CHAPTER 2.0

Project Description

2.1 Project Location, Existing System, and Regional Context

2.1.1 Project Location

The proposed Embarcadero-Potrero 230 kV Transmission Project will include construction, operation, and maintenance of a 230 kV transmission line in San Francisco from Embarcadero Substation near the corner of Fremont and Folsom Streets, to Potrero Switchyard on Illinois Street between 22nd and 23rd Streets. The project is approximately 3.5 miles in total length, including approximately 2.5 miles to be installed offshore in the San Francisco Bay (the Bay), 0.4 mile to be installed in horizontal directional drills (HDD) from the Bay to the transition points on land, and approximately 0.6 mile to be installed underground in paved areas.

The submarine portion of the proposed transmission line will typically be buried 6 to 10 feet underneath the floor of the Bay, roughly 1,500 to 2,500 feet off the western shoreline. At the ends of the submarine portion of the route, transitional sections totaling approximately 0.4 mile will be installed in HDD conduit where the submarine cable transitions from offshore to onshore. At the northern end, the transition to underground cable in city streets will be located in the lower Embarcadero area south of the Bay Bridge, with the HDD passing between Piers 28 and Piers 30-32 to end inland at Spear Street. At the southern end, the cable transition will be located along 23rd Street. Figures 2-1, Project Vicinity, and 2-2, Project Location show the location of the project on the northeastern portion of the San Francisco Peninsula.

PG&E will interconnect the new 230 kV transmission line within Embarcadero Substation (which is currently being upgraded pursuant to the separate Embarcadero Substation 230 kV Bus Upgrade project) and will install a new 230 kV switchyard adjacent to the existing Potrero Switchyard to accommodate additional substation equipment. The Embarcadero Substation Bus Upgrade Project is further addressed in Section 4.3, Cumulative Impacts. In addition, construction will require equipment staging sites and laydown yards. Field work and agency coordination will be conducted in advance of finalizing the construction plan to identify appropriate staging and laydown areas, in existing city streets and nearby paved areas; the precise location of some of the staging or laydown areas may depend on specific encroachment permits and other construction ongoing in the area and will be coordinated with the City and/or the Port as appropriate. Barges and other floating equipment necessary for the project may be docked or anchored temporarily in the project vicinity. Construction materials for the project may be stored at existing PG&E-owned properties or leased industrial properties.

