
7.25	0.9887	0.1276	0.0254	0.0098	0.0156	--------
7.33	1.0140	0.1377	0.0253	0.0101	0.0153	--------
7.42	1.0394	0.1481	0.0253	0.0104	0.0150	--------
7.50	1.0647	0.1587	0.0253	0.0107	0.0147	--------
7.58	1.1027	0.1752	0.0380	0.0165	0.0215	--------
7.67	1.1408	0.1923	0.0380	0.0171	0.0209	--------
7.75	1.1788	0.2100	0.0380	0.0177	0.0204	--------
7.83	1.2168	0.2282	0.0380	0.0182	0.0198	--------
7.92	1.2548	0.2469	0.0380	0.0187	0.0193	--------
8.00	1.2929	0.2661	0.0380	0.0192	0.0188	--------
8.08	1.3495	0.2956	0.0566	0.0295	0.0271	--------
8.17	1.4061	0.3261	0.0566	0.0305	0.0261	--------
8.25	1.4627	0.3576	0.0566	0.0315	0.0252	--------
8.33	1.5193	0.3899	0.0566	0.0324	0.0243	--------
8.42	1.5759	0.4232	0.0566	0.0332	0.0234	--------
8.50	1.6325	0.4572	0.0566	0.0340	0.0226	--------
8.58	1.7069	0.5030	0.0744	0.0459	0.0285	--------
8.67	1.7813	0.5501	0.0744	0.0471	0.0273	--------
8.75	1.8556	0.5984	0.0744	0.0483	0.0261	--------
8.83	1.9300	0.6477	0.0744	0.0493	0.0250	--------
8.92	2.0043	0.6981	0.0744	0.0504	0.0240	--------
9.00	2.0787	0.7494	0.0744	0.0513	0.0230	--------
9.08	2.1598	0.8064	0.0811	0.0570	0.0241	--------
9.17	2.2409	0.8645	0.0811	0.0580	0.0231	--------
9.25	2.3221	0.9234	0.0811	0.0590	0.0221	--------
9.33	2.4032	0.9833	0.0811	0.0599	0.0213	--------
9.42	2.4843	1.0440	0.0811	0.0607	0.0204	--------
9.50	2.5654	1.1055	0.0811	0.0615	0.0196	--------
9.58	2.6347	1.1586	0.0693	0.0531	0.0162	--------
9.67	2.7040	1.2122	0.0693	0.0536	0.0157	--------
9.75	2.7733	1.2663	0.0693	0.0541	0.0152	--------

9.83	2.8426	1.3209	0.0693	0.0546	0.0147	--------
9.92	2.9119	1.3760	0.0693	0.0550	0.0143	--------
10.00	2.9812	1.4314	0.0693	0.0555	0.0138	--------
10.08	3.0158	1.4593	0.0346	0.0279	0.0068	--------
10.17	3.0505	1.4873	0.0346	0.0280	0.0067	--------
10.25	3.0851	1.5154	0.0346	0.0281	0.0066	--------
10.33	3.1197	1.5435	0.0346	0.0282	0.0065	--------
10.42	3.1544	1.5718	0.0346	0.0283	0.0064	--------
10.50	3.1890	1.6002	0.0346	0.0284	0.0063	--------
10.58	3.2118	1.6189	0.0228	0.0187	0.0041	--------
10.67	3.2347	1.6377	0.0228	0.0188	0.0040	--------
10.75	3.2575	1.6565	0.0228	0.0188	0.0040	--------
10.83	3.2803	1.6753	0.0228	0.0188	0.0040	--------
10.92	3.3031	1.6942	0.0228	0.0189	0.0039	--------
11.00	3.3259	1.7131	0.0228	0.0189	0.0039	--------
11.08	3.3454	1.7293	0.0194	0.0161	0.0033	--------
11.17	3.3648	1.7454	0.0194	0.0162	0.0033	--------
11.25	3.3842	1.7616	0.0194	0.0162	0.0032	--------
11.33	3.4037	1.7778	0.0194	0.0162	0.0032	--------
11.42	3.4231	1.7941	0.0194	0.0162	0.0032	--------
11.50	3.4425	1.8103	0.0194	0.0163	0.0032	--------
11.58	3.4603	1.8252	0.0177	0.0149	0.0029	--------
11.67	3.4780	1.8401	0.0177	0.0149	0.0029	--------
11.75	3.4958	1.8550	0.0177	0.0149	0.0028	--------
11.83	3.5135	1.8699	0.0177	0.0149	0.0028	--------
11.92	3.5313	1.8849	0.0177	0.0150	0.0028	--------
12.00	3.5490	1.8999	0.0177	0.0150	0.0028	--------
12.08	3.5659	1.9141	0.0169	0.0143	0.0026	--------
12.17	3.5828	1.9284	0.0169	0.0143	0.0026	--------
12.25	3.5997	1.9427	0.0169	0.0143	0.0026	--------
12.33	3.6166	1.9571	0.0169	0.0143	0.0026	--------
12.42	3.6335	1.9714	0.0169	0.0143	0.0026	--------
12.50	3.6504	1.9857	0.0169	0.0144	0.0025	--------
12.58	3.6665	1.9994	0.0161	0.0137	0.0024	--------
12.67	3.6825	2.0131	0.0161	0.0137	0.0024	--------
12.75	3.6986	2.0268	0.0161	0.0137	0.0024	--------
12.83	3.7146	2.0405	0.0161	0.0137	0.0024	--------
12.92	3.7307	2.0542	0.0161	0.0137	0.0023	--------
13.00	3.7467	2.0679	0.0161	0.0137	0.0023	--------
13.08	3.7611	2.0802	0.0144	0.0123	0.0021	--------
13.17	3.7755	2.0925	0.0144	0.0123	0.0021	--------
13.25	3.7898	2.1048	0.0144	0.0123	0.0021	--------
13.33	3.8042	2.1171	0.0144	0.0123	0.0020	--------
13.42	3.8186	2.1295	0.0144	0.0123	0.0020	--------
13.50	3.8329	2.1418	0.0144	0.0123	0.0020	--------
13.58	3.8464	2.1534	0.0135	0.0116	0.0019	--------
13.67	3.8600	2.1651	0.0135	0.0116	0.0019	--------
13.75	3.8735	2.1767	0.0135	0.0116	0.0019	--------
13.83	3.8870	2.1884	0.0135	0.0117	0.0019	--------
13.92	3.9005	2.2001	0.0135	0.0117	0.0019	--------
14.00	3.9140	2.2117	0.0135	0.0117	0.0018	--------
14.08	3.9293	2.2249	0.0152	0.0131	0.0021	--------
14.17	3.9445	2.2380	0.0152	0.0132	0.0021	--------
14.25	3.9597	2.2512	0.0152	0.0132	0.0020	--------
14.33	3.9749	2.2644	0.0152	0.0132	0.0020	--------
14.42	3.9901	2.2776	0.0152	0.0132	0.0020	--------
14.50	4.0053	2.2908	0.0152	0.0132	0.0020	--------
14.58	4.0138	2.2981	0.0085	0.0073	0.0011	--------
14.67	4.0222	2.3055	0.0084	0.0073	0.0011	--------
14.75	4.0307	2.3128	0.0084	0.0073	0.0011	--------
14.83	4.0391	2.3201	0.0084	0.0073	0.0011	--------
14.92	4.0476	2.3275	0.0084	0.0074	0.0011	--------
15.00	4.0560	2.3349	0.0084	0.0074	0.0011	--------

15.08	4.0695	2.3466	0.0135	0.0118	0.0017	--------
15.17	4.0830	2.3584	0.0135	0.0118	0.0017	--------
15.25	4.0966	2.3702	0.0135	0.0118	0.0017	--------
15.33	4.1101	2.3820	0.0135	0.0118	0.0017	--------
15.42	4.1236	2.3938	0.0135	0.0118	0.0017	--------
15.50	4.1371	2.4056	0.0135	0.0118	0.0017	--------
15.58	4.1498	2.4167	0.0127	0.0111	0.0016	--------
15.67	4.1625	2.4278	0.0127	0.0111	0.0016	--------
15.75	4.1751	2.4389	0.0127	0.0111	0.0016	--------
15.83	4.1878	2.4500	0.0127	0.0111	0.0016	--------
15.92	4.2005	2.4611	0.0127	0.0111	0.0016	--------
16.00	4.2132	2.4722	0.0127	0.0111	0.0016	--------
16.08	4.2250	2.4826	0.0118	0.0104	0.0014	--------
16.17	4.2368	2.4930	0.0118	0.0104	0.0014	--------
16.25	4.2487	2.5034	0.0118	0.0104	0.0014	--------
16.33	4.2605	2.5138	0.0118	0.0104	0.0014	--------
16.42	4.2723	2.5242	0.0118	0.0104	0.0014	--------
16.50	4.2842	2.5346	0.0118	0.0104	0.0014	--------
16.58	4.2968	2.5458	0.0127	0.0112	0.0015	--------
16.67	4.3095	2.5570	0.0127	0.0112	0.0015	--------
16.75	4.3222	2.5681	0.0127	0.0112	0.0015	--------
16.83	4.3349	2.5793	0.0127	0.0112	0.0015	--------
16.92	4.3475	2.5905	0.0127	0.0112	0.0015	--------
17.00	4.3602	2.6017	0.0127	0.0112	0.0015	--------
17.08	4.3703	2.6107	0.0101	0.0090	0.0012	--------
17.17	4.3805	2.6196	0.0101	0.0090	0.0012	--------
17.25	4.3906	2.6286	0.0101	0.0090	0.0012	--------
17.33	4.4008	2.6376	0.0101	0.0090	0.0012	--------
17.42	4.4109	2.6465	0.0101	0.0090	0.0012	--------
17.50	4.4210	2.6555	0.0101	0.0090	0.0012	--------
17.58	4.4320	2.6652	0.0110	0.0097	0.0013	--------
17.67	4.4430	2.6750	0.0110	0.0097	0.0012	--------
17.75	4.4540	2.6847	0.0110	0.0097	0.0012	--------
17.83	4.4650	2.6945	0.0110	0.0097	0.0012	--------
17.92	4.4760	2.7042	0.0110	0.0098	0.0012	--------
18.00	4.4870	2.7140	0.0110	0.0098	0.0012	--------
18.08	4.4954	2.7215	0.0084	0.0075	0.0009	--------
18.17	4.5038	2.7290	0.0084	0.0075	0.0009	--------
18.25	4.5123	2.7365	0.0085	0.0075	0.0009	--------
18.33	4.5208	2.7440	0.0084	0.0075	0.0009	--------
18.42	4.5292	2.7515	0.0084	0.0075	0.0009	--------
18.50	4.5377	2.7591	0.0084	0.0075	0.0009	--------
18.58	4.5461	2.7666	0.0085	0.0075	0.0009	--------
18.67	4.5545	2.7741	0.0084	0.0075	0.0009	--------
18.75	4.5630	2.7816	0.0085	0.0075	0.0009	--------
18.83	4.5715	2.7892	0.0084	0.0075	0.0009	--------
18.92	4.5799	2.7967	0.0084	0.0075	0.0009	--------
19.00	4.5884	2.8042	0.0084	0.0075	0.0009	--------
19.08	4.5960	2.8110	0.0076	0.0068	0.0008	--------
19.17	4.6036	2.8178	0.0076	0.0068	0.0008	--------
19.25	4.6112	2.8246	0.0076	0.0068	0.0008	--------
19.33	4.6188	2.8314	0.0076	0.0068	0.0008	--------
19.42	4.6264	2.8382	0.0076	0.0068	0.0008	--------
19.50	4.6340	2.8450	0.0076	0.0068	0.0008	--------
19.58	4.6424	2.8525	0.0085	0.0076	0.0009	--------
19.67	4.6509	2.8601	0.0084	0.0076	0.0009	--------
19.75	4.6593	2.8676	0.0085	0.0076	0.0009	--------
19.83	4.6678	2.8752	0.0084	0.0076	0.0009	--------
19.92	4.6762	2.8827	0.0084	0.0076	0.0009	--------
20.00	4.6847	2.8903	0.0084	0.0076	0.0009	--------
20.08	4.6940	2.8986	0.0093	0.0083	0.0010	--------
20.17	4.7033	2.9069	0.0093	0.0083	0.0010	--------
20.25	4.7126	2.9153	0.0093	0.0083	0.0010	--------

20.33	4.7219	2.9236	0.0093	0.0083	0.0010	--------
20.42	4.7312	2.9319	0.0093	0.0083	0.0010	--------
20.50	4.7405	2.9403	0.0093	0.0083	0.0010	--------
20.58	4.7489	2.9478	0.0084	0.0076	0.0009	--------
20.67	4.7574	2.9554	0.0084	0.0076	0.0009	--------
20.75	4.7658	2.9630	0.0084	0.0076	0.0009	--------
20.83	4.7743	2.9706	0.0085	0.0076	0.0009	--------
20.92	4.7827	2.9782	0.0084	0.0076	0.0009	--------
21.00	4.7912	2.9858	0.0084	0.0076	0.0009	--------
21.08	4.7988	2.9926	0.0076	0.0068	0.0008	--------
21.17	4.8064	2.9994	0.0076	0.0068	0.0008	--------
21.25	4.8140	3.0063	0.0076	0.0068	0.0008	--------
21.33	4.8216	3.0131	0.0076	0.0068	0.0008	--------
21.42	4.8292	3.0200	0.0076	0.0068	0.0008	--------
21.50	4.8368	3.0268	0.0076	0.0068	0.0008	--------
21.58	4.8444	3.0337	0.0076	0.0068	0.0008	--------
21.67	4.8520	3.0405	0.0076	0.0068	0.0008	--------
21.75	4.8596	3.0473	0.0076	0.0068	0.0008	--------
21.83	4.8672	3.0542	0.0076	0.0069	0.0008	--------
21.92	4.8748	3.0610	0.0076	0.0069	0.0008	--------
22.00	4.8824	3.0679	0.0076	0.0069	0.0008	--------
22.08	4.8900	3.0748	0.0076	0.0069	0.0007	--------
22.17	4.8976	3.0816	0.0076	0.0069	0.0007	--------
22.25	4.9052	3.0885	0.0076	0.0069	0.0007	--------
22.33	4.9128	3.0953	0.0076	0.0069	0.0007	--------
22.42	4.9204	3.1022	0.0076	0.0069	0.0007	--------
22.50	4.9280	3.1091	0.0076	0.0069	0.0007	--------
22.58	4.9356	3.1159	0.0076	0.0069	0.0007	--------
22.67	4.9432	3.1228	0.0076	0.0069	0.0007	--------
22.75	4.9509	3.1297	0.0076	0.0069	0.0007	--------
22.83	4.9585	3.1365	0.0076	0.0069	0.0007	--------
22.92	4.9661	3.1434	0.0076	0.0069	0.0007	--------
23.00	4.9737	3.1503	0.0076	0.0069	0.0007	--------
23.08	4.9821	3.1579	0.0084	0.0076	0.0008	--------
23.17	4.9906	3.1656	0.0084	0.0076	0.0008	--------
23.25	4.9990	3.1732	0.0084	0.0076	0.0008	--------
23.33	5.0075	3.1809	0.0085	0.0076	0.0008	--------
23.42	5.0159	3.1885	0.0084	0.0076	0.0008	--------
23.50	5.0244	3.1962	0.0084	0.0077	0.0008	--------
23.58	5.0320	3.2030	0.0076	0.0069	0.0007	--------
23.67	5.0396	3.2099	0.0076	0.0069	0.0007	--------
23.75	5.0472	3.2168	0.0076	0.0069	0.0007	--------
23.83	5.0548	3.2237	0.0076	0.0069	0.0007	--------
23.92	5.0624	3.2306	0.0076	0.0069	0.0007	--------
24.00	5.0700	3.2375	0.0076	0.0069	0.0007	--------

```
----------------------------------------------------------------------
----------------------------------------------------------------------
Total soil rain loss =      1.83(In)
Total effective runoff =      3.24(In)
-----------------------------------------------------------------------
Peak flow rate this hydrograph =        1472.48(CFS)
Total runoff volume this hydrograph =       26515056.7(Ft3)
-----------------------------------------------------------------------
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
                  24 - H O U R   S T O R M
             R u n o f f     H y d r o g r a p h
----------------------------------------------------------------------
            Hydrograph in   5   Minute intervals ((CFS))

----------------------------------------------------------------------
Time(h+m) Volume Ac.Ft   Q(CFS)  0      375.0     750.0    1125.0    1500.0
-----------------------------------------------------------------------
  0+ 5       0.0000      0.00  Q         |         |         |         |
```

```
 0+10        0.0000        0.00  Q          |         |         |         |
 0+15        0.0000        0.00  Q          |         |         |         |
 0+20        0.0000        0.00  Q          |         |         |         |
 0+25        0.0000        0.00  Q          |         |         |         |
 0+30        0.0000        0.00  Q          |         |         |         |
 0+35        0.0000        0.00  Q          |         |         |         |
 0+40        0.0000        0.00  Q          |         |         |         |
 0+45        0.0000        0.00  Q          |         |         |         |
 0+50        0.0000        0.00  Q          |         |         |         |
 0+55        0.0000        0.00  Q          |         |         |         |
 1+ 0        0.0000        0.00  Q          |         |         |         |
 1+ 5        0.0000        0.00  Q          |         |         |         |
 1+10        0.0000        0.00  Q          |         |         |         |
 1+15        0.0000        0.00  Q          |         |         |         |
 1+20        0.0000        0.00  Q          |         |         |         |
 1+25        0.0000        0.00  Q          |         |         |         |
 1+30        0.0000        0.00  Q          |         |         |         |
 1+35        0.0000        0.00  Q          |         |         |         |
 1+40        0.0000        0.00  Q          |         |         |         |
 1+45        0.0000        0.00  Q          |         |         |         |
 1+50        0.0000        0.00  Q          |         |         |         |
 1+55        0.0000        0.00  Q          |         |         |         |
 2+ 0        0.0000        0.00  Q          |         |         |         |
 2+ 5        0.0000        0.00  Q          |         |         |         |
 2+10        0.0000        0.00  Q          |         |         |         |
 2+15        0.0000        0.00  Q          |         |         |         |
 2+20        0.0000        0.00  Q          |         |         |         |
 2+25        0.0000        0.00  Q          |         |         |         |
 2+30        0.0000        0.00  Q          |         |         |         |
 2+35        0.0000        0.00  Q          |         |         |         |
 2+40        0.0000        0.00  Q          |         |         |         |
 2+45        0.0000        0.00  Q          |         |         |         |
 2+50        0.0000        0.00  Q          |         |         |         |
 2+55        0.0000        0.00  Q          |         |         |         |
 3+ 0        0.0000        0.00  Q          |         |         |         |
 3+ 5        0.0000        0.00  Q          |         |         |         |
 3+10        0.0000        0.00  Q          |         |         |         |
 3+15        0.0000        0.00  Q          |         |         |         |
 3+20        0.0000        0.00  Q          |         |         |         |
 3+25        0.0000        0.00  Q          |         |         |         |
 3+30        0.0000        0.00  Q          |         |         |         |
 3+35        0.0000        0.00  Q          |         |         |         |
 3+40        0.0000        0.00  Q          |         |         |         |
 3+45        0.0000        0.00  Q          |         |         |         |
 3+50        0.0000        0.00  Q          |         |         |         |
 3+55        0.0000        0.00  Q          |         |         |         |
 4+ 0        0.0000        0.00  Q          |         |         |         |
 4+ 5        0.0000        0.00  Q          |         |         |         |
 4+10        0.0000        0.00  Q          |         |         |         |
 4+15        0.0000        0.00  Q          |         |         |         |
 4+20        0.0002        0.02  Q          |         |         |         |
 4+25        0.0006        0.06  Q          |         |         |         |
 4+30        0.0016        0.14  Q          |         |         |         |
 4+35        0.0037        0.31  Q          |         |         |         |
 4+40        0.0080        0.62  Q          |         |         |         |
 4+45        0.0162        1.19  Q          |         |         |         |
 4+50        0.0307        2.10  Q          |         |         |         |
 4+55        0.0540        3.38  Q          |         |         |         |
 5+ 0        0.0887        5.03  Q          |         |         |         |
 5+ 5        0.1369        7.01  Q          |         |         |         |
 5+10        0.2006        9.25  Q          |         |         |         |
 5+15        0.2814       11.73  Q          |         |         |         |
 5+20        0.3806       14.40  Q          |         |         |         |
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 5+25       0.4994     17.25  Q         |         |         |         |
 5+30       0.6396     20.36  Q         |         |         |         |
 5+35       0.8033     23.76  Q         |         |         |         |
 5+40       0.9921     27.43  Q         |         |         |         |
 5+45       1.2075     31.27  Q         |         |         |         |
 5+50       1.4499     35.19  Q         |         |         |         |
 5+55       1.7196     39.16  VQ        |         |         |         |
 6+ 0       2.0173     43.23  VQ        |         |         |         |
 6+ 5       2.3441     47.46  VQ        |         |         |         |
 6+10       2.7013     51.86  VQ        |         |         |         |
 6+15       3.0896     56.38  VQ        |         |         |         |
 6+20       3.5095     60.97  VQ        |         |         |         |
 6+25       3.9620     65.70  VQ        |         |         |         |
 6+30       4.4501     70.87  VQ        |         |         |         |
 6+35       4.9775     76.58  V Q       |         |         |         |
 6+40       5.5479     82.82  V Q       |         |         |         |
 6+45       6.1629     89.30  V Q       |         |         |         |
 6+50       6.8226     95.78  V Q       |         |         |         |
 6+55       7.5267    102.25  V Q       |         |         |         |
 7+ 0       8.2779    109.07  V Q       |         |         |         |
 7+ 5       9.0804    116.52  V  Q      |         |         |         |
 7+10       9.9389    124.65  V  Q      |         |         |         |
 7+15      10.8558    133.14  V  Q      |         |         |         |
 7+20      11.8320    141.74  V  Q      |         |         |         |
 7+25      12.8697    150.67  V   Q     |         |         |         |
 7+30      13.9786    161.01  V   Q     |         |         |         |
 7+35      15.1722    173.31  V   Q     |         |         |         |
 7+40      16.4641    187.59  |V   Q    |         |         |         |
 7+45      17.8623    203.02  |V   Q    |         |         |         |
 7+50      19.3689    218.76  |V   Q    |         |         |         |
 7+55      20.9898    235.35  |V    Q   |         |         |         |
 8+ 0      22.7500    255.57  |V    Q   |         |         |         |
 8+ 5      24.6828    280.65  |V     Q  |         |         |         |
 8+10      26.8218    310.59  |V      Q |         |         |         |
 8+15      29.1827    342.80  |V       Q|         |         |         |
 8+20      31.7663    375.13  | V       Q         |         |         |
 8+25      34.5768    408.08  | V       Q         |         |         |
 8+30      37.6520    446.52  | V       |Q        |         |         |
 8+35      41.0452    492.69  | V       |  Q      |         |         |
 8+40      44.8100    546.64  | V       |   Q     |         |         |
 8+45      48.9635    603.09  |  V      |     Q   |         |         |
 8+50      53.4973    658.31  |  V      |      Q  |         |         |
 8+55      58.4007    711.99  |  V      |       Q |         |         |
 9+ 0      63.7011    769.61  |   V     |         Q         |         |
 9+ 5      69.4457    834.12  |   V     |         | Q       |         |
 9+10      75.6831    905.67  |   V     |         |   Q     |         |
 9+15      82.4138    977.30  |    V    |         |     Q   |         |
 9+20      89.6116   1045.12  |    V    |         |      Q  |         |
 9+25      97.2379   1107.35  |     V   |         |        Q|         |
 9+30     105.2716   1166.49  |     V   |         |         |Q        |
 9+35     113.7085   1225.04  |      V  |         |         | Q       |
 9+40     122.5476   1283.44  |       V |         |         |   Q     |
 9+45     131.7580   1337.34  |       V |         |         |    Q    |
 9+50     141.3019   1385.78  |        V|         |         |     Q   |
 9+55     151.1223   1425.92  |        V|         |         |       Q |
10+ 0     161.1331   1453.57  |         V         |         |       Q |
10+ 5     171.2490   1468.83  |         |V        |         |        Q|
10+10     181.3900   1472.48  |         |V        |         |        Q|
10+15     191.4987   1467.78  |         | V       |         |        Q|
10+20     201.5492   1459.33  |         |  V      |         |       Q |
10+25     211.4937   1443.94  |         |  V      |         |       Q |
10+30     221.1908   1408.02  |         |   V     |         |      Q  |
10+35     230.4821   1349.10  |         |    V    |         |    Q    |
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10+40     239.2192   1268.63  |         |    V    |         |  Q      |
10+45     247.3746   1184.17  |         |     V   |         |Q        |
10+50     255.0005   1107.28  |         |     V   |        Q|         |
10+55     262.1781   1042.19  |         |      V  |      Q  |         |
11+ 0     268.9496    983.22  |         |      V  |     Q   |         |
11+ 5     275.3090    923.38  |         |       V |   Q     |         |
11+10     281.2369    860.74  |         |       V | Q       |         |
11+15     286.7706    803.49  |         |       V |Q        |         |
11+20     291.9548    752.75  |         |        VQ         |         |
11+25     296.8436    709.86  |         |       QV|         |         |
11+30     301.4770    672.76  |         |      Q V|         |         |
11+35     305.8695    637.79  |         |      Q  V         |         |
11+40     310.0351    604.85  |         |     Q   V         |         |
11+45     313.9988    575.53  |         |    Q    V         |         |
11+50     317.7848    549.72  |         |   Q     V         |         |
11+55     321.4224    528.18  |         |   Q     |V        |         |
12+ 0     324.9303    509.35  |         |  Q      |V        |         |
12+ 5     328.3194    492.09  |         |  Q      |V        |         |
12+10     331.5991    476.22  |         | Q       |V        |         |
12+15     334.7822    462.18  |         | Q       |V        |         |
12+20     337.8814    450.01  |         | Q       | V       |         |
12+25     340.9118    440.01  |         |Q        | V       |         |
12+30     343.8876    432.08  |         |Q        | V       |         |
12+35     346.8154    425.11  |         |Q        | V       |         |
12+40     349.6998    418.82  |         |Q        | V       |         |
12+45     352.5454    413.17  |         |Q        |  V      |         |
12+50     355.3568    408.22  |         Q         |  V      |         |
12+55     358.1392    404.01  |         Q         |  V      |         |
13+ 0     360.8960    400.29  |         Q         |  V      |         |
13+ 5     363.6269    396.52  |         Q         |  V      |         |
13+10     366.3310    392.64  |         Q         |   V     |         |
13+15     369.0089    388.83  |         Q         |   V     |         |
13+20     371.6623    385.28  |         Q         |   V     |         |
13+25     374.2925    381.90  |         Q         |   V     |         |
13+30     376.8957    377.98  |         Q         |   V     |         |
13+35     379.4660    373.22  |        Q|         |   V     |         |
13+40     381.9980    367.65  |        Q|         |    V    |         |
13+45     384.4917    362.09  |        Q|         |    V    |         |
13+50     386.9510    357.09  |        Q|         |    V    |         |
13+55     389.3810    352.83  |        Q|         |    V    |         |
14+ 0     391.7840    348.91  |        Q|         |    V    |         |
14+ 5     394.1599    344.98  |        Q|         |    V    |         |
14+10     396.5082    340.97  |        Q|         |     V   |         |
14+15     398.8328    337.53  |        Q|         |     V   |         |
14+20     401.1386    334.80  |       Q |         |     V   |         |
14+25     403.4333    333.19  |       Q |         |     V   |         |
14+30     405.7293    333.38  |       Q |         |     V   |         |
14+35     408.0352    334.81  |       Q |         |     V   |         |
14+40     410.3577    337.23  |       Q |         |     V   |         |
14+45     412.6941    339.24  |        Q|         |      V  |         |
14+50     415.0362    340.07  |        Q|         |      V  |         |
14+55     417.3664    338.34  |        Q|         |      V  |         |
15+ 0     419.6478    331.26  |       Q |         |      V  |         |
15+ 5     421.8471    319.33  |       Q |         |      V  |         |
15+10     423.9363    303.35  |       Q |         |      V  |         |
15+15     425.9138    287.13  |      Q  |         |      V  |         |
15+20     427.7973    273.48  |      Q  |         |       V |         |
15+25     429.6190    264.52  |      Q  |         |       V |         |
15+30     431.4243    262.13  |     Q   |         |       V |         |
15+35     433.2489    264.93  |      Q  |         |       V |         |
15+40     435.1203    271.73  |      Q  |         |       V |         |
15+45     437.0507    280.29  |      Q  |         |       V |         |
15+50     439.0338    287.96  |      Q  |         |       V |         |
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15+55     441.0550    293.48  |      Q  |         |       V |         |
16+ 0     443.0988    296.76  |      Q  |         |        V|         |
16+ 5     445.1545    298.48  |      Q  |         |        V|         |
16+10     447.2163    299.38  |      Q  |         |        V|         |
16+15     449.2775    299.27  |      Q  |         |        V|         |
16+20     451.3365    298.98  |      Q  |         |        V|         |
16+25     453.3938    298.72  |      Q  |         |        V|         |
16+30     455.4452    297.86  |      Q  |         |        V|         |
16+35     457.4879    296.60  |      Q  |         |         V         |
16+40     459.5180    294.77  |      Q  |         |         V         |
16+45     461.5365    293.09  |      Q  |         |         V         |
16+50     463.5461    291.79  |      Q  |         |         V         |
16+55     465.5507    291.07  |      Q  |         |         V         |
17+ 0     467.5585    291.53  |      Q  |         |         V         |
17+ 5     469.5740    292.66  |      Q  |         |         V         |
17+10     471.6009    294.30  |      Q  |         |         V         |
17+15     473.6380    295.78  |      Q  |         |         |V        |
17+20     475.6814    296.71  |      Q  |         |         |V        |
17+25     477.7235    296.51  |      Q  |         |         |V        |
17+30     479.7484    294.02  |      Q  |         |         |V        |
17+35     481.7423    289.52  |      Q  |         |         |V        |
17+40     483.6940    283.38  |      Q  |         |         |V        |
17+45     485.6016    276.99  |      Q  |         |         |V        |
17+50     487.4711    271.45  |      Q  |         |         | V       |
17+55     489.3128    267.41  |      Q  |         |         | V       |
18+ 0     491.1388    265.13  |      Q  |         |         | V       |
18+ 5     492.9568    263.97  |      Q  |         |         | V       |
18+10     494.7719    263.56  |      Q  |         |         | V       |
18+15     496.5864    263.46  |      Q  |         |         | V       |
18+20     498.3980    263.04  |      Q  |         |         | V       |
18+25     500.2002    261.69  |     Q   |         |         | V       |
18+30     501.9798    258.39  |     Q   |         |         | V       |
18+35     503.7234    253.18  |     Q   |         |         |  V      |
18+40     505.4205    246.42  |     Q   |         |         |  V      |
18+45     507.0690    239.35  |     Q   |         |         |  V      |
18+50     508.6741    233.07  |     Q   |         |         |  V      |
18+55     510.2452    228.12  |     Q   |         |         |  V      |
19+ 0     511.7900    224.30  |    Q    |         |         |  V      |
19+ 5     513.3129    221.13  |    Q    |         |         |  V      |
19+10     514.8164    218.30  |    Q    |         |         |  V      |
19+15     516.3037    215.96  |    Q    |         |         |  V      |
19+20     517.7764    213.83  |    Q    |         |         |   V     |
19+25     519.2345    211.72  |    Q    |         |         |   V     |
19+30     520.6762    209.34  |    Q    |         |         |   V     |
19+35     522.0987    206.55  |    Q    |         |         |   V     |
19+40     523.5000    203.47  |    Q    |         |         |   V     |
19+45     524.8811    200.53  |    Q    |         |         |   V     |
19+50     526.2452    198.07  |    Q    |         |         |   V     |
19+55     527.5980    196.43  |    Q    |         |         |   V     |
20+ 0     528.9467    195.84  |    Q    |         |         |   V     |
20+ 5     530.2980    196.20  |    Q    |         |         |   V     |
20+10     531.6571    197.35  |    Q    |         |         |   V     |
20+15     533.0273    198.94  |    Q    |         |         |    V    |
20+20     534.4084    200.54  |    Q    |         |         |    V    |
20+25     535.8003    202.10  |    Q    |         |         |    V    |
20+30     537.2057    204.07  |    Q    |         |         |    V    |
20+35     538.6278    206.49  |    Q    |         |         |    V    |
20+40     540.0699    209.39  |    Q    |         |         |    V    |
20+45     541.5307    212.10  |    Q    |         |         |    V    |
20+50     543.0071    214.37  |    Q    |         |         |    V    |
20+55     544.4942    215.93  |    Q    |         |         |    V    |
21+ 0     545.9847    216.41  |    Q    |         |         |    V    |
21+ 5     547.4724    216.01  |    Q    |         |         |    V    |
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21+10     548.9521    214.86  |    Q    |         |         |     V   |
21+15     550.4212    213.31  |    Q    |         |         |     V   |
21+20     551.8798    211.79  |    Q    |         |         |     V   |
21+25     553.3282    210.32  |    Q    |         |         |     V   |
21+30     554.7645    208.55  |    Q    |         |         |     V   |
21+35     556.1854    206.31  |    Q    |         |         |     V   |
21+40     557.5874    203.57  |    Q    |         |         |     V   |
21+45     558.9709    200.88  |    Q    |         |         |     V   |
21+50     560.3380    198.51  |    Q    |         |         |     V   |
21+55     561.6919    196.58  |    Q    |         |         |     V   |
22+ 0     563.0354    195.08  |    Q    |         |         |     V   |
22+ 5     564.3700    193.79  |    Q    |         |         |      V  |
22+10     565.6969    192.66  |    Q    |         |         |      V  |
22+15     567.0175    191.75  |    Q    |         |         |      V  |
22+20     568.3326    190.96  |    Q    |         |         |      V  |
22+25     569.6432    190.30  |    Q    |         |         |      V  |
22+30     570.9498    189.72  |    Q    |         |         |      V  |
22+35     572.2528    189.20  |    Q    |         |         |      V  |
22+40     573.5530    188.78  |    Q    |         |         |      V  |
22+45     574.8507    188.42  |    Q    |         |         |      V  |
22+50     576.1463    188.13  |    Q    |         |         |      V  |
22+55     577.4404    187.90  |    Q    |         |         |      V  |
23+ 0     578.7334    187.74  |    Q    |         |         |       V |
23+ 5     580.0258    187.66  |    Q    |         |         |       V |
23+10     581.3183    187.67  |    Q    |         |         |       V |
23+15     582.6117    187.81  |    Q    |         |         |       V |
23+20     583.9071    188.08  |    Q    |         |         |       V |
23+25     585.2062    188.63  |    Q    |         |         |       V |
23+30     586.5135    189.82  |    Q    |         |         |       V |
23+35     587.8331    191.61  |    Q    |         |         |       V |
23+40     589.1686    193.92  |    Q    |         |         |       V |
23+45     590.5198    196.19  |    Q    |         |         |       V |
23+50     591.8839    198.07  |    Q    |         |         |       V |
23+55     593.2563    199.28  |    Q    |         |         |       V |
24+ 0     594.6300    199.46  |    Q    |         |         |        V|
24+ 5     595.9968    198.46  |    Q    |         |         |        V|
24+10     597.3492    196.37  |    Q    |         |         |        V|
24+15     598.6787    193.04  |    Q    |         |         |        V|
24+20     599.9793    188.85  |    Q    |         |         |        V|
24+25     601.2378    182.73  |   Q     |         |         |        V|
24+30     602.4179    171.35  |   Q     |         |         |        V|
24+35     603.4822    154.54  |   Q     |         |         |        V|
24+40     604.3972    132.86  |  Q      |         |         |        V|
24+45     605.1594    110.68  | Q       |         |         |        V|
24+50     605.7860     90.98  | Q       |         |         |        V|
24+55     606.3042     75.24  | Q       |         |         |        V|
25+ 0     606.7394     63.19  |Q        |         |         |        V|
25+ 5     607.1053     53.13  |Q        |         |         |        V|
25+10     607.4101     44.26  |Q        |         |         |        V|
25+15     607.6661     37.18  Q         |         |         |        V|
25+20     607.8801     31.07  Q         |         |         |        V|
25+25     608.0579     25.81  Q         |         |         |        V|
25+30     608.2051     21.38  Q         |         |         |        V|
25+35     608.3250     17.40  Q         |         |         |        V|
25+40     608.4220     14.09  Q         |         |         |        V|
25+45     608.4992     11.20  Q         |         |         |        V|
25+50     608.5591      8.69  Q         |         |         |        V|
25+55     608.6052      6.70  Q         |         |         |        V|
26+ 0     608.6395      4.99  Q         |         |         |        V|
26+ 5     608.6644      3.61  Q         |         |         |        V|
26+10     608.6816      2.50  Q         |         |         |        V|
26+15     608.6927      1.62  Q         |         |         |        V|
26+20     608.6989      0.90  Q         |         |         |        V|
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   26+25     608.7013      0.34  Q          |         |         |        V|
   26+30     608.7019      0.10  Q          |         |         |        V|
-----------------------------------------------------------------------
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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 09/09/10
------------------------------------------------------------------------
Tule Wind Project
System 1
Proposed Conditions 100 Year


------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.100 to Point/Station       1.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  184.120(Ft.)
Highest elevation = 3965.000(Ft.)
Lowest elevation = 3953.000(Ft.)
Elevation difference =   12.000(Ft.) Slope =  6.517 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   6.52 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.65 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*( 100.000^.5)/(   6.517^(1/3)]=   6.65
Rainfall intensity (I) =      7.673(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.736(CFS)
Total initial stream area =       0.234(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       1.200 to Point/Station       1.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3953.000(Ft.)
Downstream point elevation =  3926.000(Ft.)
Channel length thru subarea  =   709.830(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     12.738(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     12.738(CFS)
Depth of flow =   0.342(Ft.), Average velocity =   3.272(Ft/s)
Channel flow top width =   12.739(Ft.)
Flow Velocity =    3.27(Ft/s)
Travel time  =    3.62 min.
Time of concentration =   10.26 min.
Critical depth =      0.352(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Rainfall intensity =      5.799(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410  CA =      4.250
Subarea runoff =     23.909(CFS) for     10.132(Ac.)
Total runoff =     24.645(CFS)  Total area =      10.366(Ac.)
Depth of flow =   0.501(Ft.), Average velocity =   4.099(Ft/s)
Critical depth =      0.531(Ft.)
End of computations, total study area =          10.366 (Ac.)
```

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San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 08/18/10
------------------------------------------------------------------------
Tule Wind Project
System 2
Proposed 100 Yr 24 Hr
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.100 to Point/Station       2.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  147.250(Ft.)
Highest elevation = 4068.000(Ft.)
Lowest elevation = 4015.000(Ft.)
Elevation difference =   53.000(Ft.) Slope = 35.993 %
USER ENTRY OF INITIAL AREA TIME OF CONCENTRATION
Time of Concentration =   5.00 minutes
Rainfall intensity (I) =      9.222(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.594(CFS)
Total initial stream area =       0.157(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       2.200 to Point/Station       2.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  4015.000(Ft.)
Downstream point elevation =  3931.000(Ft.)
Channel length thru subarea  =   918.230(Ft.)
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Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     19.681(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     19.681(CFS)
Depth of flow =   0.342(Ft.), Average velocity =   5.068(Ft/s)
Channel flow top width =   12.733(Ft.)
Flow Velocity =    5.07(Ft/s)
Travel time  =    3.02 min.
Time of concentration =    8.02 min.
Critical depth =      0.461(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Rainfall intensity =      6.799(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.410  CA =      5.688
Subarea runoff =     38.084(CFS) for     13.717(Ac.)
Total runoff =     38.677(CFS)  Total area =      13.874(Ac.)
Depth of flow =   0.504(Ft.), Average velocity =   6.382(Ft/s)
Critical depth =      0.703(Ft.)
End of computations, total study area =          13.874 (Ac.)
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San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 09/08/10
------------------------------------------------------------------------
Tule Wind Project
System 3
Proposed 100 Year
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.100 to Point/Station       3.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =   72.890(Ft.)
Highest elevation = 4062.000(Ft.)
Lowest elevation = 4058.000(Ft.)
Elevation difference =    4.000(Ft.) Slope =  5.488 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   5.49 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.96 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(   5.488^(1/3)]=   7.96
Rainfall intensity (I) =      6.832(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      0.092(CFS)
Total initial stream area =        0.042(Ac.)