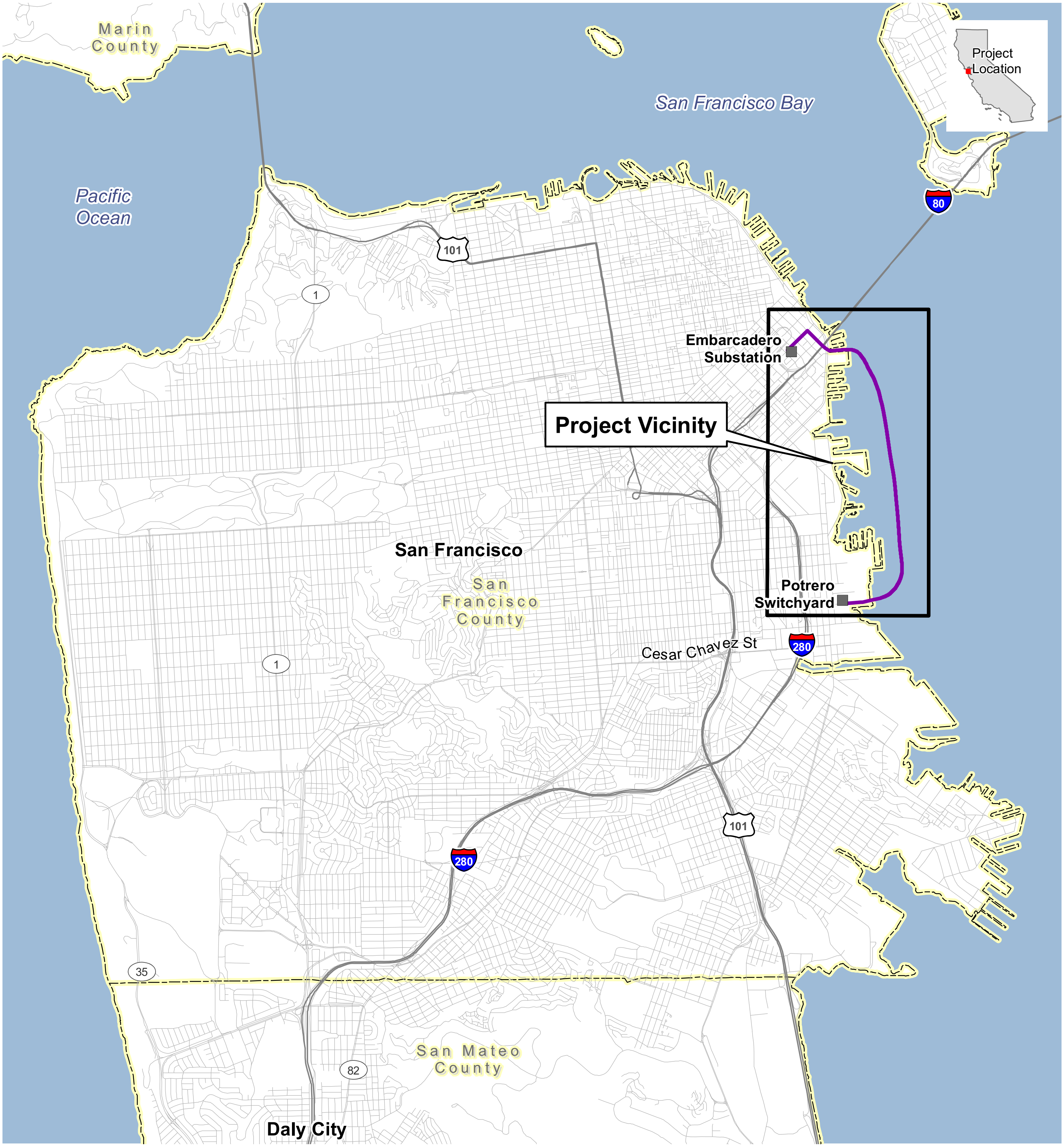
2.1.2 Existing System

PG&E's customers in the San Francisco area are supplied with electricity by PG&E's 230 kV and 115 kV transmission systems. These systems are not currently interconnected within San Francisco. The 230 kV system is supplied from PG&E's Martin Substation in Daly City. The 115 kV system is supplied from Martin Substation and also by the Trans Bay Cable (TBC) connection at PG&E's Potrero Switchyard. Because no central power generation station is located within its borders, San Francisco is entirely dependent on electric transmission lines to provide electricity to residents, businesses, and public agencies.

2.1.2.1 PG&E's Existing San Francisco 230 kV Transmission System

PG&E's 230 kV transmission system in San Francisco consists of two 230 kV underground cables running roughly 7 miles from PG&E's Martin Substation in Daly City to Embarcadero Substation in San Francisco. Embarcadero Substation is not connected to PG&E's 115 kV San Francisco transmission grid. The two existing 230 kV transmission lines were placed in-service in 1974 and are the sole source of power to Embarcadero Substation.

The 230 kV underground transmission lines exit Martin Substation and follow separate but generally parallel routes to Embarcadero Substation. For most of these routes from Daly City up into San Francisco, the two lines are located under different streets.



Proposed Transmission Line

Project Location

N

Scale:
1:75,000

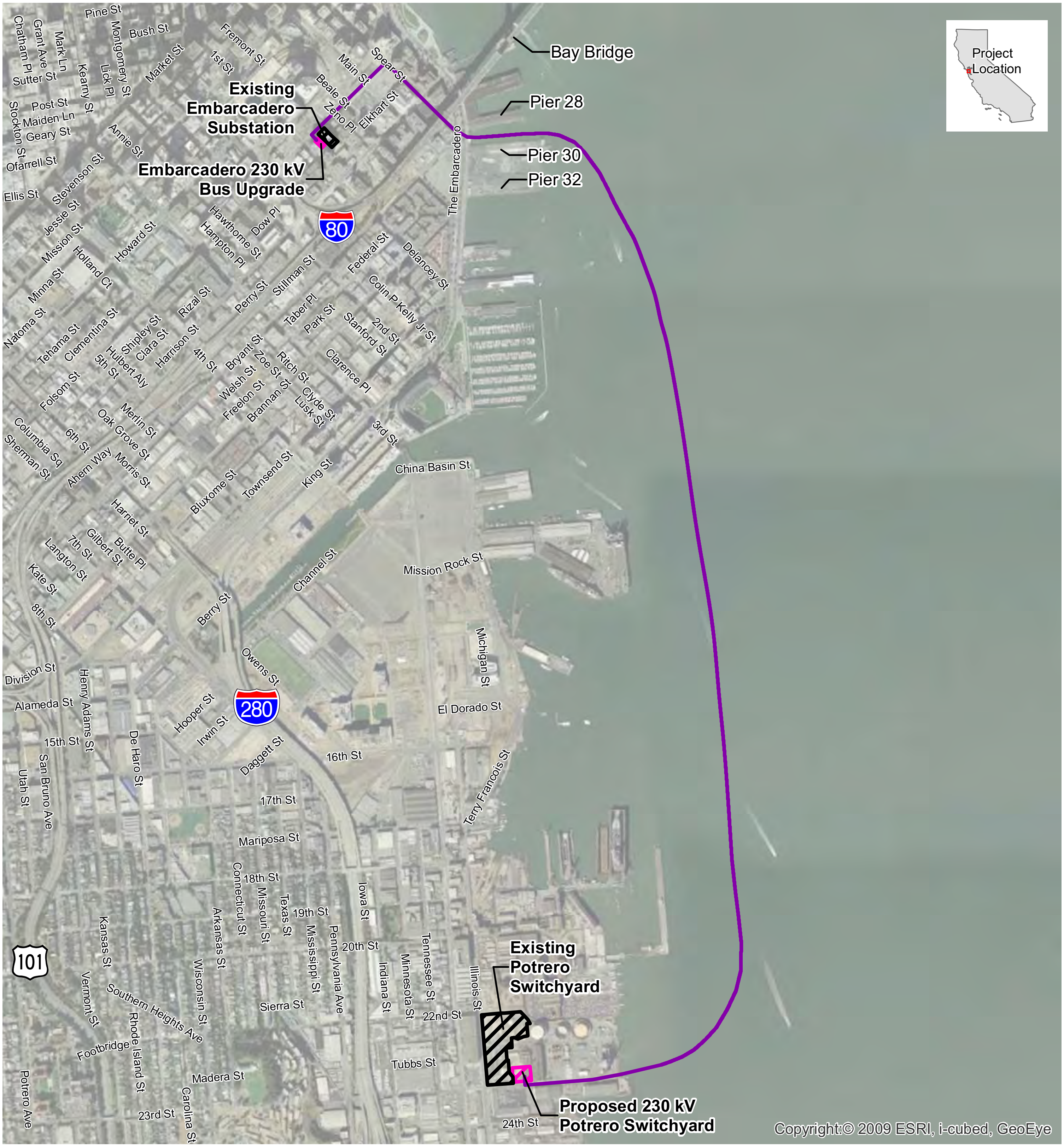
0 1 2 Miles

FIGURE 2-1

Project Vicinity

Embarcadero-Potrero 230 kV Transmission Project

San Francisco, CA



Proposed Transmission Line

Substation/Switchyard

N

Scale: 1:20,000

0 1,000 2,000 Feet

FIGURE 2-2

Project Location

Embarcadero-Potrero 230 kV Transmission Project

San Francisco, CA

PG&E

These 230 kV transmission lines are of the High Pressure Fluid Filled (HPFF) pipe-type design. This cable design uses conductors wound with oil-impregnated insulating paper, with all three phases placed in a single 10-inch diameter steel pipe containing a pressurized dielectric fluid. The steel pipe supports the high operating pressure of the cable fluid; protects the conductors from mechanical damage and water infiltration and minimizes the potential for oil leaks; and is itself protected from the chemical and electrical environment of the soil with a coating and cathodic protection. The pipes are encased in a limestone and concrete slurry that adheres to the pipe like a concrete duct bank. The slurry is weaker than concrete and can be knocked off to allow work on the pipe or coating. The slurry also helps conduct heat from line losses away from the pipe. The pipe is enclosed in a steel casing under railroad tracks and deep crossings, and connects to a splice casing inside of splice vaults. The cable insulating fluid is automatically pressurized, pumped to, and returned from each line pipe during thermal expansion and contraction of the cable fluid inside. Two pumping stations, one each at PG&E's Embarcadero and Martin substations, are connected to each line pipe through a single four-inch steel pipe. The pumping stations monitor and maintain the pressure of the fluid, and can be operated in an oscillating mode to smooth out temperatures along the circuit.