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Process from Point/Station       3.200 to Point/Station       3.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  4058.000(Ft.)
Downstream point elevation =  3963.000(Ft.)
Channel length thru subarea  =  1068.190(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =      4.803(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =      4.803(CFS)
Depth of flow =   0.150(Ft.), Average velocity =   3.013(Ft/s)
Channel flow top width =   11.203(Ft.)
Flow Velocity =    3.01(Ft/s)
Travel time  =    5.91 min.
Time of concentration =   13.87 min.
Critical depth =      0.188(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Rainfall intensity =      4.776(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      1.972
Subarea runoff =      9.323(CFS) for      6.119(Ac.)
Total runoff =      9.415(CFS)  Total area =       6.161(Ac.)
Depth of flow =   0.224(Ft.), Average velocity =   3.862(Ft/s)
Critical depth =      0.289(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       3.300 to Point/Station       3.400
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3963.000(Ft.)
Downstream point elevation =  3933.000(Ft.)
Channel length thru subarea  =   482.370(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     16.394(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     16.394(CFS)
Depth of flow =   0.344(Ft.), Average velocity =   4.194(Ft/s)
Channel flow top width =   12.749(Ft.)
Flow Velocity =    4.19(Ft/s)
Travel time  =    1.92 min.
Time of concentration =   15.79 min.
Critical depth =      0.414(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
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```
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Rainfall intensity =      4.393(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      5.305
Subarea runoff =     13.890(CFS) for     10.417(Ac.)
Total runoff =     23.305(CFS)  Total area =      16.578(Ac.)
Depth of flow =   0.421(Ft.), Average velocity =   4.735(Ft/s)
Critical depth =      0.516(Ft.)
End of computations, total study area =          16.578 (Ac.)
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                  San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 08/16/10
------------------------------------------------------------------------
Tule Wind Project
System 4
Proposed 100 Yr 24 Hr
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       4.100 to Point/Station       4.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =   84.850(Ft.)
Highest elevation = 3978.000(Ft.)
Lowest elevation = 3970.000(Ft.)
Elevation difference =    8.000(Ft.) Slope =  9.428 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   9.43 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.65 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(   9.428^(1/3)]=   6.65
Rainfall intensity (I) =      7.675(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      0.491(CFS)
Total initial stream area =       0.200(Ac.)


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Process from Point/Station       4.200 to Point/Station       4.300
**** IMPROVED CHANNEL TRAVEL TIME ****
```

```
Upstream point elevation =  3970.000(Ft.)
Downstream point elevation =  3943.000(Ft.)
Channel length thru subarea  =   295.280(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =      1.079(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =      1.079(CFS)
Depth of flow =   0.061(Ft.), Average velocity =   1.718(Ft/s)
Channel flow top width =   10.490(Ft.)
Flow Velocity =    1.72(Ft/s)
Travel time  =    2.87 min.
Time of concentration =    9.51 min.
Critical depth =      0.070(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less      )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Rainfall intensity =      6.091(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      0.264
Subarea runoff =      1.117(CFS) for      0.625(Ac.)
Total runoff =      1.608(CFS)  Total area =       0.825(Ac.)
Depth of flow =   0.078(Ft.), Average velocity =   2.005(Ft/s)
Critical depth =      0.092(Ft.)
End of computations, total study area =           0.825 (Ac.)
```

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study       Date: 08/16/10
------------------------------------------------------------------------
Tule Wind Project
System 5
Proposed 100 Yr 24 Hr
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       5.100 to Point/Station       5.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =  132.710(Ft.)
Highest elevation = 3908.000(Ft.)
Lowest elevation = 3882.000(Ft.)
Elevation difference =   26.000(Ft.) Slope = 19.592 %
Top of Initial Area Slope adjusted by User to  0.700 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 50.00 (Ft)
for the top area slope value of   0.70 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =  11.18 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*(  50.000^.5)/(   0.700^(1/3)]=  11.18
Rainfall intensity (I) =      5.487(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      0.179(CFS)
Total initial stream area =       0.102(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       5.200 to Point/Station       5.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3882.000(Ft.)
Downstream point elevation =  3715.000(Ft.)
Channel length thru subarea  =  1743.680(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     12.817(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     12.817(CFS)
Depth of flow =   0.262(Ft.), Average velocity =   4.420(Ft/s)
Channel flow top width =   12.099(Ft.)
Flow Velocity =    4.42(Ft/s)
Travel time  =    6.57 min.
Time of concentration =   17.76 min.
Critical depth =      0.352(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.650
Decimal fraction soil group B = 0.350
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.287
Rainfall intensity =      4.072(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.288  CA =      6.231
Subarea runoff =     25.192(CFS) for     21.558(Ac.)
Total runoff =     25.371(CFS)  Total area =      21.660(Ac.)
Depth of flow =   0.391(Ft.), Average velocity =   5.618(Ft/s)
Critical depth =      0.539(Ft.)
End of computations, total study area =          21.660 (Ac.)
```

```
                  San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 08/16/10
------------------------------------------------------------------------
Tule Wind Project
System 6
Proposed 100 Yr 24 Hr
August 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station        6.100 to Point/Station        6.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =  311.190(Ft.)
Highest elevation = 3910.000(Ft.)
Lowest elevation = 3894.000(Ft.)
Elevation difference =   16.000(Ft.) Slope =  5.142 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   5.14 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   8.13 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(   5.142^(1/3)]=   8.13
Rainfall intensity (I) =      6.737(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      1.242(CFS)
Total initial stream area =       0.576(Ac.)


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```

```
Process from Point/Station       6.200 to Point/Station       6.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3894.000(Ft.)
Downstream point elevation =  3750.000(Ft.)
Channel length thru subarea  =  2700.480(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     39.338(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     39.338(CFS)
Depth of flow =   0.594(Ft.), Average velocity =   5.355(Ft/s)
Channel flow top width =   14.749(Ft.)
Flow Velocity =    5.35(Ft/s)
Travel time  =    8.40 min.
Time of concentration =   16.54 min.
Critical depth =      0.711(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.990
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.010
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less      )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.321
Rainfall intensity =      4.263(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.321  CA =     18.152
Subarea runoff =     76.136(CFS) for     55.991(Ac.)
Total runoff =     77.378(CFS)  Total area =      56.567(Ac.)
Depth of flow =   0.866(Ft.), Average velocity =   6.636(Ft/s)
Critical depth =      1.063(Ft.)
End of computations, total study area =          56.567 (Ac.)
```

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 09/08/10
------------------------------------------------------------------------
Tule Wind Project
System 7
Proposed 100 Year
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       7.100 to Point/Station       7.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =   92.070(Ft.)
Highest elevation = 3689.000(Ft.)
Lowest elevation = 3685.000(Ft.)
Elevation difference =    4.000(Ft.) Slope =  4.345 %
Top of Initial Area Slope adjusted by User to  8.640 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.64 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.84 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(   8.640^(1/3)]=   6.84
Rainfall intensity (I) =      7.533(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      0.118(CFS)
Total initial stream area =       0.049(Ac.)
```

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++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       7.200 to Point/Station       7.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3685.000(Ft.)
Downstream point elevation =  3585.000(Ft.)
Channel length thru subarea  =  2100.790(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     15.257(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     15.257(CFS)
Depth of flow =   0.356(Ft.), Average velocity =   3.749(Ft/s)
Channel flow top width =   12.850(Ft.)
Flow Velocity =    3.75(Ft/s)
Travel time  =    9.34 min.
Time of concentration =   16.18 min.
Critical depth =      0.395(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Rainfall intensity =      4.323(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      7.017
Subarea runoff =     30.219(CFS) for     21.879(Ac.)
Total runoff =     30.337(CFS)  Total area =      21.928(Ac.)
Depth of flow =   0.529(Ft.), Average velocity =   4.733(Ft/s)
Critical depth =      0.602(Ft.)
End of computations, total study area =          21.928 (Ac.)
```

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 09/08/10
------------------------------------------------------------------------
Tule Wind Project
System 8
Proposed 100 Year
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       8.100 to Point/Station       8.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance  =   97.490(Ft.)
Highest elevation = 3720.000(Ft.)
Lowest elevation = 3710.000(Ft.)
Elevation difference =   10.000(Ft.) Slope = 10.257 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  10.26 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.72 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*( 100.000^.5)/(  10.257^(1/3)]=   5.72
Rainfall intensity (I) =      8.459(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.246(CFS)
Total initial stream area =        0.071(Ac.)


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Process from Point/Station       8.200 to Point/Station       8.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3710.000(Ft.)
Downstream point elevation =  3590.000(Ft.)
Channel length thru subarea  =  2167.800(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     15.053(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     15.053(CFS)
Depth of flow =   0.338(Ft.), Average velocity =   3.920(Ft/s)
Channel flow top width =   12.706(Ft.)
Flow Velocity =    3.92(Ft/s)
Travel time  =    9.22 min.
Time of concentration =   14.93 min.
Critical depth =      0.391(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.990
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.010
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less      )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.321
Rainfall intensity =      4.553(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.321  CA =      6.545
Subarea runoff =     29.551(CFS) for     20.304(Ac.)
Total runoff =     29.797(CFS)  Total area =      20.375(Ac.)
Depth of flow =   0.502(Ft.), Average velocity =   4.948(Ft/s)
Critical depth =      0.602(Ft.)
End of computations, total study area =          20.375 (Ac.)
```

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                 San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 08/16/10
------------------------------------------------------------------------
Tule Wind Project
System 9
Proposed 100 Yr 24 Hr
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station       9.100 to Point/Station       9.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =   88.120(Ft.)
Highest elevation = 3611.000(Ft.)
Lowest elevation = 3606.000(Ft.)
Elevation difference =    5.000(Ft.) Slope =  5.674 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   5.67 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   7.87 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(   5.674^(1/3)]=   7.87
Rainfall intensity (I) =      6.881(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      0.161(CFS)
Total initial stream area =       0.073(Ac.)


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Process from Point/Station       9.200 to Point/Station       9.300
**** IMPROVED CHANNEL TRAVEL TIME ****
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Upstream point elevation =  3606.000(Ft.)
Downstream point elevation =  3592.000(Ft.)
Channel length thru subarea  =   411.100(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =      2.254(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =      2.254(CFS)
Depth of flow =   0.128(Ft.), Average velocity =   1.680(Ft/s)
Channel flow top width =   11.021(Ft.)
Flow Velocity =    1.68(Ft/s)
Travel time  =    4.08 min.
Time of concentration =   11.95 min.
Critical depth =      0.115(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Rainfall intensity =      5.257(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      0.816
Subarea runoff =      4.131(CFS) for      2.478(Ac.)
Total runoff =      4.292(CFS)  Total area =       2.551(Ac.)
Depth of flow =   0.187(Ft.), Average velocity =   2.137(Ft/s)
Critical depth =      0.174(Ft.)
End of computations, total study area =           2.551 (Ac.)
```

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 08/16/10
------------------------------------------------------------------------
Tule Wind Project
System 10
Proposed 100 Yr 24 Hr
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      10.100 to Point/Station      10.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  103.135(Ft.)
Highest elevation = 3728.000(Ft.)
Lowest elevation = 3715.000(Ft.)
Elevation difference =   13.000(Ft.) Slope = 12.605 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  12.61 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.34 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*( 100.000^.5)/(  12.605^(1/3)]=   5.34
Rainfall intensity (I) =      8.842(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.384(CFS)
Total initial stream area =       0.106(Ac.)


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```

```
Process from Point/Station       10.200 to Point/Station       10.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3715.000(Ft.)
Downstream point elevation =  3582.000(Ft.)
Channel length thru subarea  =  2242.890(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     15.978(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     15.978(CFS)
Depth of flow =   0.343(Ft.), Average velocity =   4.093(Ft/s)
Channel flow top width =   12.746(Ft.)
Flow Velocity =    4.09(Ft/s)
Travel time  =    9.13 min.
Time of concentration =   14.47 min.
Critical depth =      0.406(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.930
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.070
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less      )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.326
Rainfall intensity =      4.646(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.327  CA =      6.780
Subarea runoff =     31.118(CFS) for     20.645(Ac.)
Total runoff =     31.503(CFS)  Total area =      20.751(Ac.)
Depth of flow =   0.508(Ft.), Average velocity =   5.158(Ft/s)
Critical depth =      0.617(Ft.)
End of computations, total study area =          20.751 (Ac.)
```

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 08/16/10
------------------------------------------------------------------------
Tule Wind Project
System 11
Proposed 100 Yr 24 Hr
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      11.100 to Point/Station      11.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =   92.720(Ft.)
Highest elevation = 3609.000(Ft.)
Lowest elevation = 3606.000(Ft.)
Elevation difference =    3.000(Ft.) Slope =  3.236 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   3.24 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   9.49 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(   3.236^(1/3)]=   9.49
Rainfall intensity (I) =      6.099(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      0.142(CFS)
Total initial stream area =       0.073(Ac.)


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```
Process from Point/Station      11.200 to Point/Station       11.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3606.000(Ft.)
Downstream point elevation =  3530.000(Ft.)
Channel length thru subarea  =   694.440(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =      3.026(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =      3.026(CFS)
Depth of flow =   0.107(Ft.), Average velocity =   2.700(Ft/s)
Channel flow top width =   10.860(Ft.)
Flow Velocity =    2.70(Ft/s)
Travel time  =    4.29 min.
Time of concentration =   13.78 min.
Critical depth =      0.139(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Rainfall intensity =      4.796(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      1.219
Subarea runoff =      5.703(CFS) for      3.736(Ac.)
Total runoff =      5.845(CFS)  Total area =       3.809(Ac.)
Depth of flow =   0.159(Ft.), Average velocity =   3.460(Ft/s)
Critical depth =      0.213(Ft.)
End of computations, total study area =           3.809 (Ac.)
```

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 08/16/10
------------------------------------------------------------------------
Tule Wind Project
System 12
Proposed 100 Yr 24 Hr
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      12.100 to Point/Station      12.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.040
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.960
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.406
Initial subarea total flow distance  =  105.190(Ft.)
Highest elevation = 3712.000(Ft.)
Lowest elevation = 3700.000(Ft.)
Elevation difference =   12.000(Ft.) Slope = 11.408 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  11.41 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.55 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4064)*( 100.000^.5)/(  11.408^(1/3)]=   5.55
Rainfall intensity (I) =      8.625(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.406
Subarea runoff =      0.315(CFS)
Total initial stream area =       0.090(Ac.)


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```

```
Process from Point/Station      12.200 to Point/Station      12.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3700.000(Ft.)
Downstream point elevation =  3556.000(Ft.)
Channel length thru subarea  =  2438.640(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     27.407(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     27.407(CFS)
Depth of flow =   0.469(Ft.), Average velocity =   4.916(Ft/s)
Channel flow top width =   13.755(Ft.)
Flow Velocity =    4.92(Ft/s)
Travel time  =    8.27 min.
Time of concentration =   13.81 min.
Critical depth =      0.570(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.920
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.080
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.327
Rainfall intensity =      4.788(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.327  CA =     11.362
Subarea runoff =     54.086(CFS) for     34.613(Ac.)
Total runoff =     54.401(CFS)  Total area =      34.703(Ac.)
Depth of flow =   0.692(Ft.), Average velocity =   6.153(Ft/s)
Critical depth =      0.859(Ft.)
End of computations, total study area =          34.703 (Ac.)
```

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 08/16/10
------------------------------------------------------------------------
Tule Wind Project
Sytem 13
Proposed 100 Yr 24 Hr
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      13.100 to Point/Station      13.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  123.400(Ft.)
Highest elevation = 3822.000(Ft.)
Lowest elevation = 3806.000(Ft.)
Elevation difference =   16.000(Ft.) Slope = 12.966 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  12.97 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   5.29 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*( 100.000^.5)/(  12.966^(1/3)]=   5.29
Rainfall intensity (I) =      8.896(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      0.689(CFS)
Total initial stream area =       0.189(Ac.)


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```

```
Process from Point/Station       13.200 to Point/Station       13.300
**** IMPROVED CHANNEL TRAVEL TIME ****
```

```
Upstream point elevation =  3806.000(Ft.)
Downstream point elevation =  3554.000(Ft.)
Channel length thru subarea  =  3804.300(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     42.718(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     42.718(CFS)
Depth of flow =   0.585(Ft.), Average velocity =   5.918(Ft/s)
Channel flow top width =   14.680(Ft.)
Flow Velocity =    5.92(Ft/s)
Travel time  =   10.71 min.
Time of concentration =   16.00 min.
Critical depth =      0.742(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.040
Decimal fraction soil group B = 0.760
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.200
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.336
Rainfall intensity =      4.355(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.336  CA =     19.446
Subarea runoff =     83.994(CFS) for     57.644(Ac.)
Total runoff =     84.684(CFS)  Total area =      57.833(Ac.)
Depth of flow =   0.857(Ft.), Average velocity =   7.354(Ft/s)
Critical depth =      1.117(Ft.)
End of computations, total study area =          57.833 (Ac.)
```

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                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 08/18/10
------------------------------------------------------------------------
Tule Wind Project
System 14
Proposed 100 Yr 24 Hr
Aug 16, 2010
------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      14.100 to Point/Station      14.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 1.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.410
Initial subarea total flow distance  =  233.590(Ft.)
Highest elevation = 3994.000(Ft.)
Lowest elevation = 3949.000(Ft.)
Elevation difference =   45.000(Ft.) Slope = 19.265 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of  19.27 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   4.63 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.4100)*( 100.000^.5)/(  19.265^(1/3)]=   4.63
Calculated TC of    4.633 minutes is less than 5 minutes,
 resetting TC to 5.0 minutes for rainfall intensity calculations
Rainfall intensity (I) =      9.222(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.410
Subarea runoff =      1.769(CFS)
Total initial stream area =        0.468(Ac.)
```

```
++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      14.200 to Point/Station      14.300
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3949.000(Ft.)
Downstream point elevation =  3743.000(Ft.)
Channel length thru subarea  =  3533.690(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =     45.997(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =     45.997(CFS)
Depth of flow =   0.632(Ft.), Average velocity =   5.806(Ft/s)
Channel flow top width =   15.059(Ft.)
Flow Velocity =    5.81(Ft/s)
Travel time  =   10.14 min.
Time of concentration =   14.78 min.
Critical depth =      0.781(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 0.860
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.140
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.333
Rainfall intensity =      4.584(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.333  CA =     19.668
Subarea runoff =     88.389(CFS) for     58.556(Ac.)
Total runoff =     90.158(CFS)  Total area =      59.024(Ac.)
Depth of flow =   0.919(Ft.), Average velocity =   7.172(Ft/s)
Critical depth =      1.156(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      14.300 to Point/Station      14.400
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3743.000(Ft.)
Downstream point elevation =  3620.000(Ft.)
Channel length thru subarea  =  3814.580(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =    231.883(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    231.883(CFS)
Depth of flow =   1.772(Ft.), Average velocity =   7.659(Ft/s)
Channel flow top width =   24.175(Ft.)
Flow Velocity =    7.66(Ft/s)
Travel time  =    8.30 min.
Time of concentration =   23.08 min.
Critical depth =      1.969(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.070
Decimal fraction soil group B = 0.710
Decimal fraction soil group C = 0.000
```

```
Decimal fraction soil group D = 0.220
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.336
Rainfall intensity =      3.439(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.336  CA =    108.625
Subarea runoff =    283.354(CFS) for    264.517(Ac.)
Total runoff =    373.512(CFS)  Total area =     323.541(Ac.)
Depth of flow =   2.251(Ft.), Average velocity =   8.732(Ft/s)
Critical depth =      2.531(Ft.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      14.400 to Point/Station      14.500
**** IMPROVED CHANNEL TRAVEL TIME ****
______________________________________________________________________
Upstream point elevation =  3620.000(Ft.)
Downstream point elevation =  3542.000(Ft.)
Channel length thru subarea  =  2848.900(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =    402.785(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =    402.785(CFS)
Depth of flow =   2.432(Ft.), Average velocity =   8.396(Ft/s)
Channel flow top width =   29.455(Ft.)
Flow Velocity =    8.40(Ft/s)
Travel time  =    5.66 min.
Time of concentration =   28.73 min.
Critical depth =      2.625(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.170
Decimal fraction soil group B = 0.250
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.580
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.364
Rainfall intensity =      2.985(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.342  CA =    144.710
Subarea runoff =     58.482(CFS) for     99.216(Ac.)
Total runoff =    431.994(CFS)  Total area =     422.757(Ac.)
Depth of flow =   2.516(Ft.), Average velocity =   8.556(Ft/s)
Critical depth =      2.719(Ft.)
End of computations, total study area =         422.757 (Ac.)
```

```
                San Diego County Rational Hydrology Program

CIVILCADD/CIVILDESIGN Engineering Software,(c)1991-2004 Version 7.4

Rational method hydrology  program based on
San Diego County Flood Control Division 2003 hydrology manual
        Rational Hydrology Study        Date: 09/08/10
------------------------------------------------------------------------
Tule Wind Project
System 15
Proposed Conditions 100 Year

------------------------------------------------------------------------
 *********   Hydrology Study Control Information **********

------------------------------------------------------------------------


Program License Serial Number 4055

------------------------------------------------------------------------
Rational hydrology study storm event year is   100.0
English (in-lb) input data Units used

Map data precipitation entered:
6 hour,  precipitation(inches) =  3.500
24 hour precipitation(inches) =  6.000
P6/P24 =    58.3%
San Diego hydrology manual 'C' values used


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
Process from Point/Station      15.100 to Point/Station      15.200
**** INITIAL AREA EVALUATION ****
______________________________________________________________________
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                     ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Initial subarea total flow distance  =   59.590(Ft.)
Highest elevation = 3699.000(Ft.)
Lowest elevation = 3694.000(Ft.)
Elevation difference =    5.000(Ft.) Slope =  8.391 %
INITIAL AREA TIME OF CONCENTRATION CALCULATIONS:
The maximum overland flow distance is 100.00 (Ft)
for the top area slope value of   8.39 %, in a development type of
 1.0 DU/A or Less
In Accordance With Figure 3-3
Initial Area Time of Concentration =   6.91 minutes
TC = [1.8*(1.1-C)*distance(Ft.)^.5)/(% slope^(1/3)]
TC = [1.8*(1.1-0.3200)*( 100.000^.5)/(   8.391^(1/3)]=   6.91
Rainfall intensity (I) =      7.485(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for area (Q=KCIA) is C = 0.320
Subarea runoff =      0.144(CFS)
Total initial stream area =       0.060(Ac.)


++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
```

```
Process from Point/Station      15.200 to Point/Station      15.300
**** IMPROVED CHANNEL TRAVEL TIME ****
```