2.1.2.2 PG&E's Existing San Francisco 115 kV Transmission System

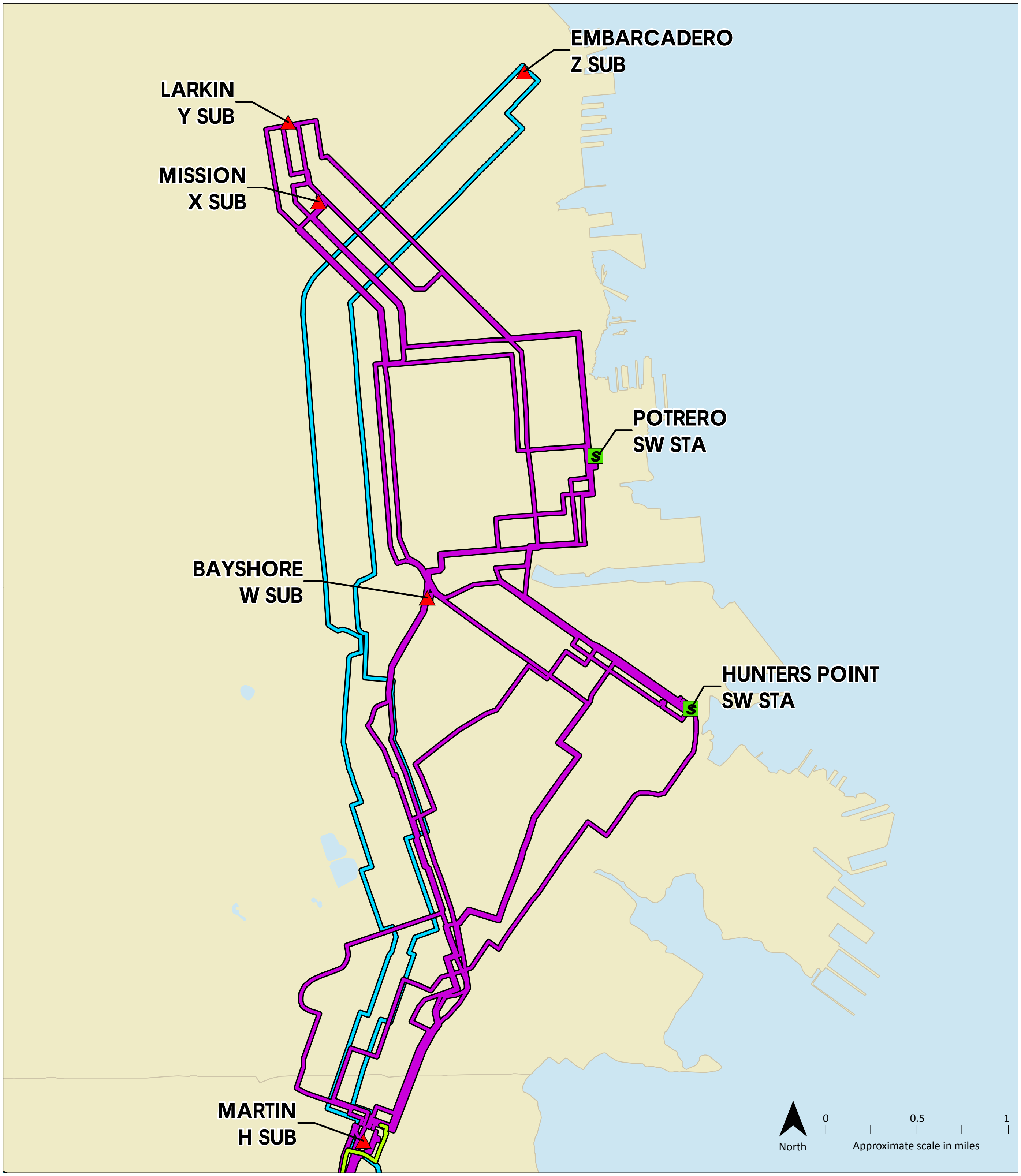
PG&E's 115 kV transmission system in San Francisco consists of 13 underground transmission lines. Six of these lines, with a total length of almost 30 circuit-miles of cable, are "import" lines that bring power into the city from Martin Substation: three 115 kV import lines run from Martin Substation to Hunters Point Substation; two 115 kV import lines run from Martin Substation to Bayshore Substation and then on to Potrero Switchyard; and one 115 kV import line runs from Martin Substation to Larkin Substation. A circuit-mile includes all conductors for that circuit, which is three conductors for alternating current (AC) transmission lines such as these. Therefore, each circuit-mile of AC line contains 3 miles of cable.