```
Upstream point elevation =  3694.000(Ft.)
Downstream point elevation =  3645.000(Ft.)
Channel length thru subarea  =   661.420(Ft.)
Channel base width      =   10.000(Ft.)
Slope or 'Z' of left channel bank =   4.000
Slope or 'Z' of right channel bank =   4.000
Estimated mean flow rate at midpoint of channel =      5.541(CFS)
Manning's 'N'    = 0.040
Maximum depth of channel  =    5.000(Ft.)
Flow(q) thru subarea =      5.541(CFS)
Depth of flow =   0.173(Ft.), Average velocity =   3.001(Ft/s)
Channel flow top width =   11.382(Ft.)
Flow Velocity =    3.00(Ft/s)
Travel time  =    3.67 min.
Time of concentration =   10.58 min.
Critical depth =      0.207(Ft.)
 Adding area flow to channel
Decimal fraction soil group A = 0.000
Decimal fraction soil group B = 1.000
Decimal fraction soil group C = 0.000
Decimal fraction soil group D = 0.000
[LOW DENSITY RESIDENTIAL                    ]
(1.0 DU/A or Less       )
Impervious value, Ai = 0.100
Sub-Area C Value = 0.320
Rainfall intensity =      5.685(In/Hr) for a   100.0 year storm
Effective runoff coefficient used for total area
(Q=KCIA) is C = 0.320  CA =      1.910
Subarea runoff =     10.718(CFS) for      5.910(Ac.)
Total runoff =     10.861(CFS)  Total area =       5.970(Ac.)
Depth of flow =   0.257(Ft.), Average velocity =   3.836(Ft/s)
Critical depth =      0.316(Ft.)
End of computations, total study area =           5.970 (Ac.)
```

APPENDIX G
Standard Crossing Plate

Figure G-1: Standard Crossing Geometry

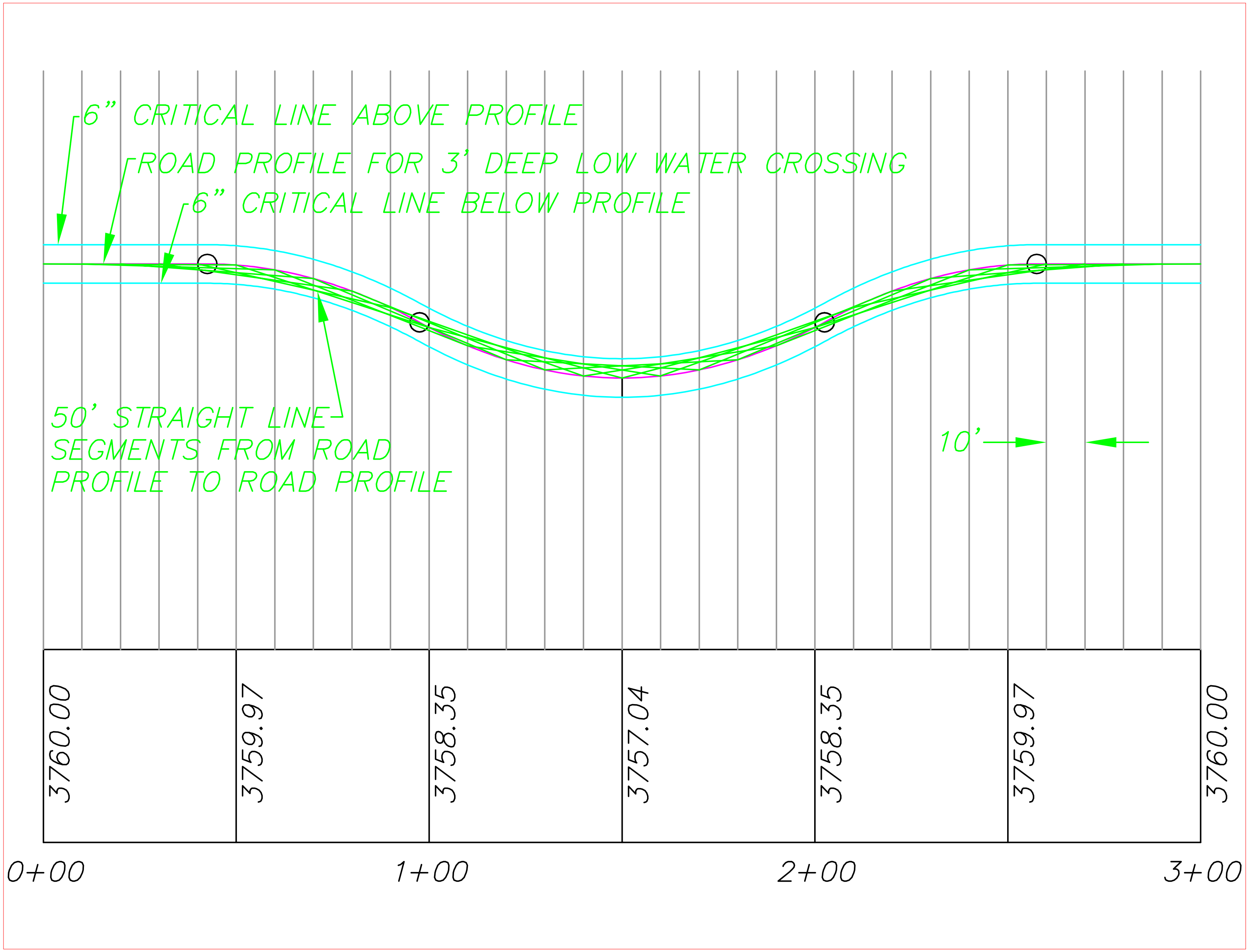


FIGURE G-1: STANDARD AT-GRADE CROSSING GEOMETRY

APPENDIX H
Crossing Hydraulics CulvertMaster Output

General Crossings

Rating Table Report
Overtopping

Range Data:				
	Minimum	Maximum	Increment	
Discharge	0.00	600.00	10.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)
0.00	0.00	0.00
10.00	0.29	0.13
20.00	0.40	0.20
30.00	0.49	0.25
40.00	0.56	0.30
50.00	0.63	0.34
60.00	0.68	0.38
70.00	0.74	0.42
80.00	0.79	0.45
90.00	0.83	0.48
100.00	0.87	0.52
110.00	0.92	0.55
120.00	0.95	0.58
130.00	0.99	0.60
140.00	1.03	0.63
150.00	1.06	0.66
160.00	1.09	0.68
170.00	1.13	0.71
180.00	1.16	0.73
190.00	1.19	0.76
200.00	1.22	0.78
210.00	1.25	0.80
220.00	1.27	0.83
230.00	1.30	0.85
240.00	1.33	0.87
250.00	1.35	0.89
260.00	1.38	0.91
270.00	1.40	0.93
280.00	1.43	0.95
290.00	1.45	0.97
300.00	1.48	0.99
310.00	1.50	1.01
320.00	1.52	1.03
330.00	1.54	1.05
340.00	1.57	1.07
350.00	1.59	1.09
360.00	1.61	1.11
370.00	1.63	1.13
380.00	1.65	1.15
390.00	1.67	1.16
400.00	1.69	1.18
410.00	1.71	1.20
420.00	1.73	1.22
430.00	1.75	1.23
440.00	1.77	1.25
450.00	1.79	1.27
460.00	1.80	1.28
470.00	1.82	1.30
480.00	1.84	1.32
490.00	1.86	1.33
500.00	1.88	1.35

Rating Table Report
Overtopping

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)
510.00	1.89	1.36
520.00	1.91	1.38
530.00	1.93	1.40
540.00	1.94	1.41
550.00	1.96	1.43
560.00	1.98	1.44
570.00	1.99	1.46
580.00	2.01	1.47
590.00	2.03	1.49
600.00	2.04	1.50

Rating Table Report
Overtopping

Range Data:

	Minimum	Maximum	Increment	
Discharge	0.00	2,000.00	20.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)
0.00	0.00	0.00
20.00	0.11	0.08
40.00	0.17	0.12
60.00	0.22	0.15
80.00	0.26	0.18
100.00	0.30	0.20
120.00	0.34	0.23
140.00	0.37	0.25
160.00	0.40	0.27
180.00	0.43	0.29
200.00	0.46	0.31
220.00	0.49	0.33
240.00	0.52	0.35
260.00	0.54	0.36
280.00	0.57	0.38
300.00	0.60	0.39
320.00	0.62	0.41
340.00	0.64	0.43
360.00	0.67	0.44
380.00	0.69	0.45
400.00	0.71	0.47
420.00	0.73	0.48
440.00	0.75	0.50
460.00	0.77	0.51
480.00	0.79	0.52
500.00	0.81	0.54
520.00	0.83	0.55
540.00	0.85	0.56
560.00	0.87	0.57
580.00	0.89	0.59
600.00	0.91	0.60
620.00	0.93	0.61
640.00	0.95	0.62
660.00	0.97	0.63
680.00	0.98	0.64
700.00	1.00	0.66
720.00	1.02	0.67
740.00	1.03	0.68
760.00	1.05	0.69
780.00	1.07	0.70
800.00	1.08	0.71
820.00	1.10	0.72
840.00	1.12	0.73
860.00	1.13	0.74
880.00	1.15	0.75
900.00	1.17	0.76
920.00	1.18	0.77
940.00	1.20	0.78
960.00	1.21	0.79
980.00	1.23	0.80
1,000.00	1.24	0.81

Rating Table Report
Overtopping

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)
1,020.00	1.26	0.82
1,040.00	1.27	0.83
1,060.00	1.29	0.84
1,080.00	1.30	0.85
1,100.00	1.32	0.86
1,120.00	1.33	0.87
1,140.00	1.34	0.88
1,160.00	1.36	0.89
1,180.00	1.37	0.90
1,200.00	1.39	0.91
1,220.00	1.40	0.92
1,240.00	1.41	0.92
1,260.00	1.43	0.93
1,280.00	1.44	0.94
1,300.00	1.45	0.95
1,320.00	1.47	0.96
1,340.00	1.48	0.97
1,360.00	1.49	0.98
1,380.00	1.51	0.99
1,400.00	1.52	0.99
1,420.00	1.53	1.00
1,440.00	1.55	1.01
1,460.00	1.56	1.02
1,480.00	1.57	1.03
1,500.00	1.59	1.04
1,520.00	1.60	1.04
1,540.00	1.61	1.05
1,560.00	1.62	1.06
1,580.00	1.64	1.07
1,600.00	1.65	1.08
1,620.00	1.66	1.09
1,640.00	1.67	1.09
1,660.00	1.69	1.10
1,680.00	1.70	1.11
1,700.00	1.71	1.12
1,720.00	1.72	1.12
1,740.00	1.73	1.13
1,760.00	1.75	1.14
1,780.00	1.76	1.15
1,800.00	1.77	1.16
1,820.00	1.78	1.16
1,840.00	1.79	1.17
1,860.00	1.80	1.18
1,880.00	1.82	1.19
1,900.00	1.83	1.19
1,920.00	1.84	1.20
1,940.00	1.85	1.21
1,960.00	1.86	1.22
1,980.00	1.87	1.22
2,000.00	1.89	1.23

System 14 Crossing

Rating Table Report
Overtopping

Range Data:				
	Minimum	Maximum	Increment	
Discharge	0.00	600.00	10.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)
0.00	0.00	0.00
10.00	0.14	0.13
20.00	0.21	0.20
30.00	0.27	0.25
40.00	0.32	0.30
50.00	0.37	0.34
60.00	0.41	0.38
70.00	0.45	0.42
80.00	0.48	0.45
90.00	0.52	0.48
100.00	0.55	0.52
110.00	0.58	0.55
120.00	0.62	0.58
130.00	0.65	0.60
140.00	0.68	0.63
150.00	0.70	0.66
160.00	0.73	0.68
170.00	0.76	0.71
180.00	0.78	0.73
190.00	0.81	0.76
200.00	0.83	0.78
210.00	0.86	0.80
220.00	0.88	0.83
230.00	0.90	0.85
240.00	0.93	0.87
250.00	0.95	0.89
260.00	0.97	0.91
270.00	0.99	0.93
280.00	1.02	0.95
290.00	1.03	0.97
300.00	1.05	0.99
310.00	1.07	1.01
320.00	1.10	1.03
330.00	1.12	1.05
340.00	1.14	1.07
350.00	1.16	1.09
360.00	1.17	1.11
370.00	1.19	1.13
380.00	1.21	1.15
390.00	1.23	1.16
400.00	1.25	1.18
410.00	1.27	1.20
420.00	1.28	1.22
430.00	1.30	1.23
440.00	1.32	1.25
450.00	1.34	1.27
460.00	1.35	1.28
470.00	1.37	1.30
480.00	1.39	1.32
490.00	1.40	1.33
500.00	1.42	1.35

Rating Table Report
Overtopping

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)
510.00	1.44	1.36
520.00	1.46	1.38
530.00	1.47	1.40
540.00	1.49	1.41
550.00	1.50	1.43
560.00	1.52	1.44
570.00	1.53	1.46
580.00	1.55	1.47
590.00	1.56	1.49
600.00	1.58	1.50

Rating Table Report
Overtopping

Range Data:

	Minimum	Maximum	Increment	
Discharge	0.00	11,000.00	100.00	cfs

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)
0.00	0.00	0.00
100.00	0.08	0.07
200.00	0.13	0.10
300.00	0.17	0.13
400.00	0.21	0.16
500.00	0.24	0.18
600.00	0.28	0.20
700.00	0.30	0.22
800.00	0.33	0.24
900.00	0.36	0.26
1,000.00	0.39	0.27
1,100.00	0.41	0.29
1,200.00	0.43	0.30
1,300.00	0.46	0.32
1,400.00	0.48	0.33
1,500.00	0.50	0.35
1,600.00	0.52	0.36
1,700.00	0.55	0.38
1,800.00	0.57	0.39
1,900.00	0.59	0.40
2,000.00	0.61	0.41
2,100.00	0.63	0.43
2,200.00	0.65	0.44
2,300.00	0.66	0.45
2,400.00	0.68	0.46
2,500.00	0.70	0.47
2,600.00	0.72	0.48
2,700.00	0.74	0.50
2,800.00	0.75	0.51
2,900.00	0.77	0.52
3,000.00	0.79	0.53
3,100.00	0.81	0.54
3,200.00	0.82	0.55
3,300.00	0.84	0.56
3,400.00	0.86	0.57
3,500.00	0.87	0.58
3,600.00	0.89	0.59
3,700.00	0.90	0.60
3,800.00	0.92	0.61
3,900.00	0.94	0.62
4,000.00	0.95	0.63
4,100.00	0.97	0.64
4,200.00	0.98	0.65
4,300.00	1.00	0.65
4,400.00	1.01	0.66
4,500.00	1.03	0.67
4,600.00	1.04	0.68
4,700.00	1.06	0.69
4,800.00	1.07	0.70
4,900.00	1.08	0.71
5,000.00	1.10	0.72

Rating Table Report
Overtopping

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)
5,100.00	1.11	0.73
5,200.00	1.13	0.73
5,300.00	1.14	0.74
5,400.00	1.15	0.75
5,500.00	1.17	0.76
5,600.00	1.18	0.77
5,700.00	1.20	0.78
5,800.00	1.21	0.78
5,900.00	1.22	0.79
6,000.00	1.24	0.80
6,100.00	1.25	0.81
6,200.00	1.26	0.82
6,300.00	1.28	0.82
6,400.00	1.29	0.83
6,500.00	1.30	0.84
6,600.00	1.31	0.85
6,700.00	1.33	0.85
6,800.00	1.34	0.86
6,900.00	1.35	0.87
7,000.00	1.37	0.88
7,100.00	1.38	0.88
7,200.00	1.39	0.89
7,300.00	1.40	0.90
7,400.00	1.41	0.91
7,500.00	1.43	0.91
7,600.00	1.44	0.92
7,700.00	1.45	0.93
7,800.00	1.46	0.94
7,900.00	1.48	0.94
8,000.00	1.49	0.95
8,100.00	1.50	0.96
8,200.00	1.51	0.96
8,300.00	1.52	0.97
8,400.00	1.54	0.98
8,500.00	1.55	0.99
8,600.00	1.56	0.99
8,700.00	1.57	1.00
8,800.00	1.58	1.01
8,900.00	1.59	1.01
9,000.00	1.61	1.02
9,100.00	1.62	1.03
9,200.00	1.63	1.03
9,300.00	1.64	1.04
9,400.00	1.65	1.05
9,500.00	1.66	1.05
9,600.00	1.67	1.06
9,700.00	1.68	1.07
9,800.00	1.70	1.07
9,900.00	1.71	1.08
10,000.00	1.72	1.09
10,100.00	1.73	1.09
10,200.00	1.74	1.10
10,300.00	1.75	1.11
10,400.00	1.76	1.11
10,500.00	1.77	1.12

Rating Table Report
Overtopping

Discharge (cfs)	HW Elev. (ft)	TW Elev. (ft)
10,600.00	1.78	1.13
10,700.00	1.80	1.13
10,800.00	1.81	1.14
10,900.00	1.82	1.14
11,000.00	1.83	1.15

EXHIBITS

HDR ONE COMPANY | *Many Solutions*

Existing Conditions Drainage Map

EXHIBIT A

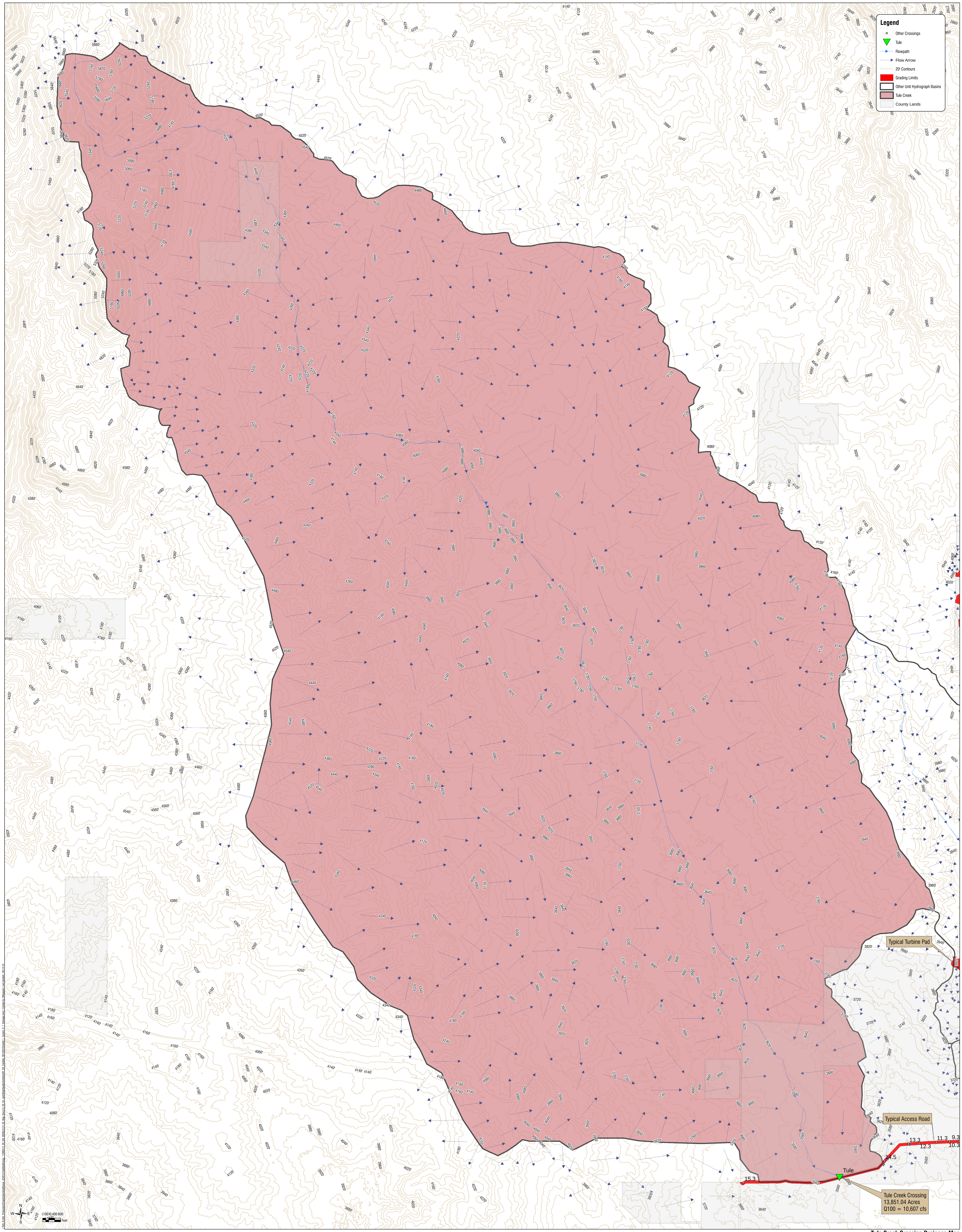
424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

HDR ONE COMPANY | *Many Solutions*

Proposed Conditions Drainage Map

EXHIBIT B

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

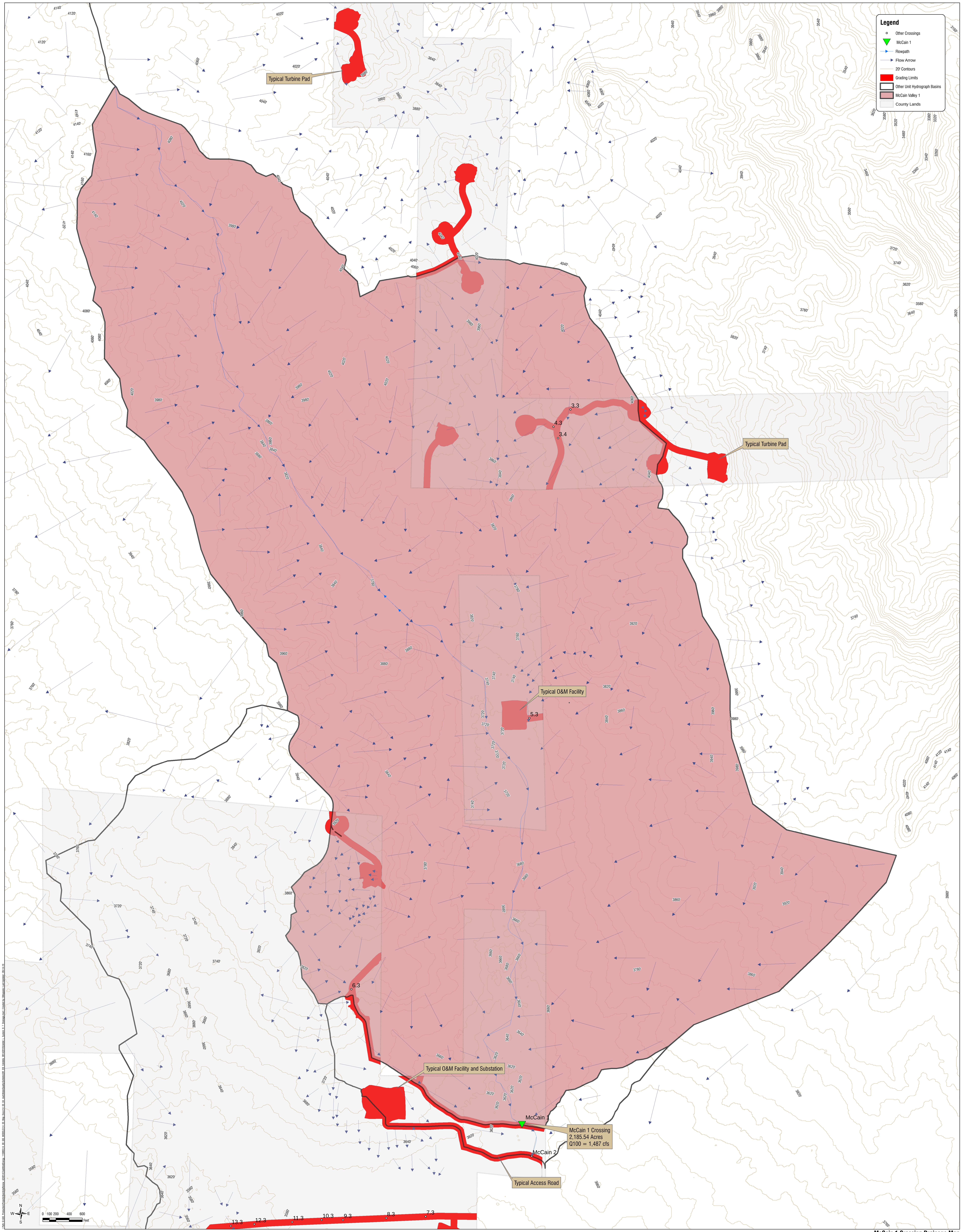


Tule Creek Crossing Drainage Map

EXHIBIT C

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

HDR ONE COMPANY | Many Solutions

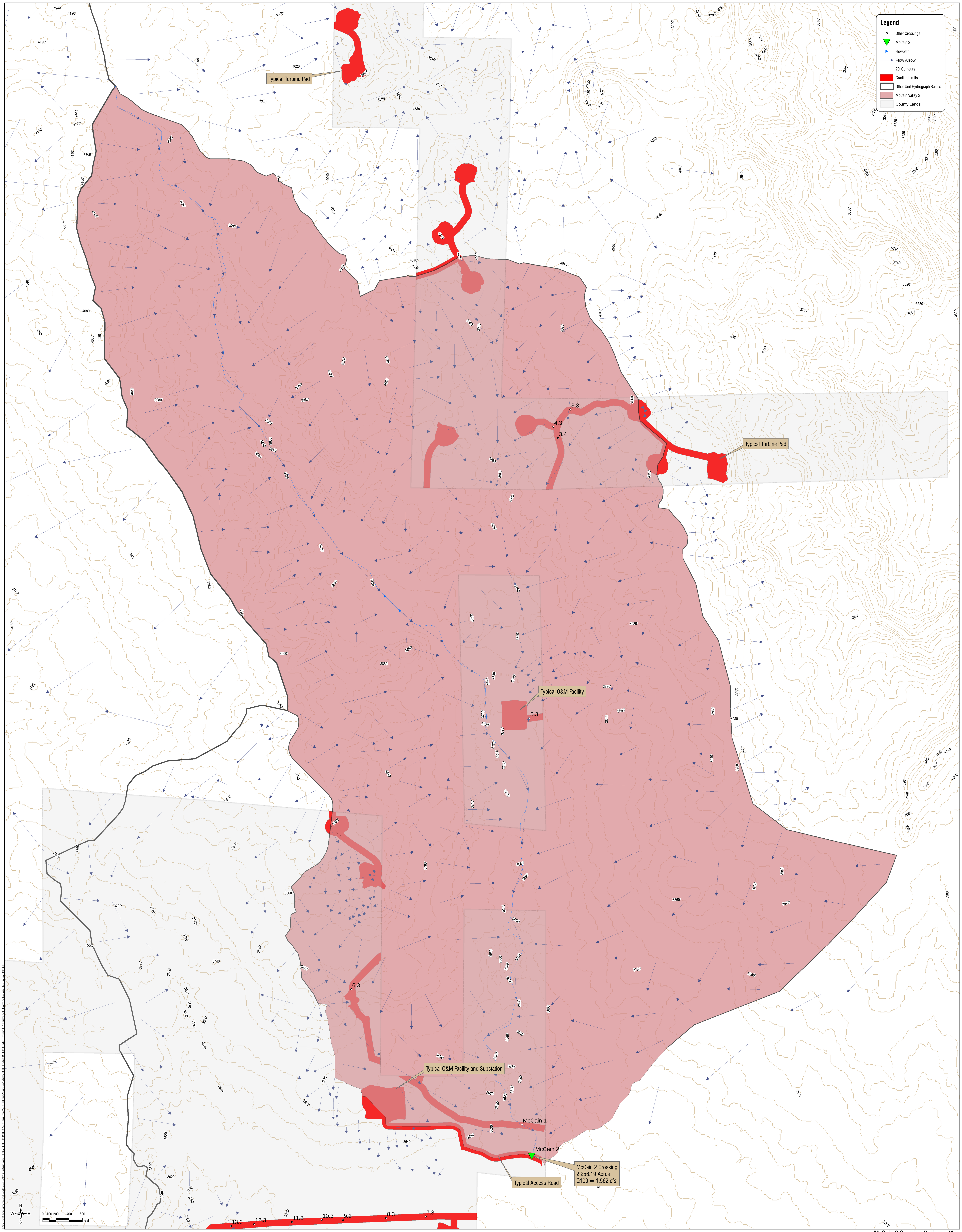


HDR ONE COMPANY | Many Solutions

McCain 1 Crossing Drainage Map

EXHIBIT D

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study



McCain 2 Crossing Drainage Map

EXHIBIT E

HDR
ONE COMPANY | Many Solutions

System 1-2 Drainage Map

EXHIBIT F

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

System 3-4 Drainage Map

EXHIBIT G

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

HDR ONE COMPANY | Many Solutions

HDR ONE COMPANY | Many Solutions

System 5 Drainage Map

EXHIBIT H

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

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System 6 Drainage Map

EXHIBIT I

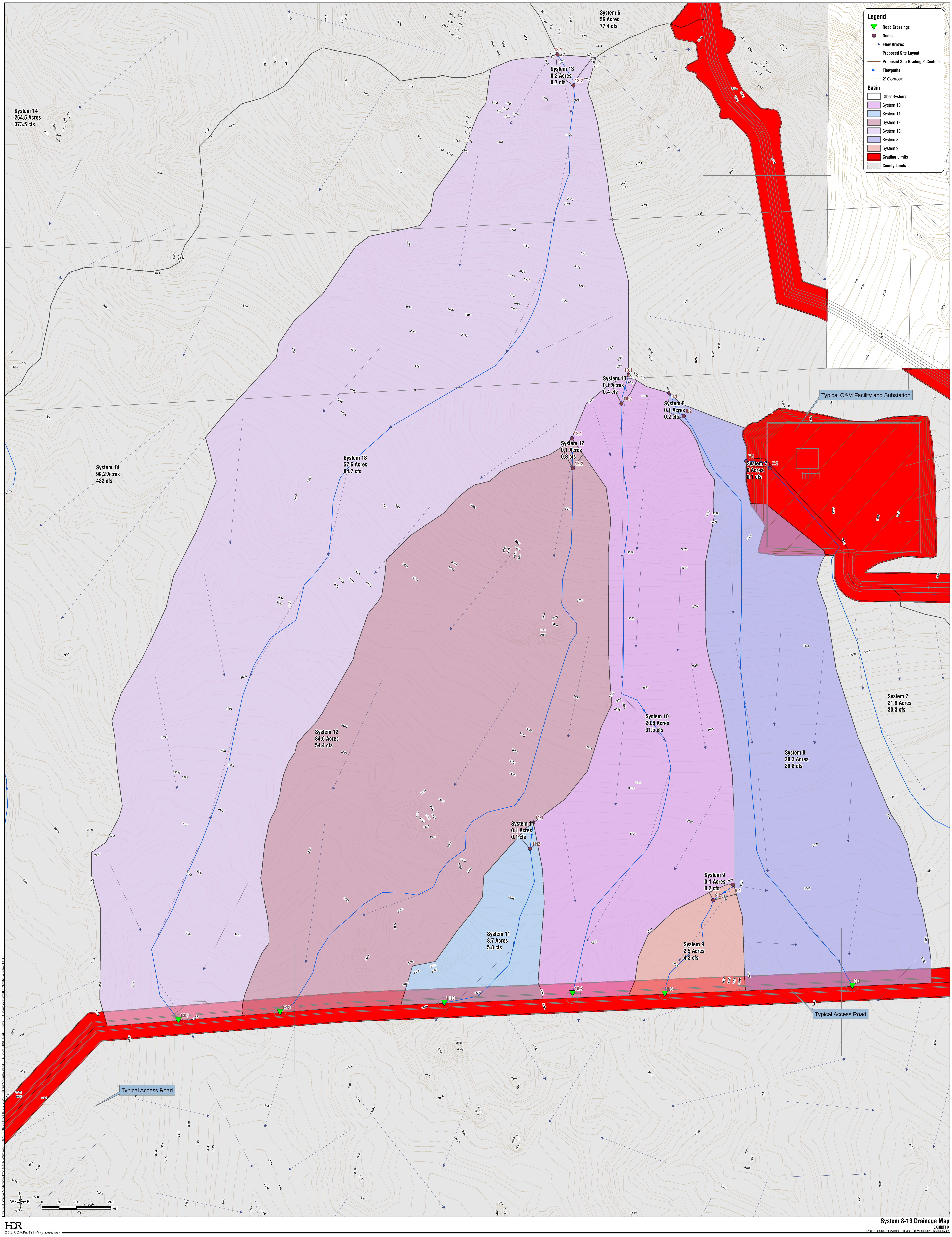
424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

HDR
ONE COMPANY | Many Solutions

System 7 Drainage Map

EXHIBIT J

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

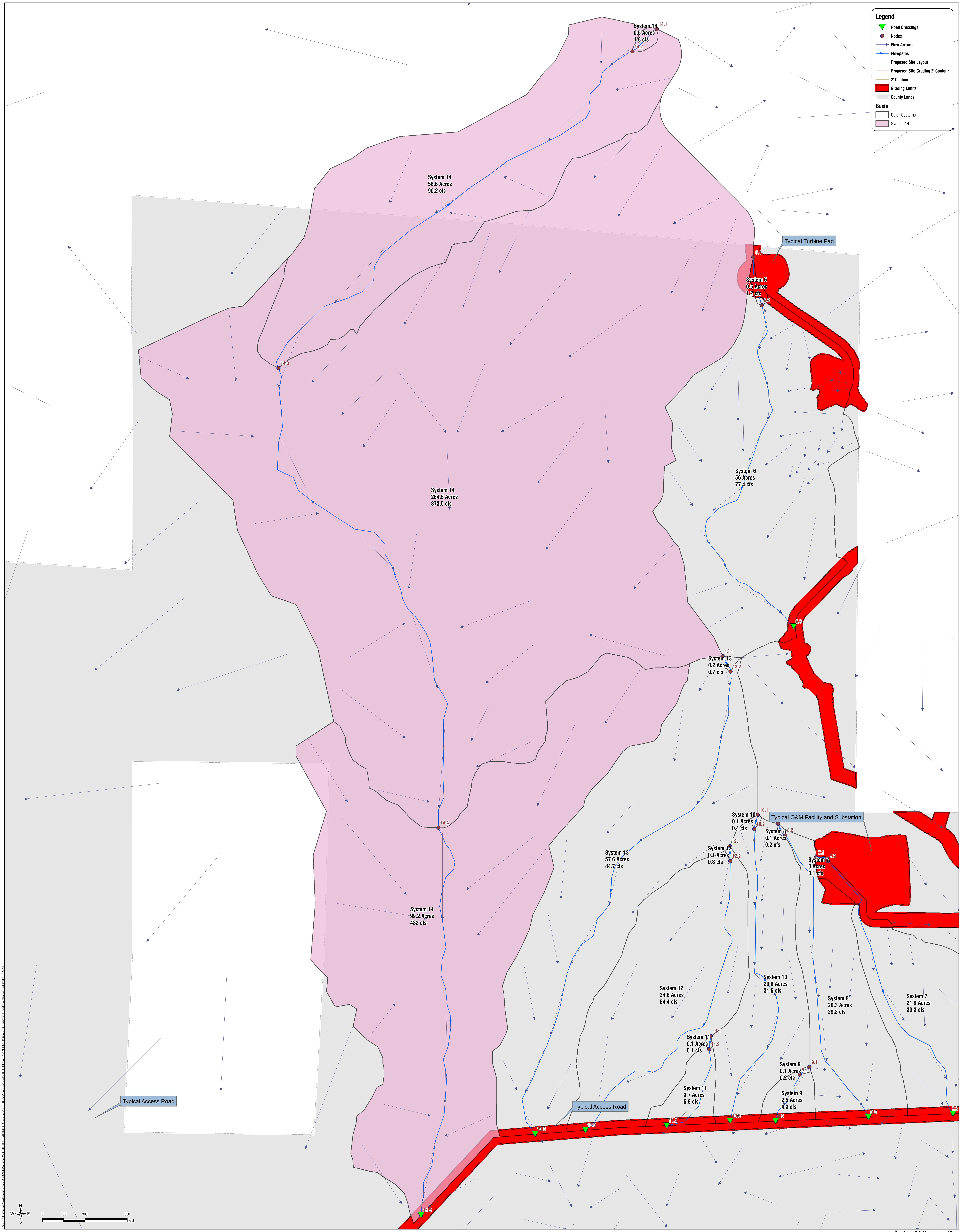


HDR
ONE COMPANY | Many Solutions

System 8-13 Drainage Map

EXHIBIT K

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study



System 14 Drainage Map

EXHIBIT L

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

HDR ONE COMPANY | Many Solutions

System 15 Drainage Map

EXHIBIT M

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

HDR ONE COMPANY | *Many Solutions*

System 15 Drainage Map

EXHIBIT N

424914 - Iberdrola Renewables | 115965 - Tule Wind Energy | Drainage Study

DRAFT
ARCHAEOLOGICAL AND HISTORICAL INVESTIGATIONS FOR THE ENERGIA SIERRA JUAREZ U.S. MAJOR USE WATER EXTRACTION PERMIT (MUP) APPLICATION JACUMBA, CALIFORNIA

Energia Sierra Juarez U.S. Transmission, LLC
MUP 10-014, KIVA PROJECT 3300-10-014

Lead Agency:

County of San Diego
Department of Planning and Land Use
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Preparers:

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(619) 233-1454

Stacey C. Jordan, Ph.D.

With contributions by Cheryl Bowden-Renna.

Project Proponent:

Energia Sierra Juarez U.S. Transmission, LLC
101 Ash Street, HQ 14
San Diego, California 92101

February 2011

National Archaeological Data Base Information

Authors:	Stacey C. Jordan with contributions by Cheryl Bowden-Renna
Firm:	AECOM
Client/Project Proponent:	Energia Sierra Juarez U.S. Transmission, LLC
Report Date:	February 2011
Report Title:	Draft Archaeological and Historical Investigations for the Energia Sierra Juarez U.S. Major Use Water Extraction Permit (MUP) Application, Jacumba, California
Type of Study:	Intensive Pedestrian Survey
New Sites:	None
Updated Sites	CA-SDI- 4455; P-37-024023
USGS Quad:	Jacumba 1975
Acreage:	Approximately 1.47 acres
Permit Numbers:	MUP 10-014, KIVA PROJECT 3300-10-014
Key Words:	Intensive pedestrian survey, Prehistoric, CA-SDI-4455, Village of *Hacúm*, Historic, P-37-024023, Old Highway 80

TABLE OF CONTENTS

APPENDICES

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS AND ABBREVIATIONS

amsl	above mean sea level
APE	Area of Potential Effect
bgs	below ground surface
B.P.	Before Present
CEQA	California Environmental Quality Act
CRHR	California Register of Historical Resources
DPLU	County of San Diego Department of Planning and Land Use
DPR	Department of Parks and Recreation
DPW	San Diego County Department of Public Works
ESJ	Energia Sierra Juarez
ESJ U.S.	Energia Sierra Juarez U.S. Transmission, LLC
Gen-Tie	generator interconnection line
HPSR	Historic Property Survey Report
In	inches
JCSD	Jacumba Community Service District
JDAD	Jacuma Discontiguous Archaeological District
kV	Kilovolt
Local Register	San Diego County Local Register of Historical Resources
MUP	Major Use Water Extraction Permit
NAHC	Native American Heritage Commission
NRHP	National Register of Historic Places
R.P.A.	Register of Professional Archaeologist
RPO	San Diego County Resource Protection Ordinance
SCIC	South Coastal Information Center
SHPO	State Historic Preservation Office
U.S.	United States

MANAGEMENT SUMMARY

Project Description

For the purposes of this Cultural Resources Technical Report, the "project" refers to the Energia Sierra Juarez U.S. Major Use Water Extraction Permit (MUP) Application, Jacumba, California. A new access route, approximately 150 feet in length, is proposed from Old Highway 80 to an existing well site. All other facilities are existing.

Energia Sierra Juarez U.S. Transmission, LLC (ESJ U.S.), on behalf of Jacumba Community Service District (JCSD), is preparing a San Diego County Major Use Water Extraction Permit (MUP) Application to allow for the acquisition of water from an existing JCSD warm water well and its use at the ESJ U.S. project site to control fugitive dust during an approximately 6 month construction schedule. It is estimated that approximately 800,000 gallons of water will be purchased for this purpose. The County of San Diego is currently reviewing a separate ESJ U.S. MUP for the construction, operation, and maintenance of a less than one mile segment of an "electric generator-tieline" (Gen-Tie) in Eastern San Diego County (KIVA Project: 09-0107420). The proposed ESJ Gen-Tie Project consists of a single circuit 500 kV line or double-circuit 230 kV line supported on three to five 150-foot steel lattice towers or 170-foot steel monopoles. It is at this project site where the water will be used for dust control. A cultural resources technical report has been previously prepared by AECOM for this project (Jordan 2009).

Surveys/Investigations

AECOM staff conducted pedestrian archaeological and historical survey investigations on January 25, 2011. This survey covered the proposed access route to the existing JCSD water well and 100 ft (30 m) buffer on either side of the proposed 150 ft (45 m) linear access route, which total approximately 1.47 acres, defined for the purposes of this study as the Project APE.

Prior to conducting the survey investigations, AECOM conducted a literature review of at the South Coastal Information Center (SCIC), housed at San Diego State University on January 24, 2011. The records search indicated that the proposed project is located within the site boundary for site CA-SDI-4455. This site has been previously recorded as the village site of *Hacúm*. Portions of this site, south of the proposed project area, have been tested and a substantial subsurface deposit was observed (Joyner and Beck 1991). The County of San Diego's Department of Public Works has previously recommended this site as eligible for inclusion to the National Register of Historic Places (NRHP) (Joyner and Beck 1991). AECOM staff also sent a Sacred Lands file search request to the Native American Heritage Commission (NAHC) on January 24, 2011. To date no response has been received. At the request of the County, Mr. Clint Linton, Kumeyaay representative, was contacted by telephone to notify them of the survey and solicit their participation. Mr. Linton was not available at this time to participate in the survey effort.

During the survey investigation, no cultural material was observed within the proposed project area. Several quartz flakes were observed within the 100 ft (30 m) buffer area, north of the proposed access route.

As the proposed project area is located within the site boundary for CA-SDi-4455, a limited testing program is recommended prior to any ground disturbing activity in the area. Additionally, monitoring by a qualified archaeologist and a Native American monitor is recommended during all ground disturbing activities for the proposed project.

1.0 INTRODUCTION

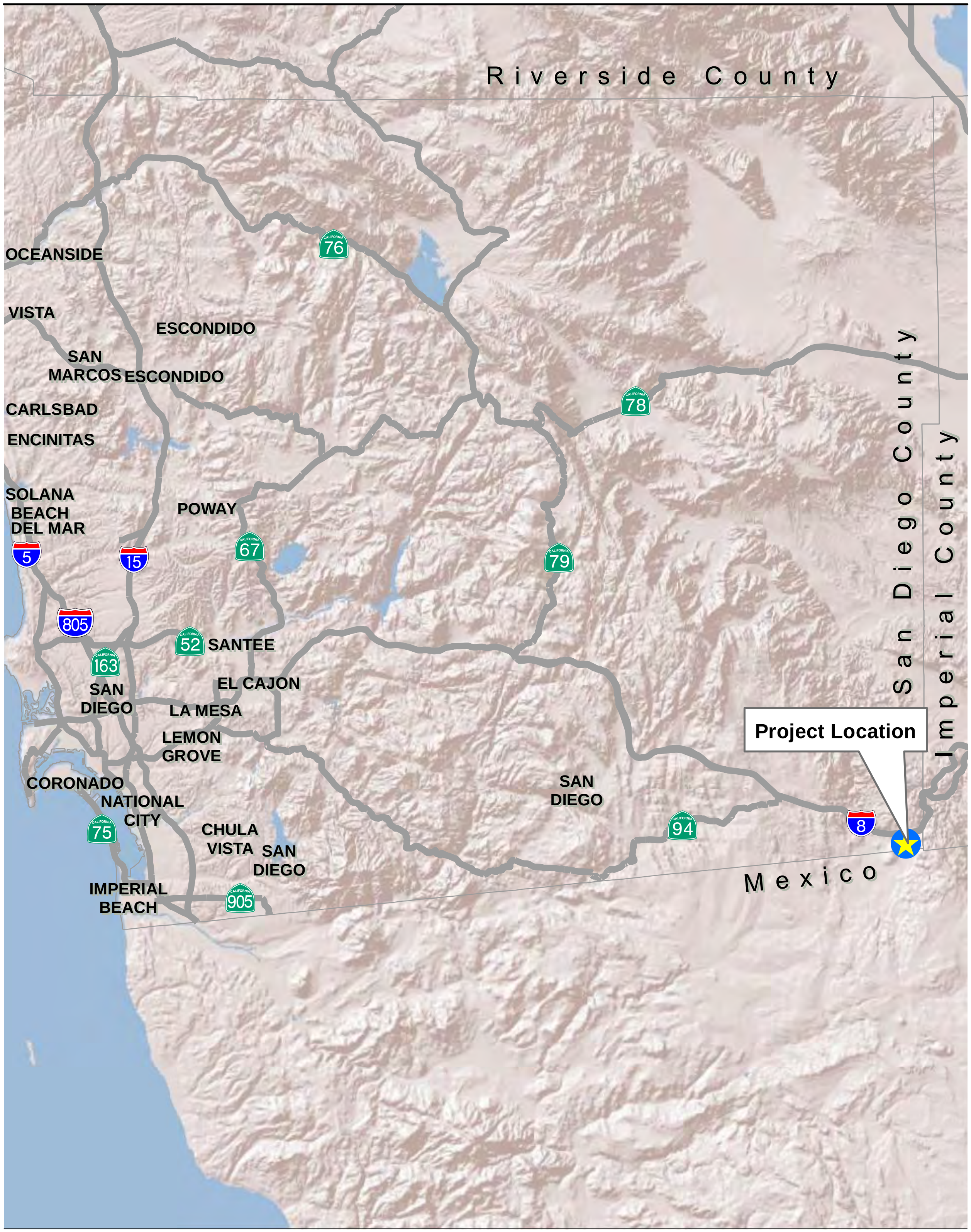
1.1 Project Description

For the purposes of this Cultural Resources Technical Report, the “project” refers to the Energia Sierra Juarez U.S. Major Use Water Extraction Permit (MUP) Application, Jacumba, California.

The proposed project for this San Diego County MUP application is the acquisition of water from an existing Jacumba Community Service District (JCSD) warm water well #6, use of the water at the ESJ Gen-Tie construction site to control fugitive dust emissions, and construction of a new access route. It is estimated that approximately 800,000 gallons will be purchased and used over a six month period for this purpose. It should be noted that this water well has been in operation since 2003, serving the JCSD since that time.

The project is located west of downtown Jacumba, in southeastern San Diego County (Figures 1 and 2). Water well #6 was drilled in 2003 to a depth of 465 feet below ground surface (bgs) and cased to 113 feet bgs. The well was initially intended for use as a potable water well; however, during drilling a hot springs aquifer was encountered. Due to its elevated temperature, use of the water is limited. The quality of the water is appropriate for fugitive dust control. The County of San Diego Department of Planning and Land Use (DPLU) has reviewed the water well quality and hydrology information and made an initial determination that water quality and quantity are adequate for the use of the water for the purpose sought in this application.

Access to the water well will be from Old Highway 80 via the construction of a new dirt road approximately 150 feet long by 15 feet wide (Figure 3). Water will be extracted from the well using an existing pump and flexible hose configuration. Water trucks will drive along the new access route, connect to the flexible hose, and upon filling will exit the site. It is estimated that two 2,500 gallon water trucks per day will be filled during a six day work week over a six month construction schedule. The speed limit in the immediate area where the easement is located on Old Highway 80 is 25 miles an hour, which will allow safe ingress and egress of the trucks. Additionally, there is an elementary school within 100 yards of the easement entrance. Visual sight lines from the exit meet County standards. The water will be transported approximately 3.75 miles west on Old Highway 80 to the ESJ Gen-Tie project site.



Source: SANGIS 2008; ESRI 2011

11 5.5 0 11 Miles

Scale: 1 = 696,960; 1 inch = 11 mile(s)

Figure 1
Regional Location Map

Path: P:\2009\09080001 ESJ Gen-Tie\6.0 GIS\6.3 Layout\Cultural\Well_Cultural\Figure1_Regional_Location.mxd, 02/03/11, SorensenJ

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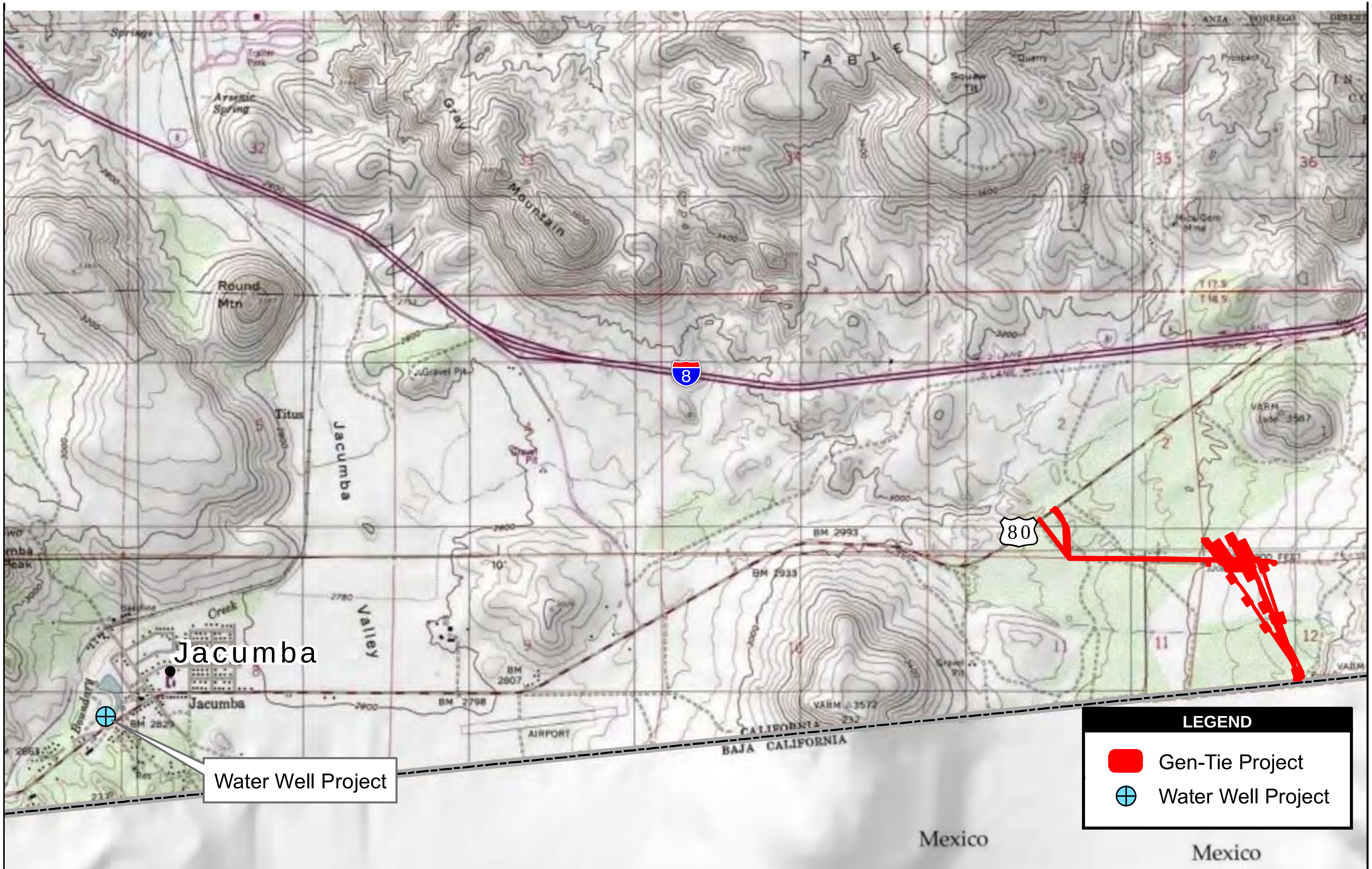

Source: Sempra Energy 2009; SANGIS 2008; USGS 7.5' Topographic Quadrangle In-Ko-Pah Gorge, CA 1975, Jacumba, CA 1975

3,000 0 3,000 Feet

Scale: 1 = 36,000; 1 inch = 3,000 feet

Figure 2
Project Vicinity Map

Source: Sempra 2010; SANGIS 2010; DigitalGlobe 2008

50 25 0 50 Feet

Scale: 1 = 600; 1 inch = 50 feet

Figure 3
Project Footprint

Path: P:\2009\09080001 ESJ Gen-Tie\6.0 GIS\6.3 Layout\Cultural\Well_Cultural\Fig3_Footprint.mxd, 02/03/11, SorensenJ

The DPLU has requested the preparation of a Minor Stormwater Management Plan (minor SWMP). The minor SWMP includes options for standard sediment control devices such as silt fences, straw wattles, straw bales and soil stabilizers, as necessary to minimize soil erosion. There will be no fueling or hazardous materials at the site associated with the JCSD Water Extraction Project.

Construction impacts for the proposed project would include:

- Clearing and grubbing;
- Access road construction consisting of using fill;
- Construct drainage in the fill; and
- Final grading and site clean-up

Vegetation would be cleared and grubbed along the proposed access road. It is anticipated that the contractor will use dirt fill to smooth out the elevation transition from Old Highway 80 to the well site. A pipe will be build into this fill area to allow water to continue to cross underneath. The road will not be paved and will remain a dirt road. It is anticipated that limited ground disturbance will be necessary for the construction of the proposed access route and that the area of impact would be no more than 150 ft (45 m in length and 20 ft (6 m) in width.

1.2 Existing Conditions

1.2.1 Environmental Setting

Natural

The water well is located at the west end of downtown Jacumba in the southeast corner of San Diego County, on the north side of Old Highway 80. Two existing dirt roads provide access to the proposed project area. Currently the area is a vacant lot. Single family residences are located to the south of the project and an elementary school is located approximately 0.1 mile west of the project. Extensive pockets of dumping of trash and construction debris litter the area.

Precipitation averages 15.58 inches (in.) per year at Jacumba. Most rain falls from November to March. Jacumba experiences its hottest average temperatures in August, with an average maximum of 94 degrees Fahrenheit (°F). January is the coldest month, with an average high of 62°F (Weather Channel 2009).

Topography

The proposed project is in the Desert Slopes ecological subsection of the Southern California Mountains and Valleys ecological subregion in southeastern-most San Diego County. Located on the eastern side of the Peninsular Ranges physiographic region, formed by the large, intrusive La Posta igneous pluton (Walawender and Hanan 1991), the proposed project is situated south of Table Mountain and the Jacumba Mountains and southwest of the In-Ko-Pah Mountains. Generally, the area contains steep to moderately steep mountains with narrow to rounded summits and broad valleys occupied by alluvial fans. The Table Mountain area provides the highest elevations within a 1-mile (1.61-km) radius of the project (3,000 to 4,000 feet [914.4 to 1,219.2 meters]) above mean sea level [amsl]) with slope gradients of up to 40 percent (Cook and Fulmer 1980). Although human uses have been found virtually anywhere in the level areas, site locations are concentrated in the Table Mountain Formation Gravels, at the escarpments of Table Mountain, and on “beaches” along the shores of well-watered drainages at the base of the Southern California Batholith. Concentrations in this area form significant patterns and imply that this geomorphic formation was particularly desirable for human occupation (May 1976).

Elevation at the project site is approximately 2,840 ft amsl and is located on a slight south facing slope into the drainage for Boundary Creek. The project is located at the base of hills leading up to Jacumba Peak and at the western edge of Jacumba Valley. A small ridge containing granitic outcroppings and boulders is located to the northeast of the proposed project.

Geology

The area began with the Mesozoic aged granitic bedrock of the Southern California Batholith, which was subsequently buried by Early Miocene-age Table Mountain Formation gravels. Subsequently, Late Miocene Jacumba Volcanics erupted to cover both earlier formations, distributing porphyritic pyroclastic materials throughout the region. Quaternary alluviation and Late Pleistocene erosion converted the Table Mountain Formation into ridges and terraces (May 1976). Gray Mountain, in the western portion of the Table Mountain area, is an exposure of the Southern California Batholith. The gravel-covered ridges in the general area are Table Mountain Formation Gravels, with Table Mountain itself composed of more recent intrusive Jacumba Volcanics (May 1976; Cooley 2006; Strand 1962). Overall, this area is predominantly granitic, with scattered zones of gabbro intrusive and mixed granitic-metamorphic rocks (Underwood and Gregory 2006).

The geology of the region provided raw materials for everyday life in prehistoric San Diego County. The exposed granitic boulders of the Southern California Batholith provide a landscape offering shelter from the elements, secluded locations for caches of cultural items, and canvasses for rock art. Boulder outcrops in well-watered washes, valleys and saddles also served as the raw materials for milling stations to process the region’s edible natural resources (May 1976). The ridges, terraces, and benches of the Table Mountain Formation gravels contain porphyritic andesites that provided suitable raw materials for the production of chipped stone tools, and the gravels contained many cobbles that retain heat well for use in roasting pits. Jacumba Volcanics, present in the northern region of the project vicinity, also yield materials such as fine-grained basalts and porphyritic andesite that can be quarried and are suitable for the production of stone tools (May 1976).

Soils

Soils within the general area consist of acid igneous rock, Rositas loamy coarse sand, rough broken land, and sloping gullied land soil associations. The acid igneous rock soil series, deposited during Quaternary alluviation, is present in the southeastern portion of the project vicinity and consists of rough, broken terrain. Large boulders and rock outcrops of granite, granodiorite, tonalite, quartz diorite, gabbro, basalt, or gabbro diorite cover 50% to 90% of the total area of this soil type in San Diego County. The soil material is loamy to coarse sand in texture and is very shallow (0 to 4 in.) over decomposed granite or basic igneous bedrock (U.S. Bureau of Land Management [BLM] 2007; Natural Resources Conservation Service [NRCS] 2007)].

Rositas loamy coarse sand consists of somewhat excessively drained, variable-depth (0 to 60 in.) loamy coarse sands derived from Quaternary granitic alluvium (BLM 2007; NRCS 2007). Rough broken land, present in the central and northeast portions of the project site, is made up of well-drained to excessively drained, steep and very steep land dissected by many narrow V-shaped valleys and sharp tortuous divides. Areas of exposed raw sediments are common, and there are areas of very shallow soils (0 to 2 in.). Runoff is rapid to very rapid, and erosion is very high (BLM 2007; NRCS 2007). Sloping gullied land occurs in the desert on alluvial fans adjacent to mountains and is present in the north-central portion of the project site. It consists of a wide variety of material derived from igneous, sedimentary, and metamorphic rocks, with a range of depths between 0 and 60 in. The texture ranges from clay loam to gravelly, cobbly sand. Limy material has been exposed where gullies have dissected areas of old alluvium. Drainage is good to somewhat excessive. Runoff is medium to very rapid, and the erosion hazard is moderate to high (BLM 2007; NRCS 2007).

Biota

Plant communities occurring in the project vicinity include desert saltbush scrub and southern cottonwood riparian. Desert saltbush scrub is comprised usually of low, grayish, microphyllous shrubs, with some succulent species. Total cover is often low, with much bare ground between the widely spaced shrubs. Stands typically are strongly dominated by a single Atriplex species and found on fine-textured, poorly drained soils with high alkalinity and/or salinity, usually surrounding playas on slightly higher ground (Holland 1986). The dominant species within the desert saltbush scrub is fourwing saltbush (*Atriplex canescens)*. Other species within this habitat included London rocket (*Sisymbrium irio*) and grasses as such wild oats (*Avena* sp.) and red brome (*Bromus madritensis). S*outhern cottonwood willow riparian is comprised of tall, open, broadleafed winter-deciduous riparian forests dominated by cottonwoods, and several tree willows. Understories usually are shrubby willows. This habitat is usually found in sub-irrigated and frequently overflowed lands along rivers and streams. The dominant species require moist, bare mineral soil for germination and establishment. This is provided after flood waters recede, leading to uniform-aged stands in this seral type (Holland 1986). The dominant species within the habitat on site is cottonwood (*Populus fremontii*), willows (*Salix* sp.) and mule fat (*Baccharis salicifolia*).

Habitat in the area supports abundant populations of small mammals and reptiles as indicated by frequent sightings of small rodent burrows and lizards. Snake species with ranges overlapping the project site include rattlesnake (*Crotalus* spp.), California kingsnake (*Lampropeltis getula californiae*), coachwhip (*Masticophis flagellum*), nightsnake (*Hypsiglena torquata*), gopher snake (*Pituophis catenifer*), and long-nosed snake (*Rheinocheilus lecontei*). Lizard species include western banded gecko (*Coleonlyx variegatus*), side-blotched lizard (*Uta stansburiana*), and tiger whiptail (*Aspidoscelis tigris*) (California Herps 2008). None of these species were detected during the site visits. Several species of birds likely use the area seasonally and during the flowering and fruiting season of local vegetation, including red-tailed hawk, common raven, house finches, and common yellowthroat. Mammals likely to be found within the area of the proposed project include desert cottontail.

Cultural

Regional Prehistory

Paleoindian

The prehistory of the east San Diego County region is generally divided into three major periods of occupation: Paleoindian, Archaic, and Late Prehistoric. An earlier pre-projectile point (pre-Paleoindian) culture was proposed by Malcolm Rogers who used the term Malpais – later reclassified as San Dieguito I – to refer to very early materials (Rogers 1939). Malpais materials consist of very heavily varnished choppers, scrapers, and other core-based tools typically found on old desert pavement areas. Many scholars are skeptical of these posited early occupations (e.g., Schaefer 1994).

The first well-documented cultural tradition in southern California is the San Dieguito complex (12,000 to 7,000 years before present [B.P.]). The type site is on the San Dieguito River in north-coastal San Diego County. The San Dieguito complex has been radiocarbon dated here at 9,030 B.P., but most scholars assume that it began a few thousand years earlier (Underwood and Gregory 2006). Related materials have been found in the Mojave Desert and in the Great Basin, sometimes called the Lake Mojave complex (e.g., Campbell et al. 1937; Warren and Ore 1978). Diagnostic artifact types and categories associated with the San Dieguito complex include percussion-flaked core tools and flake-based tools such as scraper planes; choppers; scrapers; crescentics; elongated bifacial knives; and diagnostic Silver Lake, Lake Mojave, and leaf-shaped projectile points (Rogers 1939).

In areas adjacent to the coast, many Paleoindian period sites are believed to have been covered by the rise in sea levels that began at the end of the Pleistocene. In more inland regions, alluvial sedimentation in valley areas may have covered these materials. Few San Dieguito-Lake Mojave sites in the desert contain subsurface deposits, temporally diagnostic artifacts, or datable material (Hayden 1976; Rogers 1939). Temporal placement of desert sites is based primarily on degree of weathering and patination, and absolute dating has been problematic (Underwood and Gregory 2006).

Archaic

Underwood and Gregory (2006) provide a detailed discussion of the Archaic period in the area of the current project, and their research is summarized below. Desert and coastal Archaic period sites have generally been dealt with separately, although there are clear similarities between the two. In the desert, the Archaic can be divided into the Pinto complex (7000 to 4000 B.P.) and the Amargosa or Gypsum complex (4,000 to 1,500 B.P.). The Pinto complex shows evidence of a shift from big game exploitation to a broader-based economy with increased emphasis on the exploitation of plant resources, and is thought to be an adaption to erratic climatic drying of the Altithermal (Grayson 1993; Warren 1984; Warren and Crabtree 1986). Groundstone artifacts are rare; these are typically thin slabs with smooth, highly polished surfaces which “may be platforms upon which fibrous leaves or skins were scraped. They are invariably associated with pulping planes” (Rogers 1939:52-53). Projectile points are distinctive crude, percussion-flaked Pinto series atlatl points. Other lithics include percussion-flaked scrapers, knives, scraper planes, and choppers (Underwood and Gregory 2006).