PG&E's Potrero Switchyard and Larkin, Mission and Hunters Point substations are interconnected within San Francisco by seven "internal" 115 kV lines (with a total length of 20 circuit-miles). These internal lines primarily deliver power to Larkin and Mission substations from Potrero Switchyard and Hunters Point Substation. The internal lines can also provide an alternative path for power to flow to the various substations if the import line(s) running directly from Martin Substation to any given substation should be subject to a planned or forced outage.

Construction of the 115 kV system started in the late 1940s, and 50 circuit-miles of underground cable were installed at various times between 1948 and 2009, as follows:

- 16.7 circuit-miles were installed by 1948
- 7.4 circuit-miles were installed between 1948 and 1958
- 12 circuit-miles were installed in the early 1960s
- 3.5 circuit-miles installed in the early 1970s
- 2.9 circuit-miles were installed in 1989
- 2.5 circuit-miles were installed in 2006
- 5 circuit-miles were installed in 2009

The 115 kV underground system utilizes two types of cable design. The cables installed prior to 1990 are all of the High Pressure Gas Filled (HPGF) pipe-type design. This cable design has the three phase conductors wound with oil-impregnated insulating paper, which are then placed in a steel pipe and pressurized with a nitrogen blanket. The pipelines are similar in construction to the HPFF 230 kV cables, except that there are no pumping plants. The HPGF design utilizes a static high pressure of nitrogen and requires an occasional charge of makeup gas.



Source: PG&E, 2012.

LEGEND

Electric Transmission
- 60 kV
- 115 kV
- 230 kV

PG&E Facility
- Substation
- Switching Station

FIGURE 2-3
Electric Transmission System Serving San Francisco
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

The last two cables installed in 2006 and 2009 utilize a different design; the three phase conductors are each extruded with cross-linked polyethylene (XLPE) solid dielectric insulation and are placed in a concrete-encased polyvinyl chloride (PVC) duct bank.

PG&E recently completed a re-cabling project between Martin Substation and Potrero Switchyard, which replaced 10 circuit-miles of cable circuits in the two import lines from Martin Substation to Bayshore Substation and Potrero Switchyard. The replacement work also allowed PG&E to inspect the two HPGF pipes for pipe and coating integrity and to make necessary repairs to external damage caused by others. With completion of this work, PG&E's 115 kV system in San Francisco still has 13 circuit-miles of cable that are more than 60 years old and another 7 circuit-miles of cable that are more than 50 years old.

The 115 kV system has a load-serving capability of about 900 megawatts (MW), with the Trans Bay Cable out of service. This capability assumes that the 115 kV cables can utilize their higher, short-term emergency ratings during an outage of the TBC that lasts no more than a couple of days. If the TBC is out for longer than several days, then the cables can only be loaded up to their long-term ratings, and the load-serving capability of the 115 kV system drops to about 800 MW. The total load served through the five substations that are part of the 115 kV network (which does not include Embarcadero Substation) reaches about 600 MW on hot days, and up to 630 MW on cold winter evenings. With continuing growth in San Francisco, particularly in the Mission Bay and Bayview-Hunters Point areas, the peak load on the 115 kV network is expected to exceed 650 MW within the next several years.