The subsequent Amargosa or Gypsum complex is characterized by the presence of fine, pressure-flaked Elko, Humboldt, and Gypsum-series projectile points; leaf-shaped points; rectangular-based knives; flake scrapers; T-shaped drills; and occasional large scraper planes, choppers, and hammerstones (Underwood and Gregory 2006). Manos and basin metates became relatively common, and the mortar and pestle were introduced late in this period (Warren 1984:416). The florescence of tool types and the addition of groundstone hard seed-processing equipment suggest an attempt to adapt to drier desert conditions in the greater Southwest. Most examples of this complex have been found in the southern Great Basin-Mojave Desert.

Archaic period sites are more commonly found in California in coastal areas. These are generally called La Jollan complex sites in coastal San Diego County. As noted in Underwood and Gregory (2006):

> The assemblage is similar to those of the desert Archaic prompting Warren and others (1961:28) and Kowta (1969:68) to suggest that the Altithermal (ca. 8000 B.P. to 5000 B.P.) made the deserts largely uninhabitable at that time. This induced people to migrate to the coast,

beginning at approximately 8000 B.P., where they quickly shifted their subsistence strategies to include shellfish and other seashore resources.

Subsistence again shifted to a more intense utilization of hard seeds and other terrestrial resources along the coast in the Late Archaic, when siltation is thought to have reduced available coastal lagoon resources. Further inland, the similar but separately named Pauma complex may represent seasonal inland occupations of coastal La Jollan peoples (Moratto 1984; True 1958, 1980).

Late Prehistoric

The incursion of Yuman-speaking people via the Gila/Colorado River drainages of western Arizona is apparent by approximately 2,000 years ago, and subsequent movements westward had great impact on the people of San Diego County (Moriarty 1966, 1967, 1968). This Late Prehistoric period (1,500 B.P. to 450 B.P.) is similarly characterized by two geographic expressions, the transmontane in the desert east of the mountains and the cismontane in the coast and foothill area west of the mountains. Both patterns indicate higher population densities and elaborations in social, political, and technological systems. Culture traits generally associated with this period include increasingly elaborate kinship systems and rock art, including ground figures or geoglyphs (McGuire 1982). Extensive trail systems also indicate connections between the coast and desert for trade, religious activities, and other interactions, peaceful or otherwise (Davis 1961).

The desert manifestation of the Late Prehistoric is broadly referred to as the Patayan pattern (e.g., Waters 1982). Paddle and anvil pottery first appears, likely via the Yuman-speaking Hokan culture of the middle Gila River area (Rogers 1945; Schroeder 1975, 1979). Tizon brownware appears at approximately A.D. 1000 at Mount Laguna, located 24 miles northwest of the project site (Underwood and Gregory 2006). Cottonwood Triangular series projectile points and Desert side-notched series projectile points used in bow and arrow hunting appear at approximately A.D. 800 (1200 B.P). Cremation rather than inhumation also became the burial norm. Artifactual material is characterized by the presence of arrow shaft straighteners, pendants, comales (heating stones), Tizon Brownware pottery, ceramic figurines, ceramic “Yuman bow pipes,” ceramic rattles, miniature pottery, various cobble-based tools (e.g., scrapers, choppers, hammerstones), bone awls, manos and metates, and mortars and pestles.

Subsistence in desert areas is thought to have focused on acorns and grass seeds, with small game serving as a primary protein resource and big game as a secondary resource. Vegetation resources included honey mesquite and screwbean mesquite with smaller amounts of palo verde, ironwood and native grasses (Underwood and Gregory 2006).

The proposed project sits in an area of small mountains and valleys on the eastern side of the Peninsular Ranges. Locally, the project site is situated within the area of the Cuyamaca Complex. True (1970) defined Cuyamaca complex based on excavations within Cuyamaca Rancho State Park and collections at the San Diego Museum of Man to differentiate interior San Diego County assemblages from Meighan's (1954) San Luis Rey complex. It is widely accepted that the Cuyamaca complex is associated with the Hokan-based, Yuman-speaking peoples (Diegueño/Kumeyaay) and that the San Luis Rey complex is associated with the Takic Shoshonean- speaking peoples (Luiseño).

The region surrounding the proposed project has extensive evidence of the cultural elaboration that occurred in the Late Prehistoric. In Baja California's Sierra de Juárez Mountains south of the proposed project is the town of La Rumorosa. Like the Jacumba region of the U.S., the La Rumorosa region is one of transition between the mountain and desert environments. Within this region is the site of *El Vallecito*, located approximately 3 miles northeast from the town of La Rumorosa. The site is home to La Rumorosa-style Late Prehistoric petroglyphs and pictographs, as well as other Late Prehistoric artifactual remains like ceramics. This style is associated with the Kumeyaay (often spelled Kumiai in Mexico), whose territory straddled both sides of the present-day U.S.-Mexico border. The La Rumorosa style, which flourished in southeastern San Diego County and northern Baja California, is characterized by rectilinear and curvilinear polychrome designs in red, black, yellow and white. Defining elements include lizard forms, digitate anthropomorphs, circles, sunbursts, rectangular grids, oval grids, simple anthropomorphs, crosses, and rectangles (Hedges 1970).

Ethnographic Background

The project site is in the traditional territory of the Kumeyaay. Also known as Kamia, Ipai, Tipai, and Diegueño, the Kumeyaay occupied the southern two-thirds of San Diego County. The Kumeyaay spoke a Yuman language belonging to the Hokan language family, which includes the lower Colorado River tribes and Arizona groups to whom they are closely related. South of the Kumeyaay, in the vicinity of modern-day Ensenada, are the closely related Paipai. Desert Kumeyaay or Kamia ranged over the Imperial Valley and northeastern Baja California (Underwood and Gregory 2006). As noted in Cooley (2006):

> Early chronicler Gifford (1931) designated the Kumeyaay living in the Jacumba area as the Kamia, who were distinguished by a desert orientation with contacts and travel most frequently between Jacumba and the Imperial Valley. This term has generally been replaced with the designation of eastern Kumeyaay or Tipai, or sometimes Jacumeño (Chace 1980, Cook et al. 1997, Hedges 1975; Langdon 1975; Gifford 1931:2; Luomala 1978). The Jacumeño or Kamia were closely connected to the Quechan on the Colorado River and served as trading partners

between the coastal and desert groups using a travel route through the Mountain Springs Grade.

The Kumeyaay lived in semi-sedentary, politically autonomous villages or rancherias. Most rancherias were the seat of a clan, although it is thought that some clans had more than one rancheria and some rancherias contained more than one clan (Bean and Shipek 1978). The Kamia or Desert Kumeyaay relied on hunting and gathering, supplementing that subsistence base with floodplain horticulture along the New and Alamo rivers and at various springs (Underwood and Gregory 2006).

The predominant determining factor for placement of villages and campsites was the ready availability of water, preferably on a year-round basis, with seasonal movements to exploit available food resources. Inland bands could travel to the coast to fish and gather salt, then shift to desert areas in the spring to gather agave (*Agave deserti*), moving to higher altitudes later in the year to gather seasonally available acorns and pine nuts (Cline 1984; Shipek 1991). Several large villages have been documented within the region through ethnographic accounts and archaeological investigations in the area. These include *Pa'Mu* northeast of Ramona; *Tukmak*, located near Mesa Grande, and *Pauba*, located between the previous two villages (Cooley and Barrie 2004; Kroeber 1925:590-591). Most important was likely the village of *Hakum* or *Hacúm*, the source of the word "Jacumba." Like many prehistoric villages, its location is not certain. However, it has been postulated that the large, complex archaeological site CA-SDI-4455, situated in the hills immediately west of Jacumba and within the proposed project area, is likely the village of *Hakum* (Cook et al. 1997:8; Rogers 1920s; McGinnis et al. 2003).

Historic Period

The Spanish period in California (1769-1821) represents a time of European exploration and settlement. Dual military and religious contingents established the San Diego Presidio and the Mission San Diego de Alcalá along the coast. The mission system introduced horses, cattle, and other agricultural goods and implements to the area. It also disrupted traditional native lifeways, and many Native American populations became tied economically to the colonists. Contact with the interior came later, when Pedro Fages lead a Spanish expedition through what is now Eastern San Diego County in 1785. Despite the lack of early interaction between colonists and interior Native Americans, the Jacumeño were already hostile to the Spaniards and in alliance with other native groups, actively resisting Spanish rule in the area by the time of Fages' expedition. Still, during their period of governance the Spaniards had little involvement in the eastern areas of the county.

The cultural systems and institutions established by the Spanish continued to influence the region beyond 1821, when California came under Mexican rule. The Mexican period (1821-1848) retained many of the Spanish institutions and laws; the mission system, however, was secularized in 1834. Secularization allowed for increased Mexican settlement, with large tracts of land granted to individuals and families, and establishment of a rancho system based on cattle grazing (Pourade 1963). Secularization also meant that many Native Americans were further dispossessed. The Native Americans of the eastern mountain areas began to have hostile interactions with the Mexican settlers who began to enter the area. By this time, contact had led the Eastern Kumeyaay to incorporate domestic livestock, especially horses and cattle, procured through raids. Anglo-European contact also led to the adoption of agriculture, replacing the previous subsistence system based on hunting and gathering.

In San Diego County, cattle ranching dominated agricultural activities and the development of the hide and tallow trade with the United States increased during the early part of this period. The Pueblo of San Diego was established at the former Presidio's settlement along the San Diego River in 1834. Just over a decade after that occasion, however, Mexican rule in California ended. The Mexican-American War began in 1846, following Texas' declaration of Republic status, breaking from Mexican governance. The conflict expanded to California, and Mexico ceded its California territory to the United States as part of the Treaty of Guadalupe-Hidalgo at the war's end in 1848.

At the start of American rule in 1848, gold was discovered in California and American immigration began in earnest. Few Mexican ranchos remained intact because of land claim disputes. The homestead system encouraged American immigration to the west and brought further settlement in the inland mountain areas. Mid-century saw the Jacumba area become a focal point of contact. It was situated along a well-travelled road from San Diego to Fort Yuma which served as the military mail route. The Jacumba station kept horses for the mail carriers who traveled the route, and had come under increasing attack by local Native Americans. In the early 1850s, Old Town settler James McCoy was sent to Jacumba with 14 men to protect the mail line from Native American raids. McCoy and his men constructed a fort there to protect the station garrison (Sullivan 1977). The Jacumeño, who had continued to resist European and Anglo rule through both the Mexican and American Periods, were finally subdued in 1880 and evicted from the Jacumba area (Cook et al. 1997).

The San Diego & Arizona Railway arrived in the area in 1919, with a station in Jacumba. This transportation innovation was soon followed by the formal establishment of Highway 80 for automobile transportation. Following much of the route of the Old Plank Road that had been maintained by travelers in eastern San Diego and Imperial Counties, the original alignment of the highway was in place by 1919. A "second generation" of the highway was built in the 1920 and 1930s, now known as Old Highway 80 (County of San Diego n.d.). The highway brought new traffic to Jacumba. A hot springs spa was established at Jacumba's natural spring, giving roots to the town. Now easily connected to distant markets, stock raising and dairy farming became important pursuits for the area's residents (Cook et al. 1997). The Jacumba Hot Springs Resort became a local tourist attraction beginning in the 1920s, hosting Hollywood celebrities, and spawned hotels, a race track and other recreational facilities in Jacumba (Cooley 2006). Following World War II, the popularity of the resort began to decline. The construction of Interstate 8 in 1967, bypassing Jacumba, marked the end of the town's glory days (Chace 1980).

1.2.2 Records Search Results

A records search was conducted on January 25, 2011, at the South Coastal Information Center (SCIC) located at San Diego State University. The archival searches consisted of an archaeological and historical records and literature review. The data reviewed included historic maps, the California Inventory of Historic Places, the California Register of Historic Resources (CRHR), and National Register of Historic Places (NRHP) information for the area of the proposed project. The search included a ¼-mile radius surrounding the project site. This research provides a background on the types of sites that would be expected in the region. The research was also used to determine whether previous surveys had been conducted in the area and what resources had been previously recorded within the project limits. A records search confirmation letter was received from SCIC and is included in Appendix A.

Previous Investigations

Eight cultural resources studies have been conducted within a ¼-mile radius of the project site (Table 1). Two studies, Cook et al. (2000) and Rosen (2001) have been previously conducted within or adjacent to the study area. These consist of linear surveys for a fiber optic line (Cook et al 2000) and a historic property survey for Old Highway 80 (Rosen 2001), both through the southern portion of the study area. Two additional investigations have been noted in the proposed project area, but are not on file at the SCIC. These consist of a survey investigation and monitoring program for the Jacumba Water System Rehabilitation Project (McGinnis et al. 2003; McGinnis and Baksh 2005). Monitoring of trenching along both the northern and southern shoulders of Old Highway 80 was conducted.

Previously Recorded Cultural Resources

The general area and surroundings are very rich in prehistoric cultural resources and have some notable historic era resources. This richness is caused by an intersection of eco-zones and geological formations resulting in an abundance of food and tool resources in the nearby Table Mountain and Jacumba Valley areas. The abundance of these resources attracted human populations who used the landscape in a variety of ways including long term habitation, short term campsites, agave and other plant processing areas, quarries for stone tool materials, and lithic workstations.

Table 1. Previous Investigations within a 1-Mile Radius of the Project APE

Author	Title	Date	NADB Document Number
Chace	A Cultural Resources Assessment of Jacumba, San Diego County.	1980	1120479
Cook and Fulmer	Archaeology and History of the McCain Valley Study Area, Eastern San Diego County, California.	19880	1122760
Cook et al.	Final: A Cultural Resources Inventory of the Proposed AT&T/ PF.Net Fiber optic Conduit Ocotillo to San Diego, California.	2000	1132421
Johnson	An Archaeological Inventory and Assessment of Corridor Segments 46 and 49, Preferred Southern Route, San Diego County.	1976	1121267
McGinnis and Baksh	Archaeological Monitoring Report for the Jacumba Water System Rehabilitation Project, San Diego County, California.	2005	–
McGinnis et al.	Archaeological Survey Report for the Jacumba Water System Rehabilitation Project, San Diego County, California.	2003	–
Rosen	Historic Property Survey Report for Old Highway 80, San Diego County, California.	2001	1128282
Wade	Cultural Resource Survey Report Form for the Richard Cox Property, Jacumba, California.	1995	1123014
Welch	Cultural Resource Report: Lark Canyon Motorcycle Trails and Trail Location.	1982	1125214
Wirth Environmental Services	Archaeological Investigations at SDI-4470.	1987	1121633

The results of the records search revealed that 14 resources have been recorded within a ¼-mile radius of the project area (Table 2). The project area is located within the site boundary for site CA-SDI-4455. Additionally, site P-37-024023 is adjacent to the southern portion of the proposed project APE. These resources are discussed below. No other resources were previously recorded within or directly adjacent to the proposed project APE.

CA-SDI-4455

Site CA-SDI-4455 was originally recorded by Malcolm Rogers (1920s) as a large prehistoric village site that extends into Mexico and was partially destroyed by the development of the town of Jacumba. In 1976 the site was revisited and determined to possibly be the location of the village site of *Hacúm* (Townsend 1976; Waldron 1976). Midden soils along with lithics, lithic tools, multiple milling features, ground stone, ceramics sherds as well as historic debris was observed. Backhoe trenching for a new

Table 2. Previously Recorded Cultural Resources within a 1/4-Mile Radius of the Project APE

Primary Number (P-37-)	Permanent Trinomial (CA-SDI-)	Site Description	Site Dimensions	Reference
004455	4455	Village site of *Hacúm*	920 m x 150 m	McGinnis 2003; Joyner and Beck 1991; Wilcox and Von Werlhof 1987; Waldron 1976; Townsend 1976; Rogers 1920s
007015	7015	San Diego and Arizona (Eastern) Railroad	N/A	Burkenroad 1979
008066	8066	Temporary camp	60 m x 51 m	Chace1980
008067	8067	Milling station; lithic and ceramic scatter	128 m x 94 m	Wade 1995; Chace 1980
011712	11,712H	Vaughn Hotel/ Jacumba Hot Springs Hotel	50 m x 40 m	McGinnis 2003; Crull and Smith 1990
013989	13,947	Historic debris scatter	213 m x 39 m	Wade 1995
013990	13,948	Historic debris scatter	10 m dia.	Wade 1995
013991	13,949	Lithic and ceramic scatter	55 m x 38 m	Wade 1995
014004	13,962	Milling station; lithic scatter	152 m x 73 m	Wade 1995
024023	–	Old Highway 80	NA	Lorrie 2000
024943	–	Jacumba Casino	35 m x 25 m	McGinnis 2003
024945	–	Historic stone structure	NA	McGinnis 2003
025185	16,682	Habitation site; milling station	40 m x 25 m	McGinnis 2003
025680	–	Union Pacific Railroad (portion of the San Diego and Arizona (Eastern) Railroad)	NA	Williams 2009; Wee and Ferrell 2000

waterline along Railroad Avenue, south of Old Highway 80 and the current study area, through Locus A and B in 1987, Soils from the trenching were screened and trench profiles were taken, indicating a substation subsurface deposit of approximately 20 cm (Wilcox and Von Werlhof 1987).

The site was again revisited by County of San Diego Department of Public Works (DPW) archaeologist for a proposed road widening project for the Jacumba Water Tank, located south of Old Highway 80. The proposed project impact area for the road widening was surveyed and test excavations were conducted in the area south of Old Highway 80. While portions of the site were found to be disturbed, the DPW recommended the site eligible for inclusion to the National Register of Historic Places

(Joyner and Beck 1991). In 2003, the site was once again revisited and confirmed Rogers' initial assessment that this site is the village of *Hacúm* (McGinnis et al. 2003). No evidence of State Historic Preservation Office (SHPO) concurrence with the eligibility recommendation was on file at SCIC.

P-37-024023

This site was recorded by Caltrans (Lorrie 2000) as part of a Historic Property Survey Report (HPSR) (Rosen 2001). This was recorded as a two-lane undivided highway built in the 1910s, connecting San Diego to El Centro and Yuma Arizona. Portions of the highway were upgraded between the late 1910s and the early 1930s. The highway was designated Highway 80 in the 1920. As a result of the HPSR study conducted by Caltrans, several sections of the highway are considered contributing elements to the Old U.S. 80 Historic District under Criterion A of the California Register of Historic Places eligibility criteria for its "association with San Diego's efforts to become a terminus for a U.S. transcontinental highway and the significance of the highway for the regional economy" as well as under Criterion C for its "state of preservation as an example of highway engineering and construction techniques before the modern freeway era" (Lorrie 2000). Eligible segments include the segment adjacent to the Project APE. No evidence of SHPO concurrence with the eligibility recommendation was on file at SCIC.

1.3 <u>Applicable Regulations</u>

Various federal, state, and local regulations are applicable to projects located within San Diego County. These regulations are used to assess cultural resources, address adverse impacts to cultural resources, and identify protection measures for these resources. Applicable regulations for addressing these concerns and for determining resource significance include CEQA, the San Diego County Local Register of Historical Resources (Local Register), and the San Diego County Resource Protection Ordinance (RPO). The following sections describe the criteria that a resource must meet to be determined a significant resource or an important resource under each guideline.

1.3.1 California Environmental Quality Act

A cultural resource is considered "historically significant" under CEQA if the resource meets the criteria for listing in the CRHR. The CRHR was designed to be used by state and local agencies, private groups, and citizens to identify existing historical resources within the state and to indicate which of those resources should be protected, to the extent prudent and feasible, from substantial adverse change. The following criteria have been established for the CRHR (Public Resources Code §§5024.1, Title 14 CCR, Section 4852). A resource is considered significant if it:

1. Is associated with events that have made a significant contribution to the broad patterns of California's history and cultural heritage; or
2. Is associated with the lives of persons important in our past; or
3. Embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of an important creative individual, or possesses high artistic values; or
4. Has yielded, or may be likely to yield, information important in prehistory or history.

1.3.2 San Diego County Local Register of Historical Resources

The County requires that a resource be assessed for importance at the local level as well as the state level. If a resource meets any one of the criteria outlined in the Local Register, it will be considered important. The criteria are as follows (County of San Diego 2007b):

1. Is associated with events that have made a significant contribution to the broad patterns of San Diego County's history and cultural heritage;
2. Is associated with the lives of persons important to the history of San Diego County or its communities;
3. Embodies the distinctive characteristics of a type, period, San Diego County region, or method of construction, or represents the work of an important creative individual, or possesses high artistic value; or
4. Has yielded, or may likely yield, information important in prehistory or history.

1.3.3 Resource Protection Ordinance

The County's RPO protects significant cultural resources. The RPO definition of a "Significant Prehistoric or Historic Site" is as follows (County of San Diego 2007b):

> Location of past intensive human occupation where buried deposits can provide information regarding important scientific research questions about prehistoric or historic activities that have scientific, religious or other ethnic value of local, regional, State or Federal importance. Such locations shall include, but not limited to: any prehistoric or historic district, site, or object included in or eligible for inclusion in the National Register of Historic Places or the State Landmark Register; or included or eligible for inclusion, but not previously rejected, for the San Diego County Historical Site Board List; any area of past human occupation located on public or private lands where important prehistoric or historic activities and/or events occurred; and any location of past or current sacred, religious or

ceremonial observances protected under Public Law 95-341, the American Indian Religious Freedom Act or Public Resources Code Section 5097.9, such as burial(s), pictographs, petroglyphs, solstice observatory sites, sacred shrines, religious ground figures, and natural rocks or places which are of ritual, ceremonial, or sacred value to any prehistoric or historic ethnic group.

The RPO does not allow nonexempt activities or uses damaging to significant prehistoric or historic lands on properties under County jurisdiction. The only exempt activity is scientific investigations authorized by the County. All discretionary projects are required to be in conformance with applicable County standards related to cultural resources, including the noted RPO criteria on prehistoric and historic sites.

2.0 GUIDELINES FOR DETERMINING SIGNIFICANCE

Section 15064.5(b) of the State CEQA Guidelines identifies adverse environmental impacts to historical resources. The County has prepared guidelines for determining the significance of environmental impacts to cultural resources, based on CEQA and the County RPO. Pursuant to the County of San Diego Guidelines for Determining Significance – Cultural Resources: Archaeological and Historical Resources (2007b), any of the following will be considered a significant impact to cultural resources:

1. The project, as designed, causes a substantial change in the significance of a historical resource as defined in §15064.5 of the State CEQA Guidelines. This shall include the destruction, disturbance or any alterations of characteristics or elements of a resource that cause it to be significant in the manner not consistent with the Secretary of Interior Standards.
2. The project, as designed, causes a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5 of the State CEQA Guidelines. This shall include the destruction or disturbance of an important archaeological site or any portion of an important archaeological site that contains the potential to contain information important to history or prehistory.
3. The project, as designed, disturbs any human remains, including those interred outside formal cemeteries.
4. The project proposes non-exempt activities or uses damaging to, and fails to preserve, significant cultural resources as defined by the Resource Protection Ordinance and fails to preserve those resources.

3.0 ANALYSIS OF PROJECT EFFECTS

3.1 Survey Methods

3.1.1 Survey Methods

Under the direction of Stacey C. Jordan, Ph.D., AECOM staff member Cheryl Bowden-Renna conducted the pedestrian archaeological and historical survey investigation on January 25, 2011. Stacey C. Jordan, Ph.D. prepared the County-format report based on the findings of the AECOM survey. Resumes of key AECOM personnel are provided in Appendix B.

An intensive pedestrian archaeological survey of the 1.47 acres of the Project APE was conducted in continuous parallel 10 m transects walked in an east/west direction. The project area consists of 150 ft (45 m) linear area, 20 ft (6 m) wide with a 100 ft (30 m) buffer around the proposed project area. Visibility was good to fair with approximately 20–30 percent of the project area partially obscured by ground cover in the form of non-native grasses, chaparral, and oak trees.

Two previously recorded sites, CA-SDI-4455 (the village site of *Hacúm*), and P-37-024023 (Old Highway 80), were relocated and updated during the current survey efforts. No newly recorded resources were identified during the current survey effort.

3.1.2 Native American Consultation

As part of this investigation, AECOM contacted the NAHC via fax on January 25, 2011, to solicit a Sacred Lands file search and request a list of Native American contacts for the proposed project. To date, no response has been received. The NAHC response usually indicates if there are known Native American cultural resources within or in the vicinity of the project area. At the request of the County, the NAHC response and appended Native American Contact list will forwarded to County Archaeologist for the purposes of government-to-government consultation under CEQA. Also at the request of the County, AECOM staff member Cheryl Bowden-Renna contacted Native American representatives Mr. Clint Linton, Kumeyaay, by telephone on January 25, 2011, to notify them of the access road alignment alternatives survey and solicit their participation. Mr. Clinton was not available to participate at this time. After the survey effort was completed. Ms. Bowden-Renna contacted Mr. Linton to apprise him of the survey results.

3.2 Survey Results

The field survey effort resulted in the relocation of two cultural resources within the proposed Project APE, CA-SDI-4455 and P-37-024023 (Table 3; Figure 4, Confidential

Appendix E - bound separately). No other cultural or historic resources were identified during the current survey effort.

Table 3. Cultural Resources within the Project APE

Trinomial/Primary No.	Site Type
Sites	
CA-SDI-4455	Village of Hacúm
P-37-024023	Old Highway 80

3.2.1 Sites within the APE

CA-SDI-4455

Site CA-SDI-4455 was originally recorded in the 1920s as the ethnographic village site of *Hacúm* (Rogers 1920s). Test excavations (Joyner and Beck 1991) and trenching monitoring (Wilcox and Van Werlhof 1987) have been conducted in portions of the southern part of the site, which indicated the presence of a substantial subsurface deposit in the site area. Based on the results of these survey efforts and subsequent testing efforts, the County of San Diego DPW has previously recommended this site as eligible for the NRHP (Joyner and Beck 1991).

The current effort confirmed that the project is located within the site boundaries of CA-SDI-4455. While no artifactual material was observed within the proposed access route for the existing well, several quartz flakes were observed approximately 20 m north and west of the existing well, within the 100 ft (30 m) buffer area of the Project APE. A small ridgeline of bedrock is located approximately 50 m northeast of the well with multiple milling features just outside of the Project APE. Metavolcanic lithic debitage was observed in increasing amounts around this milling area. Ceramic sherds have been stockpiled into several of the bedrock mortars from the surrounding area, though it is unknown whether this is prehistoric or more recent activity. Because the area of site CA-SDI-4455 within the Project APE has not been subject to subsurface testing, it is unknown whether subsurface deposits are present in this area.

P-37-024023

This site was recorded by Caltrans (Lorrie 2000) as part of a Historic Property Survey Report (HPSR) (Rosen 2001). This was recorded as a two-lane undivided highway built in the 1910s’, connecting San Diego to El Centro and Yuma Arizona. Portions of the highway were upgraded between the late 1910s and the early 1930s. The highway was designated Highway 80 in the 1920. The segment of P-37-024023 located at the

FIGURE 4

CULTURAL RESOURCES WITHIN THE PROJECT AREA
(Confidential – Bound Separately)
See Appendix E

southern boundary of the Project APE is considered a contributing element to a resource recommended eligible to the NRHP. Character-defining features of this contributing element consist of the Portland cement concrete road surface, the relatively narrow right-of-way, the two-lane undivided roadway, the route including the method of construction that “mostly follows the natural contours of the terrain with a minimum of cut and fill” done with a low level of earth moving (Lorrie 2000).

Site form updates have been completed on appropriated Department of Parks and Recreation (DPR) forms and are attached in Confidential Appendix C (bound separately).

4.0 INTERPRETATION OF RESOURCE IMPORTANCE AND IMPACT IDENTIFICATION

4.1 Resource Importance

The cultural resources survey conducted for the proposed project resulted in the re-identification of two previously recorded archaeological sites CA-SDI-4455 and P-37-024023, within the proposed project APE (Table 4).

Table 4. Subsurface Potential for Resources within the APE

Trinomial/ Primary No.	Resource Description	Subsurface Potential?	Recommendation
CA-SDi-4455	Village of Hacúm	Medium	Limited testing of project APE; monitoring
P-37-024023	Old Highway 80	Low	Avoidance

Prehistoric cultural uses of the APE are suggested by the observable archaeological data. Lithic reduction evidenced with CA-SDI-4455 reflects the use of diverse raw materials. Quartz was the predominant lithic material, although no quartz bedrock outcroppings are present in the project area, outcroppings of quartz are present in the vicinity. While quartz predominated the lithic assemblage, metavolcanic and volcanic materials are present. The nearby Table Mountain Archaeological District was used as a cobble quarry for volcanic rock cobbles (Laylander 2005a). Alluvium from Table Mountain has carried porphyritic andesites into the project area, making fine-grained volcanic raw materials available for stone tool production. Multiple locus of milling are noted within the site area, consisting of multiple milling elements, including slicks, mortars, and basins. The relative depths of these elements are indicative of long tern use. While no diagnostic lithic artifacts were found to date the archaeological site, the presence of Tizon Brownware indicates its use during the Late Prehistoric. The date of the first appearance of ceramics in San Diego County is a debated issue (Laylander 2005a and 2005b); however it is generally acknowledged that ceramics are a marker of the Late Prehistoric period. Test excavations (Joyner and Beck 1991) and trenching monitoring (Wilcox and Van Werlhof 1987) have been conducted in portions of the southern part of the site, which indicated the presence of a substantial subsurface deposit in the site area. The breadth and range of artifactual material, subsurface deposits, and long-term us of milling elements, support the original recordation of the site as a village site, specifically, the village of *Hacúm.*

As a village, this site interconnects with other resources in the area, such as the Table Mountain District, located approximately 2 miles northeast of the project area, and the Jacumba Discontiguous Archaeological District (JDAD). Table Mountain District, was first documented in 1976 (May 1976) and nominated for the NRHP in 1980 (BLM 1980).

The Table Mountain Historic District was defined based on the recordation of 124 sites, 11 of which are said to be permanent village sites (May 1976). Rock art panels and ethnographic documentation also imply that the Table Mountain area had medicinal or religious significance (BLM 1980). The JDAD includes 70 sites and 22 isolated finds in a 441-acre identified during linear surveys for the Southwest Powerlink 500kV line northeast of the project area. Lithic quarrying and stone tool manufacture was a major industry in the JDAD; however, temporary camps, base camps, rock cairns, and ceramic scatters are also present (Wirth Associates 1981). Jacumba Valley was an area of intensive trade between the Quechan peoples, located along the Colorado River, and the mountain and desert Kumeyaay who lived in the Peninsular Range and the general project area (Wirth Associates 1981). Carrizo and In-Ko-Pah Gorges were used as trade routes (BLM 1980).

Historic uses of the APE consist of Old Highway 80 as a transportation corridor, connecting San Diego with El Centro and further to Yuma, Arizona. The historic town of Jacumba, is located approximately 0.12 mile to the east of the proposed project. This site demonstrates large-scale infrastructure efforts and construction techniques during the early 20th century and its impact on the regions' economy (Lorrie 2000).

4.2 Impact Identification

One archaeological site, CA-SDI-4455 has the potential to be directly impacted by the proposed project (see Figure 4, Confidential Appendix E – bound separately). The footprint of proposed new access route will impact site CA-SDI-4455. Previous testing of the southern portion of the site has indicated a substation subsurface deposit is present at the site (Joyner and Beck 1991; Wilcox and Von Werlhof 1987. Further, this site has been recommended eligible for inclusion to the NRHP (Joyner and Beck 1991),

As a disturbance to an important archaeological site that has the potential to contain information important to prehistory, project activities related to the construction and use of the access road within the Project APE will cause a substantial adverse change in the significance of this archaeological resource pursuant to §15064.5 of the State CEQA Guidelines and County significance guidelines. This direct impact is significant and mitigable to below a level of significance.

The project as planned does not proposed to alter any of the character defining features of the segment of P-37-024023, Old Highway 80, located directly south of the Project APE. As such, project construction or operation activities do not pose a significant impact to this resource.

5.0 MANAGEMENT CONSIDERATIONS – MITIGATION MEASURES AND DESIGN CONSIDERATIONS

Archaeological sites are nonrenewable resources. The ideal treatment for cultural resources is avoidance of impacts, and measures to ensure avoidance can be incorporated into project design. If a project is determined to cause damage to a significant cultural resource, reasonable efforts must be made to mitigate the impact to a level below significant.

5.1 Mitigable Impacts

Unless the proposed project can be redesigned to avoid site CA-SDI-4455, which would likely prove unfeasible, impacts to this site would be considered significant and a testing program would need to be conducted within the project footprint to determine whether subsurface deposits are present. Should such testing exhaust the data potential of this portion of the site, impacts from the proposed project would be reduced to less than significant. Upon completion of this phase it may be determined, in consultation with the County, that further testing and/or data recovery will be needed. All testing and data recovery efforts would be implemented prior to construction or ground-disturbing activities.

5.2 No Significant Adverse Effects

P-37-024023, Old Highway 80, will not be impacted by the construction or operation of the proposed project. In the event of incidental discoveries during construction activities, each discovery would require significance testing as outlined in the County's Guidelines for Determining Significance (2007b). Any new facility, infrastructure, roadway or staging area for construction or maintenance not shown on the current site plan may require additional survey or, if within previous survey boundaries, further analysis of impacts to cultural resources.

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7.0 LIST OF PREPARERS AND PERSONS AND ORGANIZATIONS CONTACTED

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Senior Archaeologist
AECOM

Cheryl Bowden-Renna
Associate/Staff Archaeologist
AECOM

South Coastal Information Center
San Diego State University

8.0 LIST OF MITIGATION MEASURES AND DESIGN CONSIDERATIONS

Cultural Resource	Design Consideration	Mitigation Measure	Less than Significant Impact?
CA-SDI-4455	Construction of new access route	Site Evaluation/Data Recovery program	Yes
		Construction monitoring	Yes
P-37-024023	Construction of new access route	Avoidance, construction monitoring	Yes

APPENDIX A

RECORDS SEARCH RESULTS
(Confidential – Bound Separately)

APPENDIX B

RESUMES OF KEY PERSONNEL

Stacey Jordan, PhD, RPA
Practice Leader, Cultural Resources Group
Senior Archaeologist

Education
PhD, Anthropology, Rutgers University, New Brunswick, NJ,2000
MPhil, Anthropology, Rutgers University, New Brunswick, NJ, 1995
MA, Anthropology, Rutgers University, New Brunswick, NJ, 1994
BA with High Distinction, Anthropology, University of California, Berkeley, 1991

Professional Affiliations
Member, Society for American Archaeology
Member, Register of Professional Archaeologists

Certifications + Approvals
County of San Diego Approved Consultant List for Archaeological Resources
County of San Diego Approved Consultant List for Historic Resources
County of Riverside Approved Cultural Resources Consultant (No. 222)

Awards
2009 - San Diego Archaeological Center Excellence in Archaeology Award, Excellence in Cultural Heritage, Archaeological Data Recovery at CA-SDI-10,920 and Site Stabilization at Sites CA-SDI-586 and CA-SDI-10,920 Along the Southern Shore of Lake Hodges
2008 - San Diego AEP Outstanding Environmental Resource Document Finalist, Boulder Oaks Open Space Preserve (winner Honorable Mention at September 25 AEP Awards)
2008 - Riverside County Planning Department, Certificate of Appreciation for the Cultural Resources Working Group

Grants + Fellowships
2003, Wenner-Gren Foundation for Anthropological Research Individual Research Grant Team Member: "Analysis and Interpretation of Archaeological Residues from Excavations at the Castle of Good Hope, Cape, South Africa'"
1996-1997, Wenner-Gren Foundation for Anthropological Research, Predoctoral Research Grant #6021
1994-1995, Wenner-Gren Foundation for Anthropological Research, Predoctoral Research Grant #5739
1992-1996, Rutgers University Excellence Fellowship

Publications
Jordan, Stacey. 2002. Classification and Typologies. In: *Encyclopedia of Historical Archaeology*, Charles E. Orser, Jr. (ed.). Routledge. London.
Jordan, Stacey and Carmel Schrire. 2002. Material Culture and the Roots of Colonial Society at the South African Cape of Good Hope. In: *The Archaeology of Colonialism*, Claire Lyons and John Papadopoulos (eds.). Getty Research Institute. Los Angeles.

Dr. Stacey Jordan has been professionally involved in the fields of archaeology and history for over a decade. Her specialty in historical archaeology combines the use of material culture and the archival record in anthropologically driven analyses of cultural resources. Dr. Jordan was the recipient of the Excellence Fellowship at Rutgers University, as well as multiple research grants from the Wenner-Gren Foundation for Anthropological Research. She is the author of various publications as well as numerous papers that have been presented at national and international conferences. Dr. Jordan is particularly well versed in the analysis of historical ceramics and has taught courses in the method and theory of historical archaeology as well as in the identification and analysis of historical ceramics and glass. She has extensive experience in archival research and historical writing, and has worked on projects spanning from early colonial contact to the recent past. In addition, Dr. Jordan has served on a variety of prehistoric and historic excavations both in the United States and abroad. Supplementing her work in cultural resources management, she conducts research on ceramics, community development, and identity construction in colonial South Africa.

Project Experience

Solar Millennium Ridgecrest Solar Power Project, Ridgecrest, CA
Project Manager of ongoing BLM Class III intensive pedestrian survey, resource documentation, and site evaluation efforts for an approximately 2000-acre solar power project on BLM land in the western Mojave Desert under a Fast-Track ARRA funding schedule. This project includes extensive records searches and data management, multi-agency coordination and consultation involving BLM and the California Energy Commission, an ongoing Native American contact and outreach program.

Solar Millennium Blythe Solar Power Project, Blythe, CA
Project Coordinator of ongoing BLM Class III intensive pedestrian survey, resource documentation, and site evaluation efforts for an approximately 2000-acre solar power project on BLM land in the western Mojave Desert under a Fast-Track ARRA funding schedule. This project includes extensive records searches and data management, multi-agency coordination and consultation involving BLM and the California Energy Commission, an ongoing Native American contact and outreach program.

Solar Millennium Palen Solar Power Project, Palen, CA
Project Coordinator of ongoing BLM Class III intensive pedestrian survey, resource documentation, and site evaluation efforts for an approximately 2000-acre solar power project on BLM land in the western Mojave Desert under a Fast-Track ARRA funding schedule. This project includes extensive records searches and data management, multi-agency coordination and consultation involving BLM and the California Energy Commission, an ongoing Native American contact and outreach program.

San Diego Gas & Electric On-Call Cultural Services,

San Diego and Imperial Counties, CA
Director of on-call inventory, survey, monitoring and reporting work as part of SDGEs infrastructure operations and maintenance activities on both private and public lands. Tasks include records searches, construction monitoring, archaeological survey and documentation, completion of State of California DPR forms, and management recommendations.

Southern California Edison As-Needed Archaeological Services, CA
Director of on-call survey, resource identification, documentation, testing, and evaluation efforts related to Southern California Edison infrastructure replacements and development throughout the state on both private and public lands, including BLM, USACE, and USFS. Product involves completion of State of California DPR forms, assessment of resource significance according to NRHP eligibility and CEQA significance criteria, and management recommendations. Work done before joining this firm.

Bureau of Land Management National Historic Trails Cultural and Visual Inventory, Multiple States
Cultural resources task manager for ongoing archival research and Phase I cultural resources inventories of National Historic Trails and trail-associated resources on Bureau of Land Management lands in New Mexico, Colorado, Utah, Arizona, California, Nevada and Wyoming. Inventories include pedestrian survey for the identification of trail traces of the Old Spanish, El Camino Real de Tierra Adentro, California, Oregon, Mormon Pioneer, and Pony Express National Historic Trails, documentation of sites and features associated with the trails during their period of significance, and conditions assessments of observable trail traces. Results of the inventory will be combined with visual and cultural landscape analysis to support BLM's management and protection of high potential route segments and historic sites.

City of San Diego City Planning and Community Investment As-Needed Archaeological Services, City of San Diego, CA
Project Manager of ongoing cultural resources consulting services in support of community plan updates under the newly adopted City of San Diego General Plan. Services include records searches, Native American contact programs, background information syntheses, and assessments of archaeological potential as part of the community plan update Historic Preservation Elements.

San Nicolas Island Archaeological Evaluations, Ventura County, CA
Project Manager for ongoing archaeological evaluation of prehistoric sites CA-SNI-316, 361 and 550 on San Nicolas Island in the Channel Islands of the California Bight. This project involves the significance testing and analysis of Middle and Late Holocene sites and synthesis of results with existing island-wide archaeological data.

County of San Diego Department of Parks and Recreation Sage Hill Preserve Cultural Surveys, San Diego County, CA
Cultural resources task manager for Phase I pedestrian survey and cultural resource inventories of the Sage Hill Preserve in unincorporated northern San Diego County. This project involved the identification and documentation of prehistoric and historic resources, built environment features, and existing infrastructure to assist the Department of Parks and Recreation in resource management through development of a Resource Management Plan including Area Specific Management Directives. Extensive archival and background research, including a contact program with local historic societies, was conducted to develop a historical context for the property. Methods and results of the intensive pedestrian survey were reported in a County of San Diego format technical report which included extensive cultural histories, a descriptive inventory of identified sites, and management guidelines for potentially significant cultural resources. All resources were documented on DPR 523 forms, and field work was conducted in coordination with a Native American monitor.

Emergency Storage Project Cultural Resources, Lake Hodges, San Diego County, CA
Senior Archaeologist and report co-author for data recovery project at site CA-SDI-10,920 along Lake Hodges. The project involves integration of regional data to provide context for the analysis of CA-SDI-10,920 and examination of the Late Prehistoric occupation of the San Dieguito River Valley around present-day Lake Hodges.

Jefferson National Expansion Memorial Environmental Impact Study, St. Louis, MO
Co-author for prehistoric and historical archaeology background and impact analysis sections related to the proposed expansion of the Jefferson National Expansion Memorial (Gateway Arch) in St. Louis, Missouri and East St. Louis, Illinois.

Old Town State Historic Park Jolly Boy Project, San Diego, CA
Contributor to the archaeological data recovery report for the Jolly Boy Saloon site in Old Town San Diego State Historic Park. Contributions to this project involve the synthesis of existing data on Old Town San Diego and development of an archaeological and historic context for the analysis and interpretation of recovered material.

Ocotillo Wells SVRA General Plan & Environmental Impact Report Cultural Resources, Imperial County, CA
Ongoing Cultural Resources analyses of Ocotillo Wells State Vehicular Recreation Area. This project involves the analysis of existing cultural resources conditions, and recommendations for the treatment of cultural resources.

County Department of Public Works, Bear Valley Parkway Cultural Resources Inventory and Assessment, San Diego County, CA
Task Manager for the survey, documentation and evaluation of archaeological and historical resources related to the expansion of Bear Valley Parkway in unincorporated San Diego County. Project conducted for the County Department of Public Works according to County of San Diego guidelines.

Banning State Water Transmission Line, Riverside County, CA
Task Manager for cultural resources sensitivity analysis for the construction of an approximately 2.4-mile long pipeline within the rights-of-way of paved streets within the unincorporated area of the county. As part of this analysis a records search of the Eastern Information Center was conducted to identify cultural resources studies and identified resources within a one-mile radius of the Banning State Water Transmission

Line's proposed alignment. A sacred lands file search was also requested from the Native American Heritage Commission.

Heber Dunes SVRA General Plan & Environmental Impact Report Cultural Resources, Imperial County, CA
Ongoing Cultural Resources Phase I Survey and Inventory of Heber Dunes State Vehicular Recreation Area. This project involves the analysis of existing cultural resources conditions, assessment of proposed facilities maintenance and development impacts, and recommendations for the treatment of cultural resources.

El Camino Real Bridge Historical Evaluation—City of San Diego, California
Senior Archaeologist and Historian for a historical resources assessment of the historic El Camino Real Bridge over the San Dieguito River in accordance with CEQA and City of San Diego significance guidelines. Conducted archival research on the bridge's construction history and alterations using historic photographs and original engineering drawings. Work done before joining this firm.

El Camino Real Historic Properties Survey and Evaluation Reports—Tierra Environmental Services, City of San Diego, California
Senior Archaeologist and Historian for archival and archaeological investigations along a segment of El Camino Real. Prepared Caltrans-format Historic Properties Survey Report and Historic Resources Evaluation Report for a segment of the historic El Camino Real through the San Dieguito River Valley, as well as a turn of the century bungalow and an early-20th century Craftsman residence. Conducted extensive research on the San Dieguito River Valley's land use and occupational history. Work done before joining this firm.

SWPL 500kV Line Wetland Delineation ,
San Diego County, CA
Project Director for Phase I pedestrian surveys, resource documentation, Section 106 resource evaluation, findings of effect and management recommendations in support of USACE wetland permitting associated with proposed jurisdictional water crossing improvement projects in southern San Diego County. Work done before joining this firm.

Boulder Oaks, Sycamore/Goodan, El Capitan/Oakoasis/
El Monte/Steltzer Open Space Preserve and Regional Park Cultural Resources Inventories, San Diego County, CA
Project director for Phase I pedestrian survey and cultural resource inventories of Open Space Preserves and Regional Parks in unincorporated central San Diego County. The projects involved the identification and documentation of prehistoric and historic resources, built environment features, and existing infrastructure to assist the Department of Parks and Recreation in resource management. Inventory reports included extensive archival research and historical narrative, an inventory of identified sites, and management guidelines for potentially significant cultural resources developed in consultation with Native Americans where appropriate. Work done before joining this firm.

State Route 94 Operational Improvements Inventory and Evaluation, San Diego County, CA
Director of cultural resources efforts and Caltrans coordination for survey, documentation, and evaluation related to proposed operational improvements along an 18-mile stretch of State Route 94 in San Diego County. Development of Caltrans-format documentation for archaeological and built environment resources. Work done before joining this firm.

BLM Santa Rosa San Jacinto Mountains National Monument Trails Inventory, Riverside County, CA
As Project Director, directed cultural resources inventory of trail systems within the Santa Rosa San Jacinto Mountains National Monument, including documentation of prehistoric and historic routes and associated resources within trail corridors. Completed cultural resources inventory report for BLM, including BLM-format GIS database. Work was performed before joining this firm.

High Winds Wind Farm Project, Solano County, CA
Conducted archival and historical research on the settlement and development of southern Solano County. Evaluated nine historic resources and surrounding landscape significance according to CEQA criteria. Completed historical background and assessment report, photographically documented resources and landscape, and updated State DPR forms for previously identified resources. Work done before joining this firm.

U.S. Fish & Wildlife Service Hercules Gunpowder Point Historical Resources Evaluation, Chula Vista, CA
Project director for the historical evaluation of the Hercules Powder Company Gunpowder Point facility in Chula Vista. Supervised archival and historical research, directed field survey and documentation efforts, and provided National Register eligibility evaluation for the site. Work was performed before joining this firm.

CCDC Downtown San Diego African-American Heritage Study, San Diego, CA
As Senior Historian, documented the development and growth of the African-American community in downtown San Diego through the 19th and 20th centuries. Archival information, oral histories, architectural evaluations, and recognition of potential archaeological sites were used to document the African-American community's economic, social, and political history in the downtown area, and to identify an African-American Thematic Historic District. Work was performed before joining this firm.

Mannasse's Corral/Presidio Hills Golf Course, San Diego, CA
Directed and managed archaeological excavation and interpretation of historic refuse and features related to Old Town San Diego located within the city-owned Presidio Hills Golf Course property. Conducted analysis of excavated material, researched and interpreted site history and use, and assessed resource significance, broadening the understanding of Old Town's archaeological signature and historic lifeways. Work was performed before joining this firm.

California State Parks Old Town San Diego State Historic Park Archaeological Excavations, San Diego, CA
Managed excavation and analysis of 19th-century deposits recovered from two locations within Old Town State Historic Park, representing roadbed flood wash and tavern refuse, respectively. Oversaw ceramic and glass cataloguing, and conducted historical research

and interpretation on specific site uses and depositional processes. Prepared State of California DPR forms, and assessed resource significance according to NRHP eligibility criteria. Work was performed before joining this firm.

City of El Centro Cole Road and Dogwood Road Widening Projects, Imperial County, CA
Project management of field survey and documentation efforts related to the widening of Dogwood Road and Cole Road in unincorporated Imperial County. Produced CEQA and Caltrans-format documentation related to identified resources and proposed project impacts. Work was performed before joining this firm.

Blackwater West Cultural Resources Phase I and Phase II Studies, Potrero, CA
Project director overseeing the survey of an approximately 850-acre area in eastern San Diego County and test excavation of identified prehistoric sites. Directed archaeological and built environment documentation, Extended Phase I testing, and Phase II testing efforts under the new County of San Diego Guidelines implemented September 2006. Work was performed before joining this firm.

Vine/Carter Hotel Historical Assessment, San Diego, CA
As Project Manager, conducted extensive archival research and historical assessment of the African-American-owned Vine/Carter Hotel building in San Diego's East Village. Conducted historical research on the building's ownership history and development; its historical uses, managers, and residents; and its place in San Diego's historical African-American community. Photographed and documented the building according to Office of Historic Preservation guidelines, prepared State of California DPR forms, and assessed the building's significance according to local, state, and federal significance criteria. As a result of the project, the Vine/Carter Hotel was nominated as a significant historical resource by the City of San Diego Historical Resources Board. Work was performed before joining this firm.

Mission San Gabriel Gardens Excavation, Jump Start Project, San Gabriel, CA
As Project Manager, conducted monitoring and excavation of Spanish colonial and American-era deposits associated with the construction of the original Mission San Gabriel and later 19th-century occupations. Documented the sites according to State Office of Historic Preservation guidelines, and assessed the resources according to NRHP and CEQA significance criteria. Work was performed before joining this firm.

Lillian Grant Property Public Art Project, San Diego, CA
As Project Manager, provided historical research services and written text incorporated into the public art commissioned for the redevelopment of the historical Lillian Grant Property in the East Village of San Diego. The public art, located at 14th and J streets at the Lillian Place affordable housing complex, commemorates the histories, experiences, and contributions of African-Americans to the development of San Diego and the East Village area in particular. Work was performed before joining this firm.

Lillian Grant Property Historic American Building Survey (HABS), San Diego, CA
As Project Manager, supervised HABS of the Lillian Grant properties in the East Village community of San Diego, submitted to the City of San Diego. Oversaw archival quality photographic documentation, and architectural line and plan drawings, as well as completed required HABS historical narrative on the subject buildings. Work was performed before joining this firm.

San Gabriel Mission Trench Excavation, San Gabriel, CA
As Senior Archaeologist, conducted historical and archival research on the prehistory and history of the San Gabriel Mission and surrounding areas to assess potential impacts of proposed below-grade railway trench. Compiled historical narrative, identified potential subsurface features, and recommended appropriate mitigation strategies. Work was performed before joining this firm.

LA Department of Parks and Recreation Camp Seely National Register Evaluation, San Bernardino National Forest, San Bernardino County, CA
As Senior Historian, conducted NRHP evaluation of the early-20th-century Camp Seely recreational camp facility leased by the City of Los Angeles in the San Bernardino National Forest. Conducted historical and archival research on the Camp's history and development; its individual buildings; and its architects, including Sumner P. Hunt and Silas R. Burns. Photographed and documented the building according to Office of Historic Preservation guidelines, prepared State DPR forms, and assessed resource significance according to NRHP eligibility criteria. Work was performed before joining this firm.

Camp Radford National Register Evaluation, San Bernardino National Forest, San Bernardino County, CA
As Senior Historian, conducted NRHP evaluation of the early-20th-century Camp Radford recreational camp facility leased by the City of Los Angeles in the San Bernardino National Forest. Conducted historical and archival research on the Camp's history and development; its individual buildings; and its architects, Sumner P. Hunt and Silas R. Burns. Photographed and documented the building according to Office of Historic Preservation guidelines, prepared State DPR forms, and assessed resource significance according to NRHP eligibility criteria. Work was performed before joining this firm.

Papers and Presentations

The Development of Colonial Culture at the South African Cape of Good Hope: Examining the many "functions" of utilitarian ceramics. Paper presented at the Archaeology of Colonialism Symposium, Archaeological Institute of America Annual Meetings, January 2001.

Urban Archaeology and the Focus of Memory: a study in the history and narrative of South Central Los Angeles. Paper Presented at the Society for American Archaeology Annual Meeting, March 2002.

Historical Archaeology as Anthropology: Artifacts, Identities, and Interpretations in the Study of the Recent Past. Presented at World Archaeological Congress, January 2003.

Old Town Made New Again: The Archaeology of San Diego's First Settlement. Paper presented at the Society for California Archaeology Annual Meeting, April 2005.

Past as Present: Tourism and Archaeology in Old Town San Diego. Presented at the Society for Applied Anthropology Annual Meeting, April 2005.

The Face of Mercantilism at the South African Cape of Good Hope: Ceramics and the Hesitant Empire. Presented at the Society for Historical Archaeology Annual Meeting, January 2006.

A Patchwork History: Interweaving Archaeology, Narrative and Tourism in Old Town San Diego. Paper presented at the Society for American Archaeology Annual Meeting, March 2007.

Mannasse's Corral: The Life History of a Piece of Old Town. Presented to the Presidio Council, January 2008.

Making the Past Present: Archaeology, Heritage and Tourism in Old Town San Diego. Paper presented at the Society for California Archaeology Annual Meeting, April 2008.
CEQA and Historical Resources. Guest Lecturer, California Environmental Quality Act, UCSD Extension Course, 2008-2010.

Cheryl Bowden-Renna
Archaeologist/Associate
Assistant Laboratory Director

Education
BA, Anthropology, San Diego State University, 1987
Square supervisor and Field School Instructor, at Tel Dor, Israel, U.C. Berkeley

Affiliations
Member, Society for California Archaeology

Certifications
40-Hour Hazardous Waste Operations and Emergency Response
(HAZWOPER Course maintained since 1996)

Lectures + Instruction
Sandstone Features Adjacent to Lake Cahuilla (with S. Rose), Volume 12, Society of California Archaeology, 1999
The Cultural Resources of the Chocolate Mountains (with R. Apple), Society of California Archaeology, 2004

Cheryl Bowden-Renna has served as archaeologist and assistant laboratory director for several cultural resource firms in San Diego. With 15 years of archaeological experience, Ms. Bowden-Renna has worked at sites throughout the southwestern United States. She also has a background in accounting, database management, and has developed solid management and supervisory skills.

Ms. Bowden-Renna has extensive archaeological monitoring experience of ordnance removal at the Salton Sea Test Base in Imperial County. She has also served as archaeological monitor of the test excavation for the Inmate Reception Center in downtown San Diego. In that role, she was responsible for monitoring excavations, including the use of backhoes, during the data recovery of features from an urban historic site.

Project Experience

Department of General Services Federal Services Caltrans District 11 New Headquarters, San Diego, CA
Performed cultural monitoring for historic and prehistoric resources during preconstruction and construction for Caltrans 11 new headquarters building.

County of San Diego Camp Lockett Monitoring, Campo, CA
Performed monitoring during construction of a sewage treatment facility in Campo, San Diego County.

NAVFAC Southwest and MCAS Miramar East Miramar Housing Alternative, San Diego, CA
As Project Archaeologist, conducted cultural resources survey, excavation, and evaluation of several sites located on MCB Miramar.

NAVFAC Southwest and MCAS Miramar Jet Fuel Line, San Diego, CA
As Crew Chief, conducted cultural resources survey for proposed fuel line for the Marine Corps, San Diego County.

Riverside County Economic Development Authority OHV Project, Riverside County, CA
As Crew Chief, conducted cultural resources survey of over 1,000 acres in Riverside County, California.

Sempra Utilities Coronado Monitoring Project, Coronado, CA
Monitoring of powerline trenching on Coronado Island, California.

City of Santa Clarita and Caltrans District 7 Cross Valley Survey, Los Angeles County, CA
As Crew Chief, conducted cultural resources survey in Los Angeles County, California.

City of San Diego McAuliffe (Winterwood) Community Park, San Diego, CA
Crew Chief for cultural resources survey of a proposed park.

NAVFAC Southwest and MCAS Yuma Two Crash Sites on The Barry M. Goldwater Range, Yuma, AZ
Crew Chief for cultural resources survey of two helicopter crash sites.

NAVFAC Southwest Cultural Resources Inventory For the Infantry Squad Battle Course (P-633), Marine Corps Base Camp Pendleton, CA
Crew Chief for cultural resources survey and site recordation.

San Diego County Water Authority Emergency Storage Project, San Diego County, CA
As Project Archaeologist, Crew Chief, Field Technician and Laboratory Analysis, conducted cultural resources survey, testing and evaluation of several large project sites within San Diego County.

San Diego Gas & Electric Valley Rainbow Transmission Line Project, Riverside and San Diego Counties, CA
Crew Chief for cultural resources survey and site recordation for major portions of a large transmission line project.

LMXU Village Center
Crew chief for cultural resources excavation and water screening.

Los Angeles Department of Parks and Recreation Plum Canyon Park Project, Los Angeles County, CA
As Crew Chief, conducted cultural resources survey for a community park in Saugus, Los Angeles County, California.

City of Escondido Tract 207A
As Project Archaeologist, conducted cultural resources survey of 1.13 acres in the City of Escondido.

Tactical Aircrew Combat Training System Range Upgrade, MCAS Yuma, Yuma County, AZ
Phase I cultural resource survey of proposed transmission line and 17 threat emitter stations.

North Baja Gas Pipeline Project, Riverside and Imperial Counties, CA
Conducted cultural resources survey and monitoring for large pipeline project in Riverside and Imperial counties, California.

Archaeological Testing and National Register Evaluation of Site CA SDI-16,002 Near Range 210 Marine Corps Base Camp Pendleton, CA
Field Director for test excavation of CA-SDI-16,002.

Ballpark Infrastructure, San Diego, CA
As Field Monitor, performed historic monitoring and testing of downtown east village area for the proposed Ballpark.

Ballpark Remediation, San Diego, CA
As Field Monitor, performed historic monitoring and testing of downtown east village area for the proposed Ballpark. Required hazardous materials certification.

Nobel Drive, San Diego County, CA
As Field Monitor, performed prehistoric monitoring of road extension to I-805 interchange.

Sempra Utilities On-call Cultural Services, San Diego, CA
As Field Monitor, historic monitoring and testing of downtown east village area for the proposed Ballpark. Required hazardous materials certification.

County of San Diego Inmate Reception Center Project, San Diego County, CA
As Laboratory Supervisor, conducted field monitoring of large machinery, including backhoes, during the data recovery of features from an urban historic site in downtown San Diego. Catalog and database management for project.

NAVFAC Southwest Levee Bridge, San Diego County, CA
As Crew Chief/Laboratory Supervisor, was responsible for catalog, database management, table creation for CA-SDI-10,156, and discovery sites.

U.S. Navy Salton Sea Test Base Project, Imperial County, CA
As Crew Chief, was responsible for site recordation, test excavation, and monitoring of 130 prehistoric sites in the County.

City of San Diego and Caltrans SR-56 EIR, Cultural Investigations, San Diego County, CA
As Laboratory Technician, cataloged 12 prehistoric sites during preparation of EIR.

City of San Diego and Caltrans SR-56 Cultural Resources Testing, San Diego County, CA
As Crew Chief, performed testing at 12 prehistoric sites.

P-527 Santa Margarita/San Onofre Cultural Resources Testing and Monitoring, MCB Camp Pendleton,
San Diego County, CA
Performed monitoring of water treatment pond and pipeline construction in the County.

NAVFAC Southwest San Clemente Island Existing Conditions Study for Pumped Hydrostorage/Wind Farm Project, Los Angeles County, CA
As Field Technician, responsible for recording 80 sites on San Clemente Island.

NAVFAC Southwest Tactical Aircrew Combat Training System Range Upgrade, MCAS Yuma, Yuma County, AZ
As Field Technician, responsible for Phase I cultural resource survey of proposed transmission line and 17 threat emitter stations.

Boulder Valley Project, San Diego County, CA
Cultural resource survey of proposed reservoir and pipeline tunnels in the County.

Kern River Project, San Bernardino County, CA, Beaver, Miller, and Utah Counties, UT, and Clark County, NV
Excavated, surveyed, and monitored along pipeline right-of-way. Analyzed artifacts from all phases of project in Las Vegas, Nevada.

Pacific Rim Laboratory Analysis, San Diego County, CA
As Field Technician, analyzed CA-SDI-691, a prehistoric site on Batiquitos Lagoon.

County of San Diego Cal Terraces Laboratory Analysis, San Diego County, CA
As Laboratory Technician, analyzed one prehistoric site, and reanalyzed two prehistoric sites, in Otay Mesa.

Elsmere Corporation Cultural Resource Survey, Los Angeles County, CA
As Field Technician, conducted cultural resource survey of 2,200 acres in the San Gabriel Mountains.

Caltrans Coursegold Excavation, Madera County, CA
As Field Technician, excavated site for Caltrans road widening.

U.S. Navy Vandenberg Laboratory Analysis, Santa Barbara County, CA
As Laboratory Technician, sorted artifacts and wet-screened column samples.

Camelot Cultural Resource Survey, Kern County, CA
As Crew Chief, conducted a cultural resource survey of a 200-acre lot split in the Mojave Desert.

Caltrans SR-86 Cultural Resource Survey, Imperial County, CA
As Crew Chief, conducted a cultural resource survey of SR-86 road widening in the County.

Black Mountain Ranch Excavation, San Diego County, CA
As Laboratory Supervisor, excavated and analyzed 15 prehistoric sites in the La Jolla Valley.

City of Carlsbad Cannon Ranch Reaches 3 and 4, San Diego County, CA
As Crew Chief, excavated and analyzed two prehistoric sites in Carlsbad.

San Diego Gas & Electric Rancho San Miguel Project, San Diego County, CA
As Field Technician/laboratory Supervisor, excavated and analyzed nine sites and conducted extensive surface collections in the County.

Cottonwood Canyon Laboratory Analysis, Riverside County, CA
As Laboratory Supervisor, analyzed two prehistoric sites in the County.

Rancho del Rey (Spa III) Excavation, San Diego County, CA
As Field Technician/laboratory Supervisor, excavated and analyzed a prehistoric site in Chula Vista.

Stallions Crossing Laboratory Analysis, San Diego County, CA
As Laboratory Supervisor, analyzed five prehistoric sites in Del Mar.

Valley Ranch Cultural Resource Survey, Palmdale, CA
Conducted cultural resource survey of 350 acres in Palmdale.

Fairbanks Highland Cultural Resource Survey, San Diego County, CA
Conducted cultural resource survey, excavation, and analysis.

Eagle Mountain Cultural Resource Survey, Riverside County, CA
Conducted cultural resource survey of the Eagle Mountain mine and railroad to Salton Sea.

Santa Margarita River Cultural Resource Survey, San Diego and Riverside Counties, CA
Conducted cultural resource survey of Santa Margarita River from Temecula to the Pacific Ocean.

Scripps Ranch North Excavation, San Diego County, CA
Excavated and analyzed two prehistoric sites and one historic site in Poway.

Sycamore Canyon Excavation, San Diego County, CA
Excavated and analyzed two prehistoric sites east of Poway.

Los Campanos Excavation, San Diego County, CA
Excavated and analyzed four prehistoric sites and one historic site in Valley Center.

American Girl Mine Cultural Resource Survey, Imperial County, CA

Conducted cultural resource survey, excavation, and analysis of historic artifacts from a historic gold mining town in the Cargo Muchacho Mountains.

Railroad Canyon Cultural Resource Survey, Riverside County, CA

Conducted cultural resource survey, excavation, and analysis of a road realignment in Temecula.

U.S. Air Force Edwards Air Force Base Cultural Resource Survey, Excavation, and Analysis, Kern County, CA

As Field Technician/Laboratory Technician, conducted cultural resource survey, excavation, and analysis of 1,000-acre area on Edwards Air Force Base.

County of San Diego Parks and Recreation Department Johnson-Taylor Adobe Excavation, San Diego County, CA

As Field Technician/Laboratory Technician, excavated and analyzed the area around the Johnson-Taylor Adobe and C wing.

Pacific Rim Laboratory Analysis, San Diego County, CA

As Field Technician/Laboratory Technician, conducted extensive shell and lithic analysis of prehistoric sites on Batiquitos Lagoon.

APPENDIX C

DPR FORMS

(Confidential – Bound Separately)

APPENDIX D

NATIVE AMERICAN CONSULTATION

EDAW | AECOM

EDAW Inc
1420 Kettner Boulevard, Suite 500, San Diego, California 92101
T 619.233.1454 F 619.233.0952 www.edaw.com

Facsimile

Please deliver to		From	
Name		Name	Cheryl Bowden-Renna
Firm	Native American Heritage Commission	Direct line	619-233-1454 x 6815
Fax number	916-657-5390	Date transmitted	2/3/2011
Phone number		Total pages	04
Subject	Jacumba Water Well		
Project number	09080001		

We are contacting you to request a sacred lands file check for the proposed Jacumba Water Well Access Road Project, located in eastern San Diego County. The proposed areas incorporates a 1/4-mile radius each area, located on the following quadrangle:

Jacumba T17S R8E Section 7

If you have any questions, please do not hesitate to call me at (619) 233-1454.

Sincerely,

Cheryl Bowden-Renna
Archaeologist/Associate

Document1

Source: USGS 7.5' Topo Quad Jacumba, CA 1975; ESRI 2011; Sempra 2010;

2,000 1,000 0 2,000 Feet

Scale: 1 = 24,000; 1 inch = 2000 feet

Records Search Map

JCSD Water Purchase Project

Path: P:\2009\09080001 ESJ Gen-Tie\6.0 GIS\6.3 Layout\Well_accessRd_working\Well_accessRd_.mxd, 01/04/11, SorensenJ

APPENDIX E

CONFIDENTIAL FIGURES

(Confidential – Bound Separately)

AECOM

AECOM
1420 Kettner Boulevard
Suite 500
San Diego, CA 92101
www.aecom.com

619.233.1454 tel
619.233.0952 fax

February 3, 2011

Mr. Patrick Brown
Project Manager
San Diego County Department of Planning and Land Use
5201 Ruffin Road, Suite B
San Diego, CA 92123

Subject: Energia Sierra Juarez (ESJ) Well Access Road - Project Number 09-0107420

Dear Mr. Brown:

AECOM has prepared this biological letter report in accordance with County of San Diego Guidelines (2010) for the analysis of a proposed access road for San Diego Gas and Electric (SDG&E) to access an existing water well owned and operated by the Jacumba Community Services District.

SUMMARY

The proposed project is the construction of an access road to an existing water well on property owned by the Jacumba Community Services District (APN 660-040-32-00) through a privately owned parcel (APN 660-040-33-00) that is also owned by the Jacumba Community Services District. The potential access road and a 100-foot buffer was surveyed by AECOM on January 26, 2011. Habitats within the survey area consisted of desert saltbush scrub and southern cottonwood-willow riparian forest. Several dirt roads are located within the survey area and would be classified as a disturbed cover type. The eastern portion of the survey area has been mapped as a lake/wetland on the Jacumba U.S. Geological Survey (USGS) map and as a freshwater emergent wetland on the U.S. Fish and Wildlife Service (FWS) National Wetland Inventory. An investigation of the site found that area to the east of the access road site would be regulated by the U.S. Army Corps of Engineers (USACE). The access road would not require a streambed Alteration Agreement from California Department of Fish and Game (CDFG) or authorization under the USACE as the proposed project is not located within the wetland.

No sensitive plant or wildlife species were detected on-site.

Per County guidelines, impacts to desert saltbush scrub require mitigation at a 2:1 ratio and impacts to southern cottonwood willow riparian forest habitat require mitigation at a ratio of 3:1. The southern cottonwood willow riparian forest would be protected by the County of San Diego as a wetland habitat as defined by the Resource Protection Ordinance (RPO).

The proposed access road is allowed under the RPO as the parcel is surrounded by privately owned parcels and the only access to the site is from Old Highway 80 on the southern boundary.

INTRODUCTION, PROJECT DESCRIPTION, LOCATION, AND SETTING

The project proposes to construct a 150-foot by 20-foot access road from Old Highway 80 north to an existing well owned and operated by the Jacumba Community Services District (APN 660-040-32-00), located on a privately owned parcel (APN 660-040-33-00). The site is bounded by other privately owned parcels and the access road is required to legally access the well from the public road. The access road would be constructed of fill material and would incorporate a culvert to allow drainage beneath the access road.

The project is located to the east of the town of Jacumba in eastern San Diego County, north of Old Highway 80 (Figures 1 and 2). The project is bordered to the north by undeveloped land and rural residential to the east, west, and south. The project is located on the Jacumba USGS 7.5' quadrangle map, Range 8 East and Township 18 South. The project is approximately 2,840 feet above mean sea level and relatively flat. Soils on-site consist of Rositas loamy coarse sand 2–9 percent slopes (RsC).

The proposed access road and a 100-foot buffer was surveyed on foot on January 25, 2011, by AECOM biologist Victor Novik. Plant species were identified on-site or were collected for later identification. Wildlife were identified directly by sight and indirectly by scat, tracks, or burrows. A wetland assessment and delineation was conducted using the guidelines provided by the Army Corps of Engineers Arid West supplement.

REGIONAL CONTEXT

This project is located within the County of San Diego's Mountain Empire Subregional Planning Area and is covered by the Multiple Habitat Conservation and Open Space Plan. The project would be regulated by the County of San Diego Guidelines for Determining Significance for Biological Resources, as updated in September 2010.

HABITATS/VEGETATION COMMUNITIES

Two habitats were observed within the survey area: desert saltbush scrub and southern cottonwood willow riparian forest. Also present were dirt roads and an existing pump house; these are mapped as disturbed (Figure 3). Table 1 shows the vegetation communities and cover types. A complete list of all plant species observed is located in Appendix A.

Table 1
Vegetation Communities and Cover Types

Vegetation Community	Acreage within Survey Area	Acreage within Proposed Access Road
Desert Saltbush Scrub (Holland Code 36110)	0.58	0.019
Southern Cottonwood Willow Riparian Forest (Holland Code 61330)	0.37	0.014
Disturbed (Holland Code 11300)	0.42	0.03
Total	1.37	0.063

Desert Saltbush Scrub (Holland Code 36110)

Desert saltbush scrub is composed usually of low, grayish, microphyllous shrubs, 0.3–1 meter tall, with some succulent species. Total cover is often low, with much bare ground between the widely spaced shrubs. Stands typically are strongly dominated by a single *Atriplex* species and found on fine-textured, poorly drained soils with high alkalinity and/or salinity, usually surrounding playas on slightly higher ground (Holland 1986). On-site, the desert saltbush scrub is found on the higher ground surrounding the southern cottonwood willow riparian forest habitat. The dominant species within the desert saltbush scrub is fourwing saltbush (*Atriplex canescens)*. Other species within this habitat include London rocket (*Sisymbrium irio*) and grasses as such wild oats (*Avena* sp.) and red brome (*Bromus madritensis).*

Southern Cottonwood Willow Riparian Forest (Holland Code 61330)

Southern cottonwood willow riparian forest is composed of tall, open, broadleafed winter-deciduous riparian forests dominated by cottonwoods, and several tree willows. Understories usually are shrubby willows. This habitat is usually found in sub-irrigated and frequently overflowed lands along rivers and streams. The dominant species require moist, bare mineral soil for germination and establishment. This soil is provided after floodwaters recede, leading to uniformly aged stands in this seral type (Holland 1986). The dominant species within habitat on-site are cottonwood (*Populus fremontii*), willows (*Salix* sp.) and mule fat (*Baccharis salicifolia*).

Disturbed (Holland Code 11300)

The disturbed areas of the survey area include the dirt roads that access the site from the east and west and the well head and pump house. The dirt roads are compacted and do not support vegetation.

WILDLIFE

The following wildlife species were observed during the site visit. Bird species detected near the surveys area were common raven (*Corvus corax*), house finch (*Carpodacus mexicanus),* and common yellowthroat (*Geothlypis trichas).* Mammal tracks within the survey area were identified as rabbit, most likely desert cottontail (*Sylvilagus audubonii).*

SPECIAL-STATUS SPECIES

No special-status plant or animal species were observed within the survey area during the site visit. Large trees were scanned to determine if any raptor nests were present; however, none were seen. No sign of large mammals were observed within the survey area. Various wide-ranging wildlife species could utilize the site; potential sensitive species that could occur on-site are listed in Appendix B. The survey area was visited in the winter, which could have inhibited the surveyor's ability to detect spring or summer blooming sensitive plants though the area is small in nature and no species are listed as having a moderate or high potential for occurrence. For a full list of sensitive plant species with potential to occur on-site see Appendix C.

JURISDICTIONAL WETLANDS AND WATERS

The area to the east of the proposed access road is mapped as a fresh water emergent wetland by the FWS National Wetlands Inventory and as a lake/wetland on the Jacumba USGS map. This wetland is directly adjacent Boundary Creek to the north, which connects to Carrizo Creek. Carrizo Creek becomes San Felipe Creek, which flows into the Salton Sea. The proposed access road is located at the western extent of the wetland with the eastern and northern portions of the wetland being deeper. Several soil pits were dug throughout the survey area to determine the extent of wetland. Based on the soils, hydric conditions begin just east of the pump house and the proposed access road (Figure 4, Appendix D). The access road is located within an area that would not qualify as a wetland based on the lack of hydric soils, lack of hydric vegetation, and lack of hydrology. The cottonwood willow riparian forest surrounding the proposed access road does not exhibit an ordinary high water mark and therefore would not be considered a wetland nor a non-wetland waters.

OTHER UNIQUE FEATURES/RESOURCES

Wildlife corridors and linkages between significant wildlife areas are important because of their role in preserving species diversity and viability. Without some connection or corridor to other areas, wildlife areas become virtual islands surrounded by development. The construction of the access road would not fragment undeveloped lands as the areas to the north east and west will remain undeveloped. The surrounding undeveloped lands will continue to allow wildlife to move freely throughout the area.

SIGNIFICANCE OF PROJECT IMPACTS AND PROPOSED MITIGATION

Impacts to biological resources can be categorized as direct, indirect, or cumulative. Direct impacts are a result of project implementation and generally include the loss of vegetation, sensitive habitats, and plant and animal populations. Indirect impacts occur as a result of human activities and may include increases in light, noise, dust, human incursion, and introduction of nonnative plants and wildlife. Cumulative impacts occur as a result of ongoing direct and indirect impacts for unrelated projects within a geographic area. Cumulative impacts are assessed on a regional basis and determine the overall effect of numerous activities on a sensitive resource over a larger area.

Direct Impacts

The proposed project will directly impact the desert saltbush scrub and southern cottonwood willow riparian forest that coincide with the access road. Per County guidelines, impacts to these habitats require mitigation (Figure 3).

The project will impact 0.019 acre of desert saltbush scrub. This will require mitigation at a ratio of 2:1 or 0.038 acre.

The project will impact 0.014 acre of southern cottonwood willow riparian forest. This will require mitigation at a ratio of 3:1 or 0.042 acre.

The loss of 0.03 acre of disturbed habitat would not require mitigation.

The RPO would allow the access road as it is the only feasible legal access to the well.

Indirect Impacts

Indirect impacts result from changes in land use adjacent to natural habitats and primarily result from adverse “edge effects”—either short-term indirect impact related to construction, or long-term indirect impacts associated with urban development. During construction, short-term indirect impacts include dust and noise, which could temporarily disrupt habitat and species vitality. Long-term indirect impacts may include intrusions by humans, soil erosion, litter, fire, and hydrological changes. The survey area contains sensitive habitats that could support sensitive species. The implementation of the project could result in indirect impacts to these resources. Implementation of the avoidance, minimization, and mitigation measures would reduce these to below a level of significance.

Avoidance, Minimization, and Mitigation Measures

The following avoidance, minimization, and mitigation measures should be implemented during construction to minimize or eliminate potential direct and indirect impacts on biological resources within the survey area.

- The limits of work should be demarcated with construction fencing or flagging to ensure that no impacts to native habitats occur outside of the work areas.
- No raptor nests were observed during the survey of the project site. However, to avoid direct and indirect impacts to raptors and migratory birds, removal of habitat that may support active nests and construction should occur outside of the avian breeding season (February 15–August 15). If habitat removal and construction activities cannot be avoided during the avian breeding season, a qualified biologist should conduct a preconstruction survey to determine the presence/absence of nesting birds on the site and within 300 feet. The preconstruction survey should be conducted within 10 days prior to the start of construction. If nests are detected, work should be delayed until it is determined that the birds have fledged or the nest is abandoned.
- If active nest are found within 300 feet of the proposed project sound attenuation devices should be installed to ensure that the noise level does not exceed 60 dB. Noise monitoring should occur near the nest to confirm noise levels do not exceed 60 dB.
- Proposed mitigation for impacts to 0.019 acre of desert saltbush scrub and 0.014 acre of southern cottonwood willow riparian forest will be mitigated through the purchase of mitigation credits from a County-approved mitigation bank in the amount of 0.038 acre of desert saltbush scrub and 0.042 acre of southern cottonwood willow riparian forest.

CUMULATIVE IMPACTS

When considered together, the impacts of past and present projects, along with foreseeable future projects, may significantly impact the region’s resources. To further understand the cumulative impacts of this project all discretionary projects within the area were considered.

Based on discussions with the County, the following list of projects has been identified for consideration as part of the cumulative impact analysis.

- Ketchum Ranch: a proposed development of a master planned community on a 1,250-acre site adjacent to the town of Jacumba. Approximately 294 acres of the property support significant biological or cultural resources and are proposed as permanent open space.
- Elder TPM 4+: a proposed minor residential subdivision within the Boulevard Community Planning Area.
- Iberdrola – Tule Wind Project: a proposed renewable energy development approximately 10 miles northwest of the ESJ Gen-Tie project.

- San Diego Gas & Electric East County Substation: a proposed substation, located immediately north of the ESJ Gen-Tie project.
- U.S.-Mexico International Border Fence: ongoing federal project to construct a single and double-layer hardened fence along the International Border.

The proposed project will result in minimal impacts (0.033 acre) to desert saltbush scrub and southern cottonwood willow riparian forest. The impacts will be mitigated as listed in the mitigation section above. With this mitigation the project would not contribute to the cumulative loss of habitats within the region.

Please contact me if you have any questions.

Sincerely,

Paula M. Jacks Victor Novik

Paula Jacks
Senior Biologist

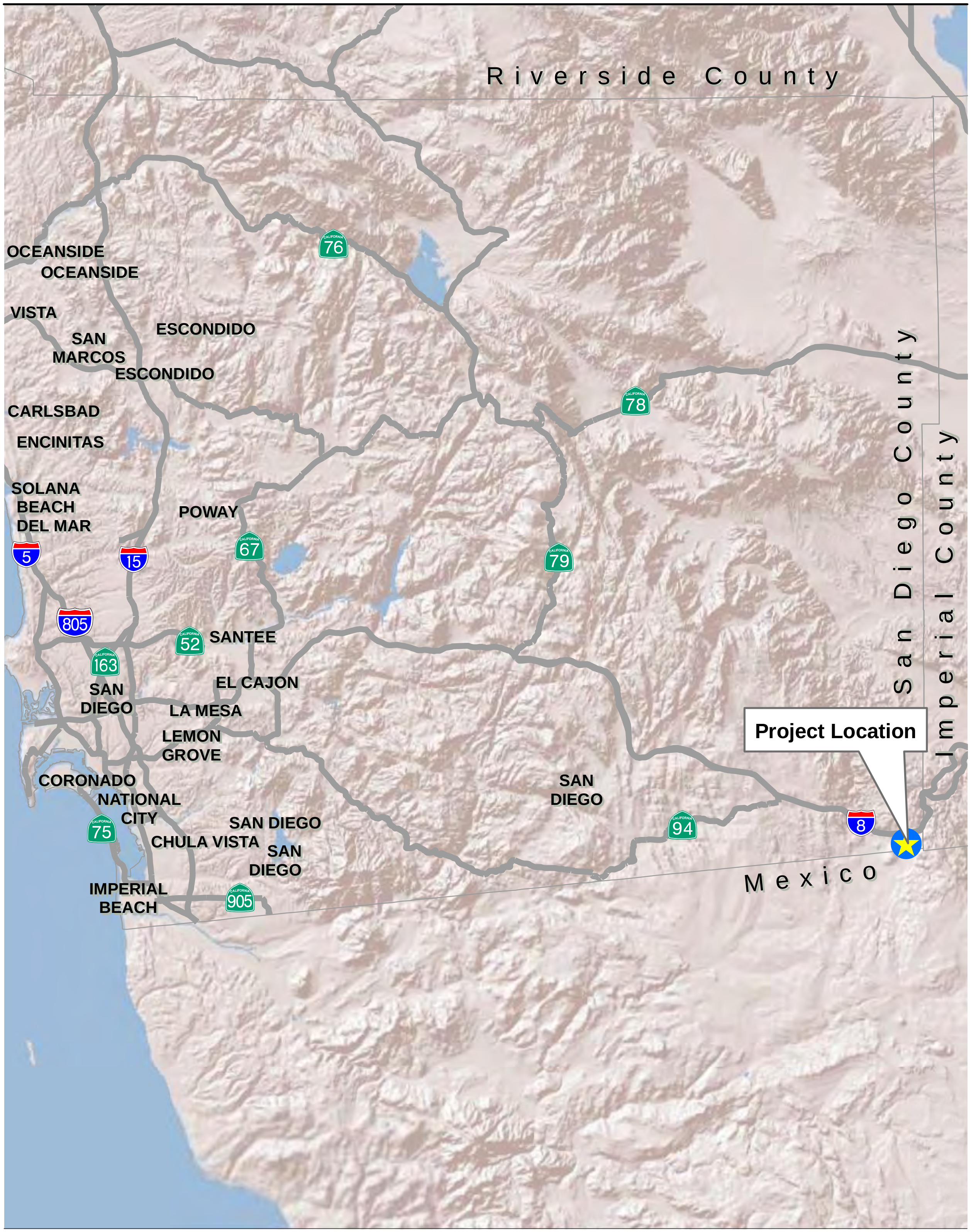
Victor Novik
Biologist

Attachments:
Figures:
1 Regional Location Map
2 Vicinity Map
3 Existing Vegetation and Project Overlay
4 Potential Jurisdictional Areas
Appendices:
A Floral Species Documented on and adjacent to the Project Site
B Sensitive Wildlife Species Observed or Potentially Occurring within the Project Site
C Sensitive Plant Species Potentially Occurring within the Proposed Project Site
D Preliminary Jurisdictional Determination/Data Forms and Photos

REFERENCES

Holland, R.
1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. Nongame Heritage Program, State of California Department of Fish and Game.

FIGURES



Source: SANGIS 2008; ESRI 2011

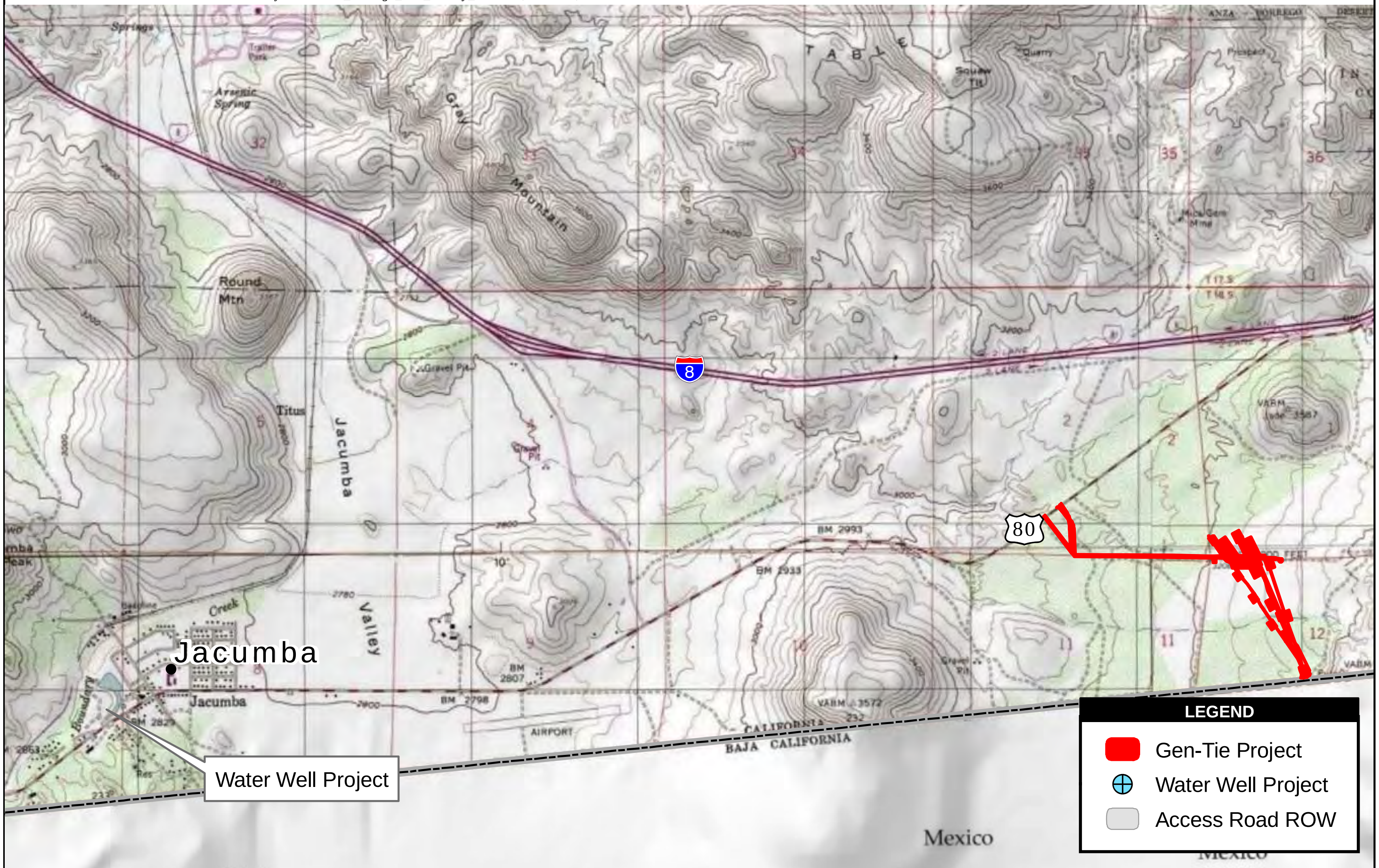
11 5.5 0 11 Miles

Scale: 1 = 696,960; 1 inch = 11 mile(s)

Figure 1
Regional Location Map

ESJ Well Driveway Project Number 09-0107420

Path: P:\2009\09080001 ESJ Gen-Tie\6.0 GIS\6.3 Layout\Bio\Well_Bio\Fig2_Well_Vicinity_8x11.mxd, 02/02/11, SorensenJ



Source: Sempra Energy 2009; SANGIS 2008; USGS 7.5' Topographic Quadrangle In-Ko-Pah Gorge, CA 1975, Jacumba, CA 1975

3,000 0 3,000 Feet

Scale: 1 = 36,000; 1 inch = 3,000 feet

Figure 2
Vicinity Map

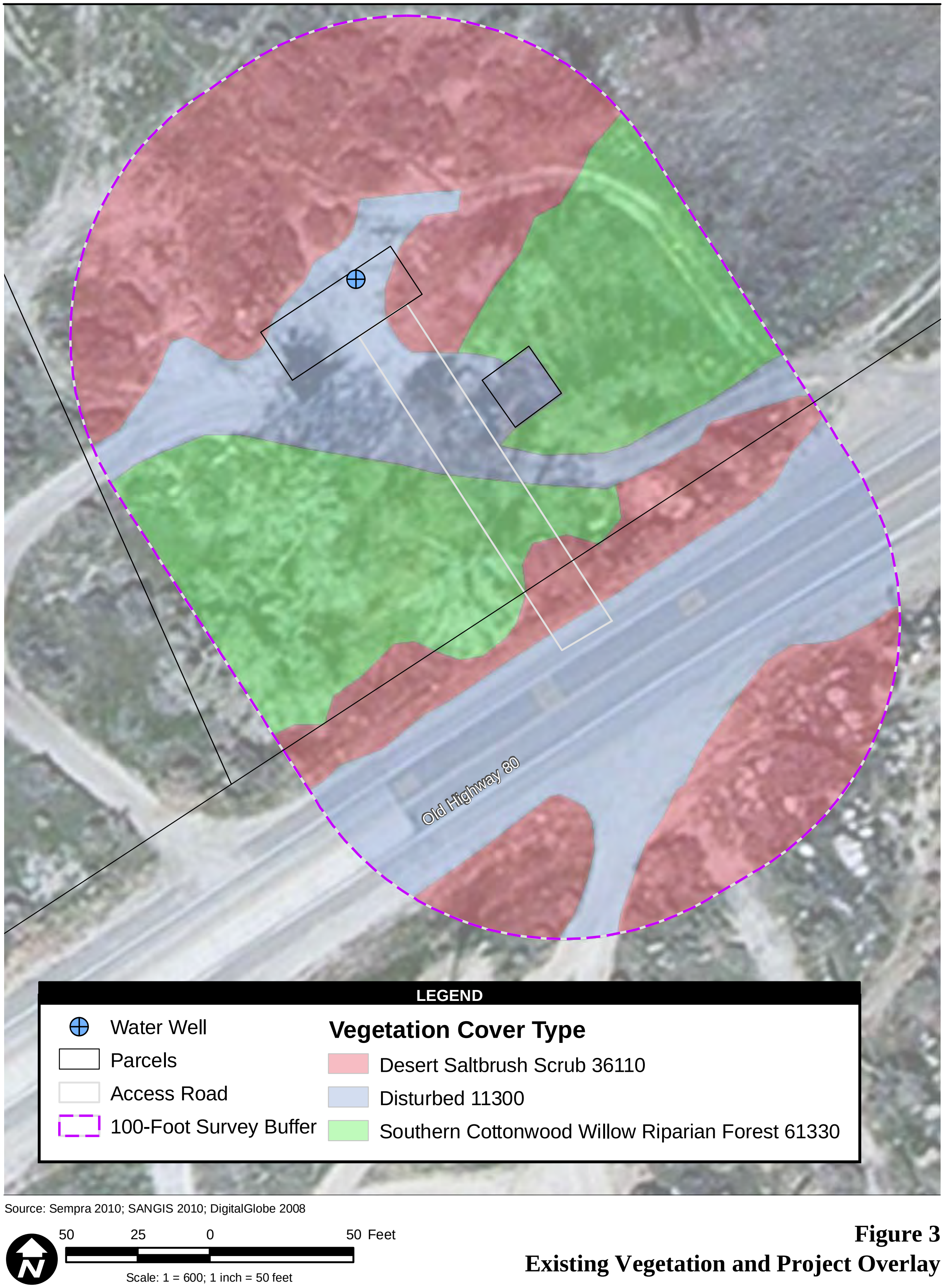
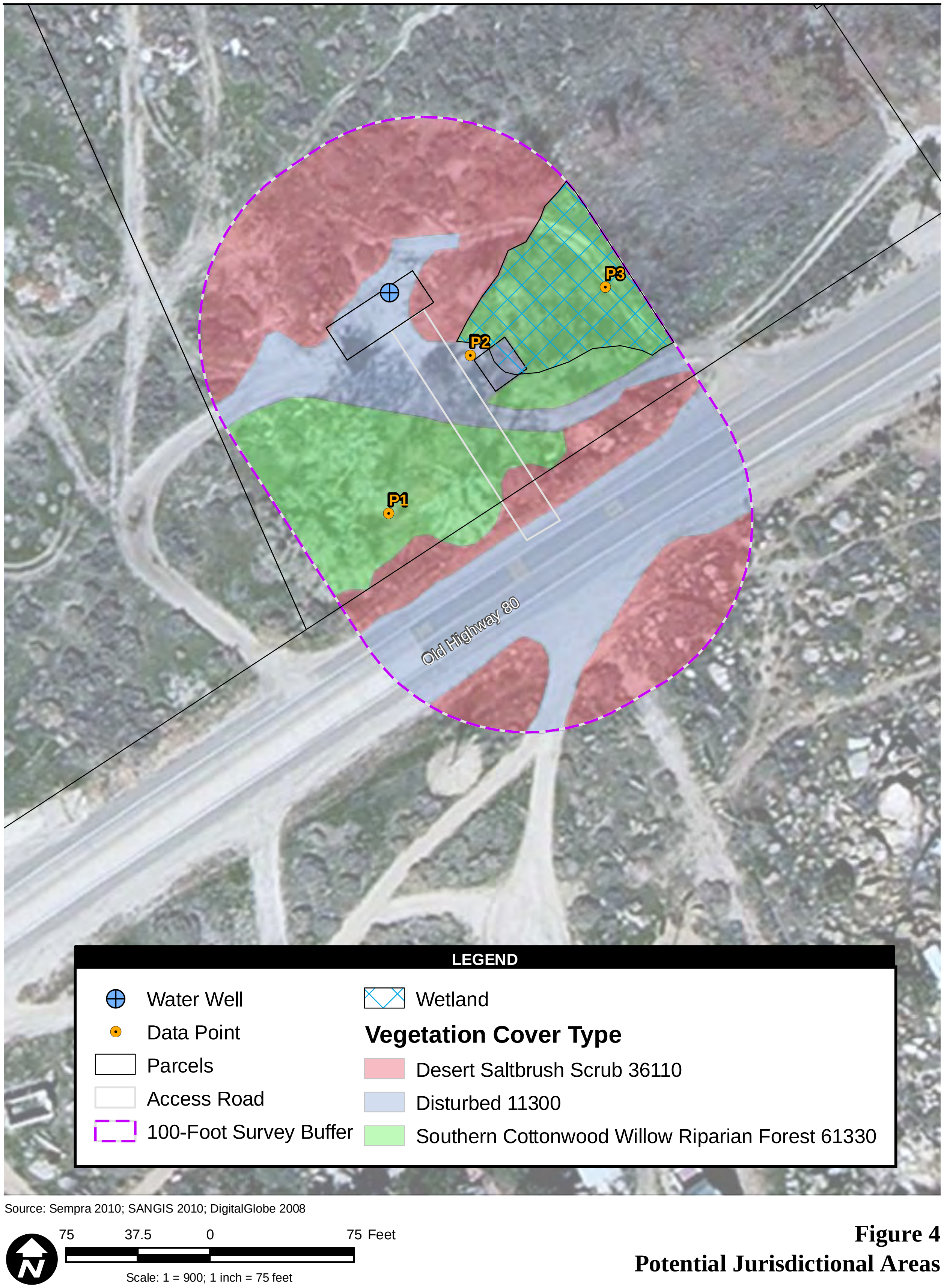


Figure 3
Existing Vegetation and Project Overlay

ESJ Well Driveway Project Number 09-0107420

Path: P:\2009\09080001 ESJ Gen-Tie\6.0 GIS\6.3 Layout\Bio\Well_Bio\Fig3_Existing_Veg.mxd, 02/02/11, SorensenJ



Source: Sempra 2010; SANGIS 2010; DigitalGlobe 2008

Figure 4
Potential Jurisdictional Areas

APPENDIX A

FLORAL SPECIES DOCUMENTED ON AND ADJACENT TO THE PROJECT SITE

APPENDIX A

FLORAL SPECIES DOCUMENTED ON AND ADJACENT TO THE PROJECT SITE

Scientific Name	Common Name
Amsinckia menziesii var. *intermedia*	Rancher's fiddleneck
Artemisia dracunculus	Mugwort
Atriplex canescens	Four-wing saltbush
Avena sp. (non-native)	Wild oats
Baccharis salicifolia	Mule fat
Brassica sp.	Mustard
Bromus madritensis	Brome
Bromus rubens (nonnative invasive)	Red brome
Cirsium vulgare	Thistle
Conyza canadensis	Horsetail
Corethrogyne filaginifolia	Sand aster
Eriastrum densiflorum	Woollystar
Erodium cicutarium (nonnative)	Filaree
Isocoma menziesii	Goldenbush
Oxalis latifolia	Wood sorrel
Phoradendron californicum	Desert mistletoe
Populus fremonti	Cottonwood
Salix sp.	Willow
Sisymbrium irio (nonnative)	London rocket
Solidago confinis	Goldenrod
Tamarix sp.	Tamarisk

APPENDIX B

SENSITIVE WILDLIFE SPECIES OBSERVED OR POTENTIALLY OCCURRING WITHIN THE PROJECT SITE

APPENDIX B

SENSITIVE WILDLIFE SPECIES OBSERVED OR POTENTIALLY OCCURRING WITHIN THE PROJECT SITE

Scientific Name	Common Name	Federal Status	State Status	BLM	County of San Diego	Habitat	Potential to Occur On-site
Birds							
Accipiter cooperii	Cooper's hawk	--	SSC		Group 1	Forests and open woodland habitats	Low (foraging); no nests detected.
Aquila chrysaetos canadensis	Golden eagle	BEGEPA	CFP		Group 1	Requires vast foraging areas in grasslands, broken chaparral or sage scrub. Secluded cliffs with overhanging ledges and large trees for nesting and cover.	Low (foraging); not expected to nest, due to lack of habitat.
Agelaius tricolor	Tricolored blackbird	--	SSC	BLM Sensitive	Group 1	Dairies and ripening grain heads, rice districts, cattail marshes	Moderate.
Athene cunicularia	Western burrowing owl	--	SSC	BLM Sensitive	Group 1	Deserts with burrowing animals	Low, habitat not appropriate.
Cathartes aura meridionalis	Turkey vulture	--			Group 1	Open stages of habitats that provide cliffs and large trees.	Not expected due to lack of habitat.
Circus cyaneus	Northern harrier (nesting)	--	SSC		Group 1	Coastal lowland, marshes grassland, agricultural fields	Low (foraging); not expected to nest, due to lack of habitat.
Eremophila alpestris actia	California horned lark	--	SSC		Group 2	Sandy shores, mesas, disturbed areas, grasslands, agricultural lands, sparse creosote bush scrub	Low, habitat is of marginal quality.
Falco mexicanus	Prairie falcon	--	SSC		Group 1	Open country	Low (foraging); not expected to nest, due to lack of habitat.
Falco peregrinus anatum	American peregrine falcon	D	E		Group 1	Open country, especially along rivers; also near lakes, along coasts, and in cities	Low (foraging); not expected to nest, due to lack of habitat.
Lanius ludovicianus	Loggerhead shrike	--	SSC		Group 1	Open foraging areas near scattered bushes and low trees	Moderate, not observed during surveys.

Scientific Name	Common Name	Federal Status	State Status	BLM	County of San Diego	Habitat	Potential to Occur On-site
Parabuteo unicinctus	Harris' hawk	--	SSC			River woods, mesquite, brush, cactus deserts	Low (foraging); not expected to nest, due to lack of habitat.
Piranga rubra	Summer tanager		SSC		Group 2	Desert riparian habitat dominated by cottonwood and willow.	Moderate, not observed.
Toxostoma crissale	Crissal thrasher	--	SSC		Group 1	Dense thickets of shrubs or low trees in desert riparian and desert wash habitats	Moderate, not observed.
Toxostoma lecontei lecontei	Leconte's thrasher	--		BLM Sensitive	Group 2	Desert scrub habitats; prefers breeding in saltbush/shadscale vegetation or cholla cacti in sandy substrate.	Moderate
Vireo bellii pusillus	Least Bell's vireo	E	E		Group 1	Riparian	Low, habitat is marginal.
Vireo vicinior	Gray vireo	--	SSC	BLM Sensitive	Group 1	Hot, semi-arid, shrubby habitats, especially mesquite and brushy pinyon-juniper woodlands; also chaparral, desert scrub. Thorn scrub, oak-juniper woodland, pinyon-juniper, juniper-cholla, mesquite, dry chaparral. Nests in mature, closed vegetation. Dependent upon elephant tree in the winter.	Low
Reptiles							
Coleonyx switaki	Barefoot banded gecko	--	T		Group 2	Arroyos and rocky hillsides, especially near large boulders or rocky outcrops	Not expected due to lack of habitat.
Phrynosoma mcalli	Flat-tailed horned lizard	--	SSC	BLM Sensitive	Group 1	Dunes and sandy flats of low desert	Not expected due to lack of habitat.
Salvadora hexalepis virgultea	Coast patch-nosed snake	--	SSC		Group 2	Grasslands, chaparral, sagebrush, desert scrub in sandy and rocky areas	Low

Scientific Name	Common Name	Federal Status	State Status	BLM	County of San Diego	Habitat	Potential to Occur On-site
Crotalus ruber ruber	Red diamond rattlesnake	--	SSC		Group 2	Desert scrub and riparian, coastal sage scrub, open chaparral, grassland, and agricultural fields	High
Phrynosoma coronatum blainvillei	San Diego horned lizard	---	SSC		Group 2	Coastal sage, annual grassland, chaparral, oak woodland, riparian woodland, and coniferous forest; loose, fine soils with a high sand fraction, an abundance of native ants or other insects, and open areas with limited overstory for basking and low but relatively dense shrubs for refuge	Moderate
Uma notata notata	Colorado Desert fringe-toed lizard	--	SSC	BLM Sensitive	Group 1	Desert dunes, flats, riverbanks, and washes with loose sand and scant vegetation	Not expected due to lack of habitat.
Mammals							
Chaetodipus californicus femoralis	Dulzura California pocket mouse	--	SSC		Group 2	Chaparral, desert grassland.	Low
Corynorhinus townsendii pallescens	Townsend's big-eared bat	--	SSC	BLM Sensitive	Group 2	Caves, mines, buildings. Variety of habitats, arid to mesic. Individual or colonial. Sensitive to disturbance.	Not expected due to lack of habitat.
Eumops perotis californicus	Great western mastiff bat	--	SSC	BLM Sensitive	Group 2	Woodlands, rocky habitat, arid and semiarid lowlands, cliffs, crevices, buildings, tree hollows.	Low
Felis concolor	Mountain lion	--	CFP		Group 2	Many habitats, wherever deer are found.	Low
Lasiurus blossevillii	Western red bat	--	SSC		Group 2	Forests and woodlands from sea level up through mixed conifer woodlands. Not found in desert areas.	Not expected due to lack of habitat.
Myotis ciliolabrum	Small-footed myotis	--		BLM Sensitive	Group 2	Arid wooded and brushy uplands near water.	Low
Nyctinomops macrotis	Big free-tailed bat	--	SSC		Group 2	Prefers rugged rocky canyons. Buildings, caves, holes in trees.	Not expected due to lack of habitat.

Scientific Name	Common Name	Federal Status	State Status	BLM	County of San Diego	Habitat	Potential to Occur On-site
Ovis canadensis cremnobates	peninsular bighorn sheep	E	T		Group 1	Dry, rocky, low-elevation desert slopes	Low, per discussions with USFWS.
Onychomys torridus ramona	southern grasshopper mouse	--	SSC		Group 2	Alkali desert scrub and desert scrub preferred; also succulent scrub, wash, and riparian areas; coastal sage scrub, mixed chaparral, sagebrush, low sage, and bitterbrush; low to moderate shrub cover preferred	Moderate
Neotoma lepida intermedia	San Diego desert woodrat	--	SSC		Group 2	Coastal sage scrub, chaparral, most desert habitats	Moderate; no woodrat middens documented on-site
Perognathus longimembris internationalis	Jacumba little pocket mouse	--	SSC		Group 2	Desert scrub and grasslands on loosely packed or sandy soils with sparse to moderately dense vegetation.	Low
Lepus californicus bennettii	San Diego black-tailed jackrabbit	--	SSC		Group 2	Semi-open scrub habitats throughout southern California	High
Taxidea taxus	American badger	--	SSC		Group 2	Grasslands, Sonoran Desert scrub	Moderate
Macrotus californicus	California leaf-nosed bat	--	SSC	BLM Sensitive	Group 2	Low deserts, caves, mines, buildings.	Moderate foraging, no roosting
Antrozous pallidus	Pallid bat	--	SSC	BLM Sensitive	Group 2	Arid deserts and grasslands; shallow caves, crevices, rock outcrops, buildings, tree cavities, esp. near water	Moderate foraging, no roosting
Euderma maculatum	Spotted bat	--	SSC	BLM Sensitive	Group 2	Wide variety of habitats: caves crevices, trees; prefers sites with adequate roosting sites	Low
Corynorhinus townsendii pallescens	Pale big-eared bat	--	SSC	BLM Sensitive	Group 2	Caves, mines, buildings; variety of habitats, arid and mesic	Low
Nyctinomops femorosaccus	Pocketed free-tailed bat	--	SSC		Group 2	Crevices in rocks, slopes, cliffs; lower elevations	Moderate foraging, no roosting
Chaetodipus fallax pallidus	pallid San Diego pocket mouse	--	SSC		Group 2	Chaparral, open, sandy areas	Low

Scientific Name	Common Name	Federal Status	State Status	BLM	County of San Diego	Habitat	Potential to Occur On-site
Invertebrates							
Euphydryas editha quino	Quino checkerspot butterfly	E	--		Group 1	Coastal sage scrub	Low

Status Codes:

State/Federal Status

BEGEPA = protected under the federal Bald Eagle and Golden Eagle Protection Act.
BLM Sensitive = species that may require federal T/E listing, or with small and widely dispersed populations, or inhabiting ecological refugia or unique habitats.
CFP = California Fully Protected species.
D = Delisted.
E = Endangered.
SSC = California Species of Special Concern.
T = Threatened.

County of San Diego Status

Group I = animal species that are listed as threatened or endangered or have very specific natural history requirements that must be met.
Group II = animal species that are becoming less common, but are not yet so rare that extirpation or extinction is imminent without immediate action.

APPENDIX C

SENSITIVE PLANT SPECIES POTENTIALLY OCCURRING WITHIN THE PROPOSED PROJECT SITE

APPENDIX C

SENSITIVE PLANT SPECIES POTENTIALLY OCCURRING WITHIN THE PROPOSED PROJECT SITE

Scientific Name Common Name	State/ Federal Status	CNPS List	County of San Diego	Habitat/Blooming Period	Comments
Astragalus douglasii var. *perstrictus* Jacumba milk-vetch	–/–	1B	Group A	Chaparral, cismontane woodland, valley and foothill grassland/rocky; blooms Apr-May.	Not expected to occur, as there is a lack of suitable habitat on-site.
Astragalus magdalenae var. *peirsonii* Peirson's milk-vetch	SE/FT	1B	Group A	Perennial herb; desert dunes; blooms Dec-Apr; elevation 180-820 ft.	Not expected to occur as project site is well out of species known elevation range.
Ayenia compacta Ayenia	–/–	4	Group B	Mojave desert scrub, Sonoran desert scrub/rocky.	Not observed. Not expected to occur, as habitat is not appropriate.
Berberis fremontii Fremont barberry	--/--	3	Group C	Chaparral, Joshua tree woodland, piñon and juniper woodland/rocky; blooms Apr-June.	Not observed. Not expected to occur, as this species would have been detected during survey. Furthermore, there is a lack of suitable habitat on-site.
Bursera microphylla Elephant tree	--/--	2	Group B	Deciduous tree; Sonoran Desert scrub (rocky); blooms June-July, elevation 656-2,296 feet.	Not observed. Not expected to occur, as this species would have been detected during the survey.
Calliandra eriophylla Fairyduster	--/--	2	Group B	Sonoran Desert scrub (sandy or rocky); blooms Mar-Apr.	Not observed. Not expected to occur, habitat is inappropriate.
Caulanthus simulans Payson's jewelflower	--/--	4.2	Group D	Annual herb; chaparral, coastal scrub on sandy, granitic substrate; blooms (Feb) Mar-May (June); elevation 295-7,282 ft.	Low to moderate potential to occur based on habitat preference; CNDDB search did not show known occurrences within the vicinity of the project.
Chamaesyce platysperma Flat-seeded spurge	--/--	1B	Group A	Sonoran Desert (Coachella Valley) on sandy soils; blooms in May.	Low potential to occur. There is a known occurrence in Coachella valley, approximately 23 miles away from the project site directly. Widespread in southwest Arizona.
Croton wigginsii Wiggin's croton	--/--	2	n.a.	Sand dunes; blooms Mar-May.	Not observed. Not expected to occur, as habitat is not present on-site.

Scientific Name Common Name	State/ Federal Status	CNPS List	County of San Diego	Habitat/Blooming Period	Comments
Cynanchum utahense Utah vine milkweed	--/--	4.2	Group D	Perennial herb; Mojavean desert scrub, Sonoran desert scrub on sandy or gravelly substrate; blooms Apr-June, elevation 492-4,707 ft.	Low potential to occur based on habitat preferences; CNDDB search did not show known occurrences within the vicinity of the project.
Deinandra floribunda Tecate tarplant	--/--	1B	Group A	Chaparral, coastal scrub; blooms Aug-Oct.	Not expected to occur on-site due to lack of suitable habitat.
Delphinium parishii ssp. *subglobosum* Colorado Desert larkspur	--/--	4.3	Group D	Perennial herb; Chaparral, cismontane woodland, pinyon and juniper woodland, Sonoran desert scrub; blooms Mar-June; elevation 1,968-5,904 ft.	Low potential to occur based on habitat preferences; CNDDB search did not show known occurrences within the vicinity of the project.
Dieteria asteroids var. *lagunensis* Mount Laguna aster	–/–	2	n.a.	Cismontane woodland, lower montane coniferous forest; blooms Aug-Oct.	Not expected to occur on-site due to lack of suitable habitat.
Eryngium aristulatum ssp. *parishii* San Diego button-celery	SE/FE	1B	Group A	Annual/perennial herb; coastal scrub, valley and foothill grassland, vernal pools/mesic; blooms Apr-June; elevation 66-2,034 ft.	Low potential. Not observed on-site.
Eucnide rupestris (=*Hemizonia conjugens*) Rock nettle	--/--	2	Group B	Sonoran Desert scrub; blooms Dec-Apr.	Not observed. Not expected to occur, as this habitat is marginal and would have been detected.
Geraea viscida Sticky geraea	–/–	2	Group B	Chaparral (often in disturbed areas); blooms May-June.	Not observed. Not expected to occur due to lack of suitable habitat
Harpagonella palmeri Palmer's grappling hook	--/--	4.2	Group D	Annual herb; Chaparral, coastal scrub, valley and foothill grassland on clay substrates; blooms Mar-May; elevation 65-3,132 ft.	Low potential to occur based on habitat preferences; CNDDB search did not show known occurrences within the vicinity of the project.
Helianthus niveus Variegated dudleya	--/E	1B	n.a.	Open sandy places; blooms Sept-May.	Not observed. Not expected to occur, as this species would have been detected during survey.
Herissantia crispa Curly herissantia	--/--	2	Group B	Annual/perennial herb; Sonoran Desert scrub; blooms Apr (uncommon)/Aug-Sept; elevation 2,296-2,378 ft.	Low potential to occur. Suitable habitat does not occur on-site. The project site is out of the species' known elevation range.
Heuchera brevistaminea Laguna Mountains alumroot	--/--	1B	Group A	Riparian, chaparral, foothill woodland, mixed evergreen forest; blooms Apr-Jul/Sept. (uncommon).	Low potential. Not observed.

Scientific Name Common Name	State/ Federal Status	CNPS List	County of San Diego	Habitat/Blooming Period	Comments
Hulsea californica San Diego sunflower	–/–	1B	Group A	Openings in yellow pine forest; blooms Apr-Jun.	Not observed. Not expected to occur due to lack of suitable habitat
Hulsea mexicana Mexican hulsea	--/--	2.3	Group B	Annual/perennial herb; chaparral (volcanic, often on burns or disturbed areas); blooms Apr-June; elevation 3,936 ft.	Low potential to occur based on habitat preferences; CNDDB search did not show known occurrences within the vicinity of the project.
Ipomopsis tenuifolia Slender-leaved ipomopsis	--/--	2	Group B	Chaparral, piñon and juniper woodland, Sonoran Desert scrub/gravelly or rocky soils; blooms Mar-May.	Low potential. Habitat is marginal.
Linanthus bellus Desert beauty	--/--	2	Group B	Chaparral (sandy); blooms Apr-May.	Not observed. Not expected to occur, as habitat is not present.
Lotus haydonii Pygmy lotus	--/--	1B	Group A	Piñon and juniper woodland, Sonoran Desert scrub (rocky); blooms Mar-Jun.	Not observed. Not expected to occur, as this species would have been detected during surveys.
Lupinus excubitus var. *medius* Mountain Springs bush lupine	–/–	1B	Group A	Piñon and juniper woodland, Sonoran Desert scrub; blooms Mar-Apr.	Not observed. Habitat is not present for this species.
Mentzelia hirsutissima Hairy stickleaf	--/--	2	Group B	Annual herb; Sonoran Desert scrub (rocky); blooms Apr-May; elevation 0-2,296 ft.	Not observed. Habitat is not present for this species.
Mentzelia tridentata Creamy blazing star	–/–	1B	n.a.	Mojave Desert scrub/rocky, gravelly, sandy; blooms Apr-May.	Low potential to occur. Marginally suitable habitat does occur on-site.
Mimulus aridus low bush monkeyflower	--/--	4.3	Group D	Evergreen shrub; chaparral; blooms Apr-July; elevation 2,460-3,608 ft.	Not expected. Habitat is not present for this species. ; CNDDB search did not show known occurrences within the vicinity of the project.
Nemacaulis denudata var. *gracilis* Slender woolly-heads	--/--	2	Group B	Dunes; coastal strand, creosote bush scrub; blooms Mar-May.	Not expected. Habitat is not present for this species.
Opuntia munzii Munz’s cholla	--/--	1B	Group A	Stem succulent; Sonoran Desert, flats, hills, sandy to rocky soils; blooms in May; elevation 492-1,968 ft.	Not observed. Habitat is not present for this species. Would have been observed on-site.
Penstemon thurberi Thurber's beardtongue	--/--	4.2	Group D	Perennial herb; chaparral, Joshua tree woodland, pinyon and juniper woodland, Sonoran desert scrub; blooms May-July; elevation 3,936-4,002 ft.	Low potential to occur based on habitat preferences; CNDDB search did not show known occurrences within the vicinity of the project.

Scientific Name Common Name	State/ Federal Status	CNPS List	County of San Diego	Habitat/Blooming Period	Comments
Rhus trilobata var. *simplicifolia* Single-leaved skunk bush	--/--	2.3	Group B	Deciduous shrub; pinyon and juniper woodland; blooms Mar-Apr; elevation 4,002-4,494 ft.	Not expected to occur. Would have been detected on-site if present. Also out of elevation range.
Selaginella eremophila Desert spikemoss	--/--	1B	Group B	Rhizomatous herb; Sonoran Desert scrub (gravelly or rocky); blooms June/May and July (uncommon); elevation 656-2,952 ft.	Low potential to occur. However, the project site is out of the species' known elevation range.
Senecio aphanactis Chaparral ragwort	--/--	2.2	Group B	Annual herb; chaparral, cismontane woodland; coastal scrub/sometimes alkaline: blooms Jan-Apr; elevation 49-2,624 ft.	Not expected to occur. Marginal habitat on-site, project is slightly out of the species' known elevation range.
Senna covesii Cove's cassia	--/--	2.2	Group B	Perennial herb; Sonoran desert scrub; blooms Mar-June; elevation 1,000-3,510 ft.	Low potential to occur based on habitat preference; CNDDB search did not show known occurrences within the vicinity of the project.
Tetrococcus dioicus Parry's tetracoccus	--/--	1B	Group A	Chaparral, coastal scrub; blooms Apr-May.	Not observed. Not expected to occur due to lack of suitable habitat
Texosporium sancti-jacobi woven-spored lichen	ST/--	n.a.	n.a.	Lichen; organic matter and organic soil in sagebrush, old fenceposts, or other wood	Low to moderate potential.

STATUS CODES

State/Federal Status
FE = federally listed endangered
FT = Federally listed threatened
SE = State listed endangered
ST = State listed threatened
SR = State listed rare

County of San Diego Status
Group A = Plants rare, threatened, or endangered in California and elsewhere.
Group B = Plants rare, threatened, or endangered in California but more common elsewhere.
Group C = Plants which may be quite rare, but need more information to determine true rarity status.
Group D = Plants limited in distribution and uncommon but not presently rare or endangered.

California Native Plant Society Status
1A = Species presumed extinct.
1B = Species rare, threatened, or endangered in California and elsewhere. These species are eligible for state listing.
2 = Species rare, threatened, or endangered in California but more common elsewhere. These species are eligible for state listing.
3 = Species for which more information is needed. Distribution, endangerment, and/or taxonomic information is needed.
4 = A watch list of species of limited distribution. These species need to be monitored for changes in the status of their populations.

APPENDIX D

PRELIMINARY JURISDICTIONAL DETERMINATION/DATA FORMS AND PHOTOS

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: ESJ Well Site   City/County: Jacumba/San Diego   Sampling Date: 1/26/11

Applicant/Owner: Sempra Energy   State: CA   Sampling Point: 1

Investigator(s): VCN   Section, Township, Range: T18S, R8E

Landform (hillslope, terrace, etc.): Bowl   Local relief (concave, convex, none): bowl   Slope (%): 2

Subregion (LRR):   Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes ( ) No ( )

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes ( )	No (●)	
Hydric Soil Present?	Yes ( )	No (●)	Is the Sampled Area
Wetland Hydrology Present?	Yes ( )	No (●)	within a Wetland? Yes ( ) No (●)

Remarks: Soil pit is located within the alignment for the access road

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix sp,*	40	Yes	FACW
2. *Populus fremontii*	60	Yes	FAC*
3.			
4.			
Total Cover:	100%		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Avena sp.*	80	Yes	Not Listed
2. *Bromus rubens*	20	Yes	UPL
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	100%		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ %   % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	4	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	50.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species	40	x 2 =	80
FAC species	60	x 3 =	180
FACU species		x 4 =	0
UPL species	100	x 5 =	500
Column Totals:	200	(A)	760 (B)

Prevalence Index = B/A = 3.80

Hydrophytic Vegetation Indicators:

- Dominance Test is >50%
- Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☐ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ( ) No (●)

Remarks: The habitat onsite is southern cotton wood willow riparian forest.

SOIL

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-18	10YR 2/2						Coarse	Sandy mixture

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ○ **No** ◉

Remarks: The soil is coarse and has a sandy like feel to it.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):

Water Table Present? Yes ○ No ◉ Depth (inches):

Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? **Yes** ○ **No** ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: This sampling point is beneath the cottonwoods, this area appears to be the beginning of the flow area. Water would runoff from the surrounding uplands into this area and flow to the east.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: ESJ Well Site   City/County: Jacumba/San Diego   Sampling Date: 1/26/11

Applicant/Owner: Sempra Energy   State: CA   Sampling Point: 2

Investigator(s): VCN   Section, Township, Range: T18S, R8E

Landform (hillslope, terrace, etc.): sloped   Local relief (concave, convex, none): sloped   Slope (%): 2

Subregion (LRR):   Lat: Long: Datum:

Soil Map Unit Name: NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes (X) No ( ) (If no, explain in Remarks.)

Are Vegetation [ ] Soil [ ] or Hydrology [ ] significantly disturbed? Are "Normal Circumstances" present? Yes (X) No ( )

Are Vegetation [ ] Soil [ ] or Hydrology [ ] naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

	Yes	No
Hydrophytic Vegetation Present?	(X)	( )
Hydric Soil Present?	( )	(X)
Wetland Hydrology Present?	( )	(X)

Is the Sampled Area within a Wetland? Yes ( ) No (X)

Remarks: Sampling point is located jus north east of the existing pump house.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. *Salix sp,*	10	Yes	FACW
2. *Populus fremontii*	1	No	FAC*
3. *Bacchris salicifolia*	15	Yes	FACW
4.			
Total Cover:	26 %		
Sapling/Shrub Stratum			
1.			
2.			
3.			
4.			
5.			
Total Cover:	%		
Herb Stratum			
1. *Sisymbrium irio*	25	Yes	Not Listed
2. *Oxalis latifolia*	15	No	Not Listed
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	40 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ %   % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	2	(A)
Total Number of Dominant Species Across All Strata:	3	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	66.7 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species	25	x 2 =	50
FAC species	1	x 3 =	3
FACU species		x 4 =	0
UPL species	40	x 5 =	200
Column Totals:	66 (A)		253 (B)

Prevalence Index = B/A = 3.83

Hydrophytic Vegetation Indicators:

- [X] Dominance Test is >50%
- [ ] Prevalence Index is ≤3.0[1]
- [ ] Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- [ ] Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes (X) No ( )

Remarks: The habitat onsite is southern cotton wood willow riparian forest. Though this sampling point is located just outside the tree line.

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture[3]	Remarks
0-8	10YR 2/2						Coarse	Large pieces
8-10	7.5 4/6						Coarse	DG like feel
10-20	10YR 2/2						Coarse	Sand like feel

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):
Type:
Depth (inches):

Hydric Soil Present? Yes ○ No ◉

Remarks: The soil here appears to be layered. Coarse sand like soil.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☐ Surface Water (A1)
- ☐ High Water Table (A2)
- ☐ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ○ No ◉ Depth (inches):
Water Table Present? Yes ○ No ◉ Depth (inches):
Saturation Present? (includes capillary fringe) Yes ○ No ◉ Depth (inches):

Wetland Hydrology Present? Yes ○ No ◉

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: This sampling point is adjacent to the existing pump house adjacent to to the willow riparian habitat. Appears that water would flow to the east.

WETLAND DETERMINATION DATA FORM - Arid West Region

Project/Site: ESJ Well Site | City/County: Jacumba/San Diego | Sampling Date: 1/26/11

Applicant/Owner: Sempra Energy | State: CA | Sampling Point: 3

Investigator(s): VCN | Section, Township, Range: T18S, R8E

Landform (hillslope, terrace, etc.): Flat | Local relief (concave, convex, none): Flat | Slope (%): 1

Subregion (LRR): | Lat: | Long: | Datum:

Soil Map Unit Name: | NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes (●) No ( ) (If no, explain in Remarks.)

Are Vegetation ☐ Soil ☐ or Hydrology ☐ significantly disturbed? Are "Normal Circumstances" present? Yes (●) No ( )

Are Vegetation ☐ Soil ☐ or Hydrology ☐ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS - Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes (●)	No ( )
Hydric Soil Present?	Yes (●)	No ( )
Wetland Hydrology Present?	Yes (●)	No ( )

Is the Sampled Area within a Wetland? Yes (●) No ( )

Remarks: Sampling point is located just to the east of the site within the channel. Appears to be a weland.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
Total Cover:	%		
Sapling/Shrub Stratum			
1. *Artemisia dracunculus*	80	Yes	Not Listed
2.			
3.			
4.			
5.			
Total Cover:	80 %		
Herb Stratum			
1. *Sisymbrium irio*	20	No	Not Listed
2. *Avena sp.*	60	Yes	Not Listed
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	80 %		
Woody Vine Stratum			
1.			
2.			
Total Cover:	%		

% Bare Ground in Herb Stratum ____ % | % Cover of Biotic Crust ____ %

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC:	0	(A)
Total Number of Dominant Species Across All Strata:	2	(B)
Percent of Dominant Species That Are OBL, FACW, or FAC:	0.0 %	(A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	0
FACW species		x 2 =	0
FAC species		x 3 =	0
FACU species		x 4 =	0
UPL species	160	x 5 =	800
Column Totals:	160	(A)	800 (B)

Prevalence Index = B/A = 5.00

Hydrophytic Vegetation Indicators:

- ☐ Dominance Test is >50%
- ☐ Prevalence Index is ≤3.0[1]
- ☐ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ☒ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes (●) No ( )

Remarks: The habitat onsite is southern cotton wood willow riparian forest. Though this sampling point is located just outside the tree line. The dominant species appears to be tarragon though it likely that other wetland species exist onsite.

SOIL

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox Features %	Type[1]	Loc[2]	Texture[3]	Remarks
0-20	10YR 2/1						Coarse	Sandy feel

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.
[3]Soil Textures: Clay, Silty Clay, Sandy Clay, Loam, Sandy Clay Loam, Sandy Loam, Clay Loam, Silty Clay Loam, Silt Loam, Silt, Loamy Sand, Sand.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ☐ Histosol (A1)
- ☐ Histic Epipedon (A2)
- ☐ Black Histic (A3)
- ☐ Hydrogen Sulfide (A4)
- ☐ Stratified Layers (A5) (**LRR C**)
- ☐ 1 cm Muck (A9) (**LRR D**)
- ☐ Depleted Below Dark Surface (A11)
- ☐ Thick Dark Surface (A12)
- ☐ Sandy Mucky Mineral (S1)
- ☐ Sandy Gleyed Matrix (S4)
- ☐ Sandy Redox (S5)
- ☐ Stripped Matrix (S6)
- ☐ Loamy Mucky Mineral (F1)
- ☐ Loamy Gleyed Matrix (F2)
- ☐ Depleted Matrix (F3)
- ☐ Redox Dark Surface (F6)
- ☐ Depleted Dark Surface (F7)
- ☐ Redox Depressions (F8)
- ☐ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[4]:

- ☐ 1 cm Muck (A9) (**LRR C**)
- ☐ 2 cm Muck (A10) (**LRR B**)
- ☐ Reduced Vertic (F18)
- ☐ Red Parent Material (TF2)
- ☐ Other (Explain in Remarks)

[4]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type:

Depth (inches):

Hydric Soil Present? **Yes** ◉ **No** ○

Remarks: The soil here appears to be low chroma.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- ☒ Surface Water (A1)
- ☒ High Water Table (A2)
- ☒ Saturation (A3)
- ☐ Water Marks (B1) (**Nonriverine**)
- ☐ Sediment Deposits (B2) (**Nonriverine**)
- ☐ Drift Deposits (B3) (**Nonriverine**)
- ☐ Surface Soil Cracks (B6)
- ☐ Inundation Visible on Aerial Imagery (B7)
- ☐ Water-Stained Leaves (B9)
- ☐ Salt Crust (B11)
- ☐ Biotic Crust (B12)
- ☐ Aquatic Invertebrates (B13)
- ☐ Hydrogen Sulfide Odor (C1)
- ☐ Oxidized Rhizospheres along Living Roots (C3)
- ☐ Presence of Reduced Iron (C4)
- ☐ Recent Iron Reduction in Plowed Soils (C6)
- ☐ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ☐ Water Marks (B1) (**Riverine**)
- ☐ Sediment Deposits (B2) (**Riverine**)
- ☐ Drift Deposits (B3) (**Riverine**)
- ☒ Drainage Patterns (B10)
- ☐ Dry-Season Water Table (C2)
- ☐ Thin Muck Surface (C7)
- ☐ Crayfish Burrows (C8)
- ☐ Saturation Visible on Aerial Imagery (C9)
- ☐ Shallow Aquitard (D3)
- ☐ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present?	Yes ◉	No ○	Depth (inches): 0
Water Table Present?	Yes ◉	No ○	Depth (inches): 18
Saturation Present? (includes capillary fringe)	Yes ◉	No ○	Depth (inches): 0

Wetland Hydrology Present? **Yes** ◉ **No** ○

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks: This sampling point is adjacent to the east of the site. This point is located within the flat area that seems to flow to the east from the well pump house area. This area was saturated at the surface, and the pit filled with water.

PRELIMINARY JURISDICTIONAL DETERMINATION FORM
U.S. Army Corps of Engineers
Sempra Energy Well Access
Jacumba, California

This form should be completed by following the instructions provided in Section IV of the JD Form Instructional Guidebook.

SECTION I: BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): January 31, 2011

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:

Sempra Energy
101 Ash Street
San Diego, California 92101
Phone: (619)
Point of Contact: Alberto Abreu

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Los Angeles District Regulatory Division, Los Angeles Section, South Coast Branch, San Diego Section

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
Sempra energy would like to construct an approximately 150 foot by 20 foot wide access driveway to access an existing well north of Old Highway 80 just west of the town of Jacumba. A portion of the survey area has been mapped as a fresh water emergent wetland by the USFWS National Wetlands Inventory.

(Use the attached table to document multiple waterbodies at different sites)
State: CA County/parish/borough: San Diego City: N/A (Jacumba)
Center coordinates of site (lat/long in degree decimal format): Lat: 32.616015 Long: -116.192995
UTM: 11S 575735.97 m E 3609017.27 m N
Name of nearest waterbody: Boundary Creek
Identify (estimate) amount of waters in the review area:
Non-wetland waters:
Cowardin Class:
Stream Flow:
Wetlands: 0.13 acre
Cowardin Class: Palustrine
Name of any waterbodies on the site that have been identified as Section 10 waters: None
Tidal:
Non-Tidal:

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):
☐ Office (Desk) Determination. Date:
☒ Field Determination. Date(s): January 26,2011

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide

an approved JD to accomplish that result, as soon as is practicable. This preliminary JD finds that there "may be" waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

A. SUPPORTING DATA. Data reviewed for JD (check all that apply - checked items shall be included in case file and, where checked
and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: See Biological Letter Report
☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant. (2008 Supplement Wetland Determination Data Forms — Arid West Region [Version 2.0]).
  ☐ Office concurs with data sheets/delineation report.
  ☐ Office does not concur with data sheets/delineation report.
☐ Data sheets prepared by the Corps: .
☐ Corps navigable waters' study: .
☐ U.S. Geological Survey Hydrologic Atlas: .
  ☐ USGS NHD data.
  ☐ USGS 8 and 12 digit HUC maps.
  ☒ U.S. Geological Survey map(s). Cite scale & quad name: 7.5' U.S. Geologic Service (USGS) Jacumba

☐ USDA Natural Resources Conservation Service Soil Survey. Citation: Web Soil Survey.
☒ National wetlands inventory map(s). Cite name: NWI Website.
☐ State/Local wetland inventory map(s): .
☐ FEMA/FIRM maps:
☐ 100-year Floodplain Elevation is: (National Geodetic Vertical Datum of 1929)
☐ Photographs: ☒ Aerial (Name & Date): 2010 Aerial Maps of the survey area (Digital Globe 2010)

☐ Other (Name & Date):.
☐ Previous determination(s). File no. and date of response letter: .
☐ Other information (please specify):

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

Signature and date of Regulatory Project Manager (REQUIRED)	Signature and date of person requesting preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

Appendix A – Sites

District Office: **Los Angeles District** File/ORM # PJD Date: January 31, 2000
State: **CA** City/County: **San Diego County**

Person Requesting PJD: Alberto Abreu

Holland Code	Cowardin Class	Class	Area (acres)	Latitude	Longitude
Southern cottonwood riparian forest 61330	Palustrine	Fresh water emergent Wetland	0.13	32.616015	-116.192995

Note: All acreages are rounded to the nearest hundredth (which may account for minor rounding error).

Sample pit one.

Sample pit two.

Sample pit two and surrounding habitat.

Sample pit three.

Habitat around pit one.

Adjacent Habitats.

Source: Sempra 2010; SANGIS 2010; AerialsExpress 2009; ESRI 2011; NWI 2010

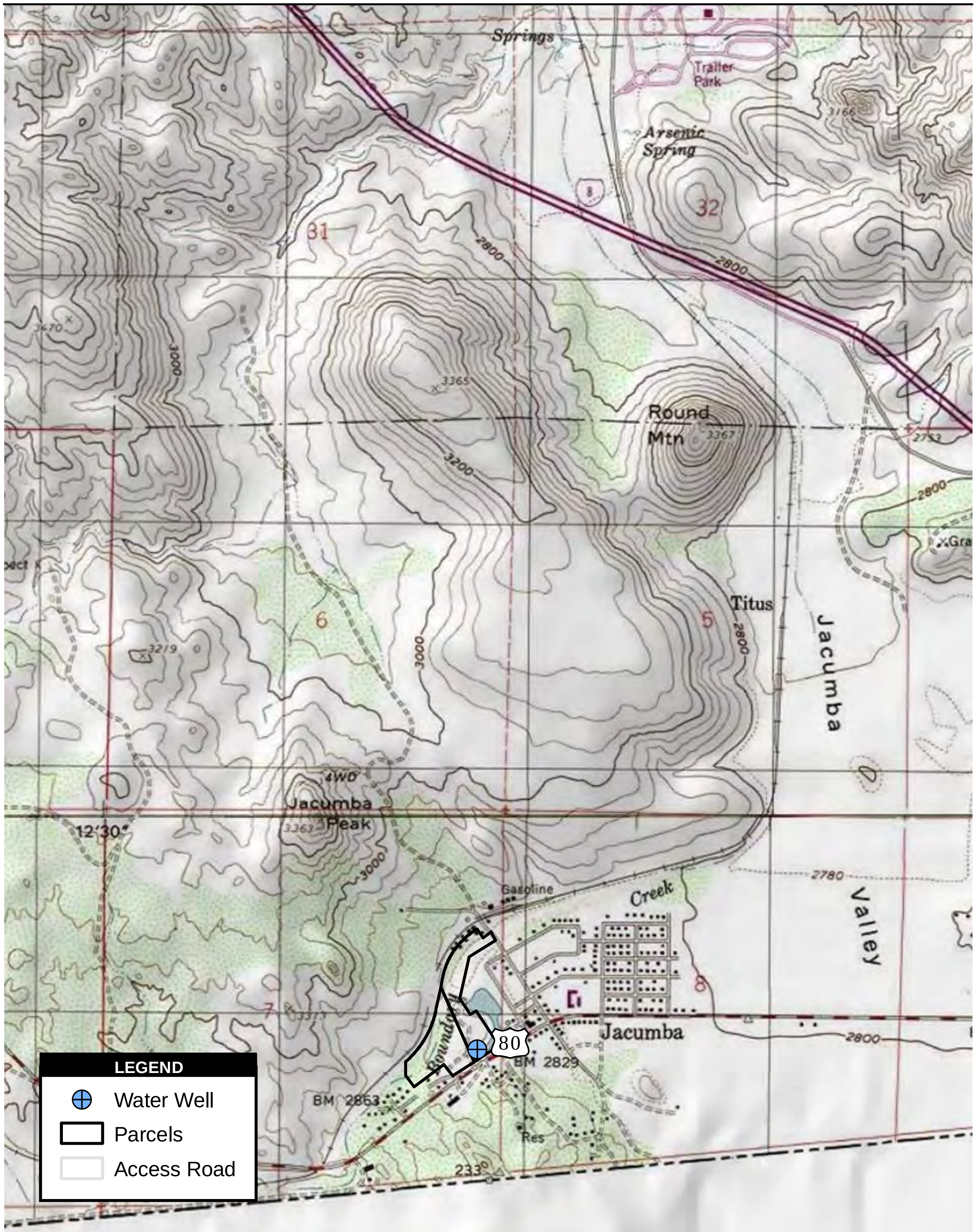
200 100 0 200 Feet

Scale: 1 = 2,400; 1 inch = 200 feet

National Wetlands Inventory Map

ESJ Well Driveway Project Number 09-0107420

Path: P:\2009\09080001 ESJ Gen-Tie\6.0 GIS\6.3 Layout\Bio\Well_Bio\Aerial_attachment.mxd, 02/02/11, SorensenJ



Source: Sempra 2010; SANGIS 2010; ESRI 2011; USGS 7.5' Topo Quad Jacumba, CA 1975

2,000 1,000 0 2,000 Feet

Scale: 1 = 24,000; 1 inch = 2,000 feet

U.S. Geological Survey Map
USGS 7.5' Jacumba, CA 1975

ESJ Well Driveway Project Number 09-0107420

Path: P:\2009\09080001 ESJ Gen-Tie\6.0 GIS\6.3 Layout\Bio\Well_Bio\Aerial_attachment.mxd, 02/02/11, SorensenJ

Source: Sempra 2010; SANGIS 2010; AerialsExpress 2009; ESRI 2011

200 100 0 200 Feet

Scale: 1 = 2,400; 1 inch = 200 feet

2009 Aerial Map of the Survey Area (Aerials Express 2009)

ESJ Well Driveway Project Number 09-0107420

Path: P:\2009\09080001 ESJ Gen-Tie\6.0 GIS\6.3 Layout\Bio\Well_Bio\Aerial_attachment.mxd, 02/02/11, SorensenJ

Comment Letter B9

From: Cindy Eldred <cindy@eldredlaw.com>
Sent: Friday, March 04, 2011 4:04 PM
To: iain.fisher@cpuc.ca.gov; ECOSUB
Cc: 'Brown, Patrick'; Ryan.Waterman@lw.com; 'Miller, Taylor'; 'Abreu, Alberto'
Subject: DOI-BLM-CA-D070-2010-0027-EIS (ECO Sub)/DOI-BLM-CA-D070-2008-0040-EIS (Tule Wind)
Attachments: DEIR-DEIS Comment Letter (030411).pdf

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Telephone: 619.233.7366
Facsimile: 619.233.7390

March 4, 2011

Iain Fisher, CPUC at iain.fisher@cpuc.ca.gov
Greg Thomsen, BLM at ecosub@dudek.com
c/o Dudek
605 Third Street
Encinitas, CA 92024

Re: DOI-BLM-CA-D070-2010-0027-EIS (ECO Sub)
DOI-BLM-CA-D070-2008-0040-EIS (Tule Wind)
Comments on Joint DEIR/DEIS dated December 24, 2010

Dear Mssrs. Fisher and Thomsen:

We represent the San Diego Rural Fire Protection District ("District") in its review of the Joint DEIR/DEIS listed above (the "DEIR/DEIS"). This letter supplements our letter dated January 4, 2011 (the "Letter") to you regarding the analyses of impacts and adequacy of mitigation provided in Section D.15 Fire and Fuels Management of the DEIR/DEIS as those analyses and mitigation measures relate to the Tule Wind Project and the ESJ Gen-Tie Project. The comments in our Letter remain unaltered as they relate to the ECO Substation Project. The District appreciates the opportunity to further comment upon the DEIR/DEIS. B9-1

The DEIR/DEIS identifies the potential for all three projects to significantly increase the probability of wildfires. Mitigation Measures FF-1, FF-2, FF-3, and FF-4 are provided in the DEIR/DEIS with the intent to mitigate the increased probability of wildfires. B9-2

The District has worked with the applicant for the Tule Wind Project to modify Mitigation Measures FF-1 and FF-2 to address the concerns expressed in our Letter. A strikeout-underline of DEIR/DEIS Mitigation Measures FF-1 through FF-7 is included in this letter as Exhibit "A". Exhibit "A" also contains mitigation measures provided in the Fire Protection Plan for the Tule Wind Project that are in addition to the mitigation measures provided in the DEIR/DEIS. The Modified Mitigation Measures FF-1 through FF-7 and the additional mitigation measures provided in the Fire Protection Plan for the Tule Wind Project are sometimes referred to collectively in this letter as the "Modified Mitigation Measures".

The applicants for each of the Tule Wind Project and the ESJ Gen-Tie Project have entered into development agreements with the District that, among other things, satisfy the requirements of Mitigation Measure FF-3. In addition, each of these two applicants has obtained the District's approval of project-specific Fire Protection Plans that, among other things, satisfy the requirements of Mitigation Measure FF-4.

The District concludes that the respective applicants for the Tule Wind Project and the ESJ Gen-Tie Project will have adequately mitigated the increased probability of wildfire through timely satisfaction of each and every requirement of the Modified Mitigation Measures, the applicants' respective development agreements, and the respective, project-specific Fire Protection Plans. Further, the District concludes that through satisfaction of each and every requirement of the Modified Mitigation Measures, implementation of the project design features described in the DEIR/DEIS where applicable, and satisfaction of each and every requirement of the respective development agreements and respective, project-specific Fire Protection Plans, the Tule Wind Project and the ESJ Gen-Tie Project will not significantly obstruct fire protection activities and that the applicants for these two projects have adequately addressed the additional fire risks posed by their respective projects. B9-2 Cont.

Very truly yours,

C Eldred

Cynthia L. Eldred, Esq.
THE LAW OFFICE OF CYNTHIA L. ELDRED

cc: (via electronic mail only)
San Diego Rural Fire Protection District
Patrick P. Brown, Project Planner, County of San Diego
Ryan Waterman, Esq., Counsel for Tule Wind, LLC
Taylor Miller, Esq., Counsel for Energia Sierra Juarez U.S. Transmission LLC
Alberto Abreu, Director - Project Development, Sempra Generation

MM	EDITED MM TEXT FROM DRAFT EIR/EIS
MM FF-1	**Develop and implement a Construction Fire Prevention/Protection Plan**. ~~Pacific Wind Development~~ The applicant shall develop a multiagency Construction Fire Prevention/Protection Plan for the Tule Wind Project and monitor construction activities to ensure implementation and effectiveness of the plan. Plan reviewers shall include the following: CAL FIRE, Rural Fire Protection District, and SDCFA. ~~Pacific Wind Development~~ The applicant shall provide a draft copy of this plan to each listed agency at least 90 days before the start of any construction activities. Comments on the plan shall be provided by ~~Pacific Wind Development~~ the applicant to all other participants, and ~~Pacific Wind Development~~ the applicant shall resolve each comment in consultation with and to the satisfaction of CAL FIRE, Rural Fire Protection District, and SDCFA. The final plan will be approved by the commenting agencies prior to the initiation of construction activities and provided to ~~Pacific Wind Development~~ the applicant for implementation during all construction activities. At minimum, the plan will include the following: • Procedures for minimizing potential ignition o vegetation clearing o fuel modification establishment o parking requirements o smoking restrictions o hot work restrictions • Red Flag Warning restrictions • Fire coordinator role and responsibility • Fire suppression equipment on site at all times work is occurring • Requirements of Title 14 of the CCR, Article 8 #918 "Fire Protection" for private land portions • Access Road widening (28-foot County roads, 18-foot-wide spur roads) • Applicable components of the SDG&E Wildland Fire Prevention and Fire Safety Electric Standard Practice (2009) • Emergency response and reporting procedures • Emergency contact information • Worker education materials; kick-off and tailgate meeting schedules • Other information as provided by CAL FIRE, Rural Fire Protection District, SDCFA, BLM, California State Land Commission (CSLC),and Tribal Governments

EXHIBIT "A"

B9-3

MM	EDITED MM TEXT FROM DRAFT EIR/EIS
	Additional restrictions will include the following: • During the construction phase of the project, ~~Pacific Wind Development~~ the applicant shall implement ongoing fire patrols. The applicant shall maintain fire patrols during construction hours and for one (1) hour after end of daily construction, and hotwork. ~~during the fire season as defined each year by local, state, and federal fire agencies. These dates vary from year to year, generally occurring from late spring through dry winter periods.~~ • Fire Suppression Resource Inventory – In addition to CCR Title 14, 918.1(a), (b), and (c), ~~Pacific Wind Development~~ the applicant shall update in writing the 24-hour contact information and on-site fire suppression equipment, tools, and personnel list on quarterly basis and provide it to the Rural Fire Protection District, SDCFA, and CAL FIRE • During Red Flag Warning events, as issued daily by the National Weather Service in SRAs and LRAs, and when the USFS PAL is Very High on CNF (as appropriate), all non-essential, non-emergency construction and maintenance activities shall cease or be required to operate under a Hot Work Procedure (see TULE-PDF-1). ~~Exception for transmission line testing: A transmission line may be tested, one time only, if the loss of another transmission facility could lead to system instability or cascading outages.~~ • ~~Utility~~ The applicant and contractor personnel shall be informed of changes to the Red Flag event status and PAL as stipulated by CAL FIRE and CNF. • All construction crews and inspectors shall be provided with radio and/or cellular telephone access that is operational ~~along the entire length of the approved route~~throughout the project area to allow for immediate reporting of fires. Communication pathways and equipment shall be tested and confirmed operational each day prior to initiating construction activities at each construction site. All fires shall be reported to the fire agencies with jurisdiction in the project area immediately upon ignition. • Each crew member shall be trained in fire prevention, initial attack firefighting, and fire reporting. Each member shall carry at all times a laminated card listing pertinent telephone numbers for reporting fires and defining immediate steps to take if a fire starts. Information on contact cards shall be updated and redistributed to all crew members as needed, and outdated cards destroyed, prior to the initiation of construction activities on the day the information change goes into effect. • Each member of the construction crew shall be trained and equipped to extinguish small fires with hand-held fire extinguishers in order to prevent them from growing into more serious threats. Each crew member shall at all times be within 100 yards of a vehicle containing equipment necessary for fire suppression as outlined in the final Construction Fire Prevention/Protection Plan. • Water storage tanks (TULE-PDF-7) shall be installed and operational at the time of start of construction, except where construction of new access roads is necessary to reach the SDRFPD's preferred location for the water tank, in which case the water tank will be installed along with access

B9-3 Cont.

MM	EDITED MM TEXT FROM DRAFT EIR/EIS
	road construction. ~~Pacific Wind Development~~ The applicant shall fully implement the plan during all construction and maintenance activities. All construction work on the ECO Substation Project, ESJ Project, and Tule Wind Project shall follow the Construction Fire Prevention/Protection Plan guidelines and commitments, and plan contents are to be incorporated into the standard construction contracting agreements for the construction of the Tule Wind Project. Primary plan enforcement implementation responsibility shall remain with ~~Pacific Wind Development~~ the applicant and monitored by CAL FIRE, Rural Fire Protection District, and SDCFA.
MM FF-2	**Revise Existing Wildland Fire Prevention and Fire Safety Electric Standard Practice Plan (2009) to Create the Wildland Fire Prevention and Fire Safety Electric Standard Practice Operation and Maintenance Plan**. Revised plan will address the ECO Substation Project, ESJ Project, and Tule Wind Project and will be implemented during all operation and maintenance work associated with the project for the life of the project. Important fire safety concepts that will be included in this document are as follows: • Focused Fire Protection Plan content applicable to the applicant's~~Tule Wind Project's~~ ongoing operation • Guidance on where maintenance activities may occur (non-vegetated areas, cleared access roads, and work pads that are approved as part of the project design plans) • Fuel modification buffers required by the FPP • When vegetation work will occur (prior to any other work activity) • Timing of vegetation clearance work to reduce likelihood of ignition and or fire spread • Coordination procedures with fire authority • Integration of the project's Construction Fire Prevention/Protection Plan content • Personnel training and fire suppression equipment. Prior to energizing the Tule Wind Project, Tule Wind, LLC will install a skid-mounted Type VI firefighting unit with at least 100 gallons water capacity and a pump rate of at least 30 gallons per minute into three (3) of its operations and maintenance pick-up trucks. In addition, also prior to energizing the Tule Wind Project, Tule Wind, LLC personnel will undergo training by San Diego Rural Fire Protection District personnel, or another entity certified to conduct such training, on the proper use of Type VI firefighting equipment to fight incipient fires. • Red Flag Warning restrictions for operation and maintenance work • Fire safety coordinator role as manager of fire prevention and protection procedures, coordinator with fire authority and educator

B9-3 Cont.

B9-4

MM	EDITED MM TEXT FROM DRAFT EIR/EIS	
	• Communication protocols • Incorporation of CAL FIRE, San Diego Rural Fire Protection District, and SDCFA reviewed and approved Response Plan mapping and assessment. • Other information as provided by CAL FIRE, San Diego Rural Fire Protection District, SDCFA, BLM, CSLC, Tribal Governments, and USFS. ~~Pacific Wind Development~~ The applicant will provide a draft copy of the Wildland Fire Prevention and Fire Safety Electric Standard Practice to the agencies listed previously for comment a minimum of 90 days prior to the start of any construction activities. The comments will be provided back to ~~Pacific Wind Development~~ the applicant and plan revisions will address each comment to the satisfaction of the commenting agency. The final plan will be approved by the commenting agencies prior to energizing the project and provided to ~~Pacific Wind Development~~ the applicant for implementation during all operation and maintenance activities.	B9-4 Cont.
MM FF-3	**Development Agreement with Rural Fire Protection District and San Diego County Fire Authority (SDCFA).** Provide funding for the training and acquisition of necessary firefighting equipment and services to Rural Fire Protection District/SDCFA to improve the response and firefighting effectiveness near wind turbines, electrical transmission lines, and aerial infrastructure based on fire protection needs and each agency's professional judgment. Although not implementable on BLM or other federal land, the local fire authority will respond through mutual aid to wildfires within its jurisdiction, regardless of land ownership designation. Funding would be provided through a Development Agreement between the applicant and the~~with~~ Rural Fire Protection District and SDCFA, which shall be executed prior to construction. ~~The Development Agreement would include, but not be limited to, the following items as agreed upon by Rural Fire Protection District, SDCFA, and the applicant:~~ ~~Funding toward purchase of a Type I (or other) fire engine equipped for potential project-related fires (i.e., foam capability).~~ ~~• Funding as required by standard Fire District fee schedule~~ • ~~Foam concentrate supply of 450 gallons, foam education equipment, and nozzles on mobile trailer.~~	B9-5

MM FF-4	**Customized Fire Protection Plan for Project.** A Fire Protection Plan to include, at minimum, the following:
	• San Diego County FPP Content Requirements (http://www.sdcounty.ca.gov/dplu/docs/Fire-Report-Format.pdf)
	• Rural Fire Protection District Content Requirements:
	    o Provisions for fire safety and prevention
	    o Water supply
		B9-6

MM	EDITED MM TEXT FROM DRAFT EIR/EIS	
	o Fire suppression/detection systems – built-in detection system with notification o Secondary containment o Site security and access o Emergency shut-down provisions o Fuel modification plan o Access road widths and surfacing o Emergency drill participation • Emergency evacuation plan. • Integration into Plans created to satisfy Mitigation Measures FF-1 and FF-2. The FPP will incorporate additional APMs described in Section B.4.4 of this EIR/EIS. The final FPP is to be approved by the commenting agencies prior to construction.	B9-6 Cont.
MM FF-5	**Wind Turbine Generator Fire Protection Systems.** Fire detection, warning, and suppression systems for each wind turbine generator will include ~~the latest~~modern technology and will address, at minimum, the following: • Use of non-combustible or difficult to ignite materials • Early fire detection and warning systems • ~~Frequent maintenance~~Maintenance according to manufacturer specifications • Auto switch-off and complete disconnection from the power supply system • Ongoing hazard/fire safety training for staff • Automatic fire extinguishing systems in the nacelle of each wind turbine (stationary, inert gas, or similar). ~~Pacific Wind Development~~ Tule Wind, LLC will implement this technology through the wind turbine manufacturer or an aftermarket supplier. • Non-combustible or high flash point lubricant oils.	B9-7
MM FF-6	**Funding for Fire Inspection~~FireSafe Council~~.** The applicants are to ~~P~~provide funding for ~~locally based~~ one (1) SDCFA Fire Code Specialist II position to enforce existing fire code requirements, including but not limited to implementing required fuel management requirements (e.g., defensible space), in priority areas to be identified by the SDCFA for the life of the project. In addition, the applicants are to provide funding to	B9-8

MM	EDITED MM TEXT FROM DRAFT EIR/EIS
	allow SDCFA to employ up to four (4) volunteer/reserve firefighters as part-time code inspectors on a stipend basis for up to 90 days per year for the life of the project. ~~FireSafe Council (e.g., Campo/Lake Moreno FireSafe Council) to prepare or implement a Community Wildfire Protection Plan.~~ The funding for the SDCFA Fire Code Specialist II position and the four (4) volunteer/reserve firefighters as part-time code inspectors will be provided through proportional contributions from each applicant to the SDCFA through their respective Development Agreements (see MM FF-3), which shall be executed prior to construction. ~~will be determined in conjunction with the local fire authority's input, the specified fuel reduction project priorities identified by the FireSafe Council and in consideration of the funding amount provided under Mitigation Measure FF-3.~~
MM FF-7	**Preparation of Disturbed Area Revegetation Plan.** All areas disturbed during construction activities that will not be continuously included in the long-term maintenance access ROW will be provided native plant restoration in order to prevent non-native, weedy plants from establishing. Disturbed areas that will be included in the long-term maintenance program will not be revegetated as any plants that establish in these areas will be removed on an ongoing (at least annual) basis. Mitigation Measure FF-7 directs that the temporary disturbance areas will be revegetated with native plants common to the area through direction detailed in a Habitat Restoration Plan. The Habitat Restoration Plan will be prepared to restore native habitat and to reduce the potential for non-native plant establishment. The restoration plan will incorporate a Noxious Weeds and Invasive Species Control Plan to assist in restoring the construction area to the prior vegetated state and lessen the possibility of establishment of non-native, flammable plant species. A copy of the Revegetation Plan will be provided to the BLM and San Diego County. In addition, prior to the termination of the ROW authorization, a decommissioning plan will be developed and approved by the BLM and other agencies having jurisdiction. The decommissioning plan will include a site reclamation plan and monitoring program. As the wind facility is removed from the site, topsoil from all decommissioning activities will be salvaged and reapplied during final reclamation. All areas of disturbed soil will be reclaimed to native habitat conditions found naturally in the area.

B9-8 Cont.

B9-9

ADDITIONAL MITIGATION MEASURES FROM SDRFPD-APPROVED FIRE PROTECTION PLAN (NOVEMBER 3, 2010) TO BE INCLUDED IN DRAFT EIR/EIS AS FIRE MITIGATION PACKAGE

MM	MITIGATION MEASURES FROM SDRFPD FPP (NOVEMBER 2010) TO BE INCLUDED IN DRAFT EIR/EIS	
FPP-4	**FPP-4: Remove hazards from the work area.** ~~IBR~~Tule Wind, LLC shall comply with ~~PRC~~Public Resources Code 4291, Reduction of Fire Hazards Around Building, to provide 100 feet fuel modification around all buildings, and the County Code Title 9 regarding brush management. ~~IBR~~Tule Wind, LLC and/or its contractor shall clear brush and dead and decaying vegetation from the work area prior to starting construction and/or maintenance work. The work area includes only those areas where personnel are active or where equipment is in use or stored, and may include portions of the transmission ROW, construction laydown areas, pull sites, access roads, parking pads, turbine pads, O&M building, substation and any other sites adjacent to the ROW where personnel are active or where equipment is in use or stored.	B9-10
FPP-5	**FPP-5: Helicopter Use:** ~~IBR~~Tule Wind, LLC shall contact CAL FIRE and the SDRFPD dispatch centers two days prior to helicopter use and will provide dispatch centers with radio frequencies being used by the aircraft, aircraft identifiers, the number of helicopters that will be used while working on or near SRA lands at any given time, and the flight pattern of helicopters to be used. Should a wildfire occur within one (1) mile of the work area, upon contact from a CAL FIRE Incident Commander and/or Forest Aviation Officer, helicopters in use by ~~IBR~~Tule Wind, LLC will immediately cease construction activities and not restart aerial operations until authorized by the appropriate fire agency.	B9-11
FPP-6	**FPP-6: Roads:** Any BLM roads or turbine roads that are proposed to be gated shall be provided with an approved Knox Box prior to energizing the project.	B9-12
FPP-7	**FPP-7, Combustible Storage: (CFC Chapter 3):** Combustible storage and trash on site during construction and operation phases shall be properly stored in a clear area with fuel modification around it, and be away from turbines and the substation. Such storage shall be orderly and be removed from the site as soon as possible.	B9-13
FPP-8	**FPP-8: Perform ~~climbing~~visual inspections.** ~~IBR~~Tule Wind, LLC shall perform ~~climbing~~visual inspections using telescopic equipment on 10 percent of project structures supporting overhead lines annually, such that every project structure has been ~~climbed and~~visually inspected at the end of a 10-year period, for the life of the project. If visual inspection does not reasonably allow inspection of project structures, then Tule Wind, LLC shall perform climbing inspections to supplement such visual inspections. In addition, ~~IBR~~Tule Wind, LLC will keep a detailed inspection log of ~~climbing~~inspections, and any potential structural weaknesses or imminent component failures shall be acted upon immediately. The inspection log will be maintained on-site and available for review by CAL FIRE/SDRFPD upon request.	B9-14
FPP-9	**FPP-9: Line Clearance.** For the 138 kV transmission line, ~~IBR~~Tule Wind, LLC shall establish and maintain adequate line clearance in conformance with CPUC GO 95. Only trees or vegetation with a mature height of 15 feet or less shall be permitted within the transmission right of way except where the transmission line spans a canyon. In addition, tree branches that overhang the ROW within 10 horizontal feet of any conductor shall be trimmed or removed, as appropriate, including those on steep hillsides that may be many vertical feet above the facility. Conductor clearance of 10 radial feet under maximum sag and sway will be maintained at all times. Cleared vegetation shall be removed to comply with requirements of	B9-15

MM	MITIGATION MEASURES FROM SDRFPD FPP (NOVEMBER 2010) TO BE INCLUDED IN DRAFT EIR/EIS	
	the County of San Diego. During the life of the project, ~~IBR~~Tule Wind, LLC shall maintain adequate conductor clearances by inspecting the growth of vegetation along the entire length of the overhead transmission line at least once each spring and documenting the survey and results. The inspection log shall be maintained on-site and available for review by CAL FIRE/SDRFPD upon request.	B9-15 Cont.
FPP-11	**FPP-11: De-Energize Electrical System** - ~~IBR~~Tule Wind, LLC shall immediately de-energize the electrical collector and transmission systems during fire emergencies at the direction of ~~in which~~ SDG&E. The fire agency liaison will coordinate with the SDG&E liaison during a fire incident to identify which, if any, particular electrical lines need to be de-energized~~s its local 138 kV system~~. Appropriate fire agencies responding to the incident shall be immediately notified of the line de-energizing. Additionally, ~~IBR~~Tule Wind, LLC shall provide all appropriate local, state, and federal fire dispatching agencies with an on-call contact person (Fire Coordinator) who has the authority to shut down the line in areas affected by a fire. ~~T~~If the transmission line ~~shall be~~is de-energized, prior to ~~and during fire suppression activities within 1 mile of the transmission corridor to maintain firefighter safety, and~~ re-energizing Tule Wind, LLC shall ~~require~~ notify~~ication~~ and receive approval from ~~of all~~ the SDG&E liaison and fire agency liaison representing the responsible fire agencies.	B9-16
FPP-12	**FPP-12: Site Maps** - All responsible agencies shall be provided with maps indicating the location of the water tanks, turbines, access roads, and project layout ~~and towers~~ prior to construction, as well as "as-built" maps after completion of construction. Tule Wind, LLC will coordinate with the SDCFA to ensure that its construction plans and "as-built" plans are incorporated into the SANGIS public safety layer for GIS mapping purposes prior to energizing the project.	B9-17
FPP-13	**FPP-13: Communication Devices** - In order to easily communicate immediate fire incidence during ~~construction,~~ operation or maintenance of the project, all crews and inspectors shall be equipped with radio and/or cellular telephone access that is operational throughout the project area to allow for immediate reporting of fires~~operational communication equipment~~ and open communication pathways shall be established prior to energizing the project.	B9-18

Comment Letter B10

STATE OF CALIFORNIA

GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

STATE CLEARINGHOUSE AND PLANNING UNIT

JERRY BROWN
GOVERNOR

March 7, 2011

Iain Fisher
California Public Utilities Commission
505 Van Ness Avenue
Energy Division Area 4A
San Francisco, CA 94102-3298

Subject: East County Substation/Tule Wind/Energia Sierra Juarez Gen-Tie Projects
SCH#: 2009121079

Dear Iain Fisher:

The State Clearinghouse submitted the above named Joint Document to selected state agencies for review. On the enclosed Document Details Report please note that the Clearinghouse has listed the state agencies that reviewed your document. The review period closed on March 4, 2011, and the comments from the responding agency (ies) is (are) enclosed. If this comment package is not in order, please notify the State Clearinghouse immediately. Please refer to the project's ten-digit State Clearinghouse number in future correspondence so that we may respond promptly.

Please note that Section 21104(c) of the California Public Resources Code states that:

> "A responsible or other public agency shall only make substantive comments regarding those activities involved in a project which are within an area of expertise of the agency or which are required to be carried out or approved by the agency. Those comments shall be supported by specific documentation."

B10-1

These comments are forwarded for use in preparing your final environmental document. Should you need more information or clarification of the enclosed comments, we recommend that you contact the commenting agency directly.

This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act. Please contact the State Clearinghouse at (916) 445-0613 if you have any questions regarding the environmental review process.

Sincerely,

Scott Morgan

Scott Morgan
Director, State Clearinghouse

Enclosures
cc: Resources Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

Document Details Report
State Clearinghouse Data Base

SCH#	**2009121079**
Project Title	East County Substation/Tule Wind/Energia Sierra Juarez Gen-Tie Projects
Lead Agency	Public Utilities Commission

Type **JD** Joint Document

Description Note: Extended Per Lead

San Diego Gas & Electric (SDG&E) is proposing to construct and operate a new 500/230/138-kilovolt (kV) East County (ECO) Substation, a new 13.3-mile 138 kV transmission line (connecting the Eco Substation with the Boulevard Substation Rebuild), and would rebuild the existing Boulevard Substation to operate at 138/69/12 kV (this proposed project is referred to as the ECO Substation Project). In addition, Pacific Wind Development is proposing to construct and operate up to 134 wind turbines (and associated facilities including an aboveground and underground cable collection system, collector substation, and an operations and maintenance facility), and an ~ 9.7-mile 139 kV transmission line to interconnect with the proposed Blvd Substation Rebuild (referred to as the Tule Wind Project). Energie Sierra Juarez U.S. Transmission, LLC, is proposing to construct and operate an ~ 1-mile 500 kv (or 230 kV) gen-tie from the U.S.-Mexico border ~ 4 miles southeast of the community of Jacumba to interconnect with the proposed ECO Substation (referred to as the ESJ Gen-Tie Project).

Lead Agency Contact

Name	Iain Fisher		
Agency	California Public Utilities Commission		
Phone	(415) 355-5308	***Fax***	
email			
Address	505 Van Ness Avenue Energy Division Area 4A		
City	San Francisco	***State*** CA	***Zip*** 94102-3298

B10-1 Cont.

Project Location

County	San Diego
City	
Region	
Lat / Long	
Cross Streets	Old Highway 80, Carrizo Gorge Road, Tule Jim Lane, Highway 94, McCain Valley Rd, Ribbonwood Rd
Parcel No.	Multiple
Township	Multip ***Range*** ***Section*** Multip ***Base*** Multiple

Proximity to:

Highways	I-8, SR-94
Airports	Jacumba
Railways	San Diego and Arizona Eastern
Waterways	Multiple
Schools	Clover Flat Elementary, Jacumba Elementary
Land Use	Undeveloped Z: General Rural, Open Space, Specific Plan, Agriculture, Indian Reservation GPD: Multiple Rural Use (1 DU/4, 8, 20 AC), Public/Semi-Public Lands, Specific Plan Area, General Agriculture, Indian Reservation

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Archaeologic-Historic; Drainage/Absorption; Economics/Jobs; Flood Plain/Flooding; Forest Land/Fire Hazard; Geologic/Seismic; Minerals; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Schools/Universities; Septic System; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Wildlife; Growth Inducing; Landuse; Cumulative Effects; Other Issues

Note: Blanks in data fields result from insufficient information provided by lead agency.

Document Details Report
State Clearinghouse Data Base

Reviewing Agencies	Resources Agency; Colorado River Board; Department of Fish and Game, Region 5; Cal Fire; Office of Historic Preservation; Department of Parks and Recreation; Department of Water Resources; Caltrans, Division of Aeronautics; California Highway Patrol; Caltrans, District 11; Regional Water Quality Control Board, Region 7; Regional Water Quality Control Board, Region 9; California Energy Commission; Native American Heritage Commission; State Lands Commission

Date Received 12/23/2010 ***Start of Review*** 12/23/2010 ***End of Review*** 03/04/2011

B10-1 Cont.

Note: Blanks in data fields result from insufficient information provided by lead agency.

STATE OF CALIFORNIA – THE NATURAL RESOURCES AGENCY

Jerry Brown, Governor

COLORADO RIVER BOARD OF CALIFORNIA
770 FAIRMONT AVENUE, SUITE 100
GLENDALE, CA 91203-1068
(818) 500-1625
(818) 543-4685 FAX

January 21, 2011

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JAN 28 2011
STATE CLEARING HOUSE

State Clearinghouse
1400 Tenth Street
P.O. Box 3044
Sacramento, CA 95812-3044

Regarding SCH# 2009-121-079: Notice of Completion & Environmental Document Transmittal for the East County Substation / Tule Wind Development / Energia Sierra Juarez Gen-Tie Project proposed by Energia Sierra Juarez U.S. Transmission, LLC, San Diego County, California

To Whom It May Concern:

The Colorado River Board of California (CRB) has received and reviewed a copy of Notice of Completion & Environmental Document Transmittal for the East County Substation / Tule Wind Development / Energia Sierra Juarez Gen-Tie Project proposed by Energia Sierra Juarez U.S. Transmission, LLC, San Diego County, California. B10-2

At this juncture, the CRB has determined that it has no comments regarding the Notice. If you have any questions, please feel free to contact me at (818) 500-1625.

Sincerely,

CSHarris

Christopher S. Harris
Acting Executive Director