2.1.2.3 PG&E's Embarcadero Substation

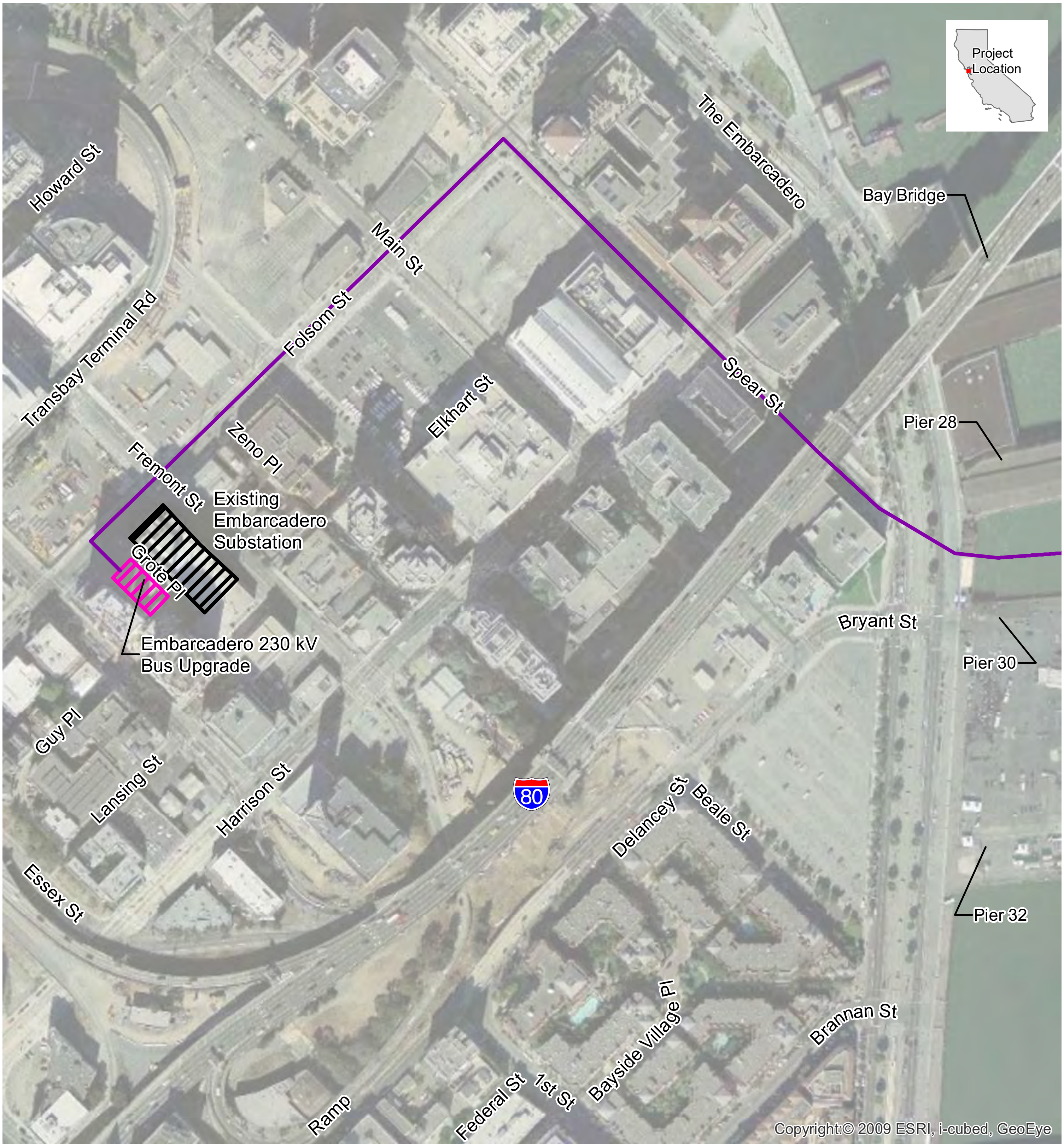
PG&E's Embarcadero Substation was built in 1974 and is located at the corner of Fremont and Folsom streets in San Francisco (see Figure 2-4, Embarcadero Substation Area). As noted above, Embarcadero Substation currently receives electricity from two 230 kV underground cables running from PG&E's Martin Substation. Unlike PG&E's other San Francisco substations, Embarcadero Substation is not tied into PG&E's 115 kV transmission network; the 230 kV lines are the only source of electricity to Embarcadero Substation. PG&E's Substation J, located on Leidesdorff Street near the Transamerica Building, is fed through Embarcadero Substation and also has no other source of electricity.

At Embarcadero Substation, power received via the 230 kV cables is stepped down through a bank of four 230 kV/34.5 kV transformers. About 45 percent of the power delivered into Embarcadero Substation flows out through two 34.5 kV busses serving two radial feeders and eleven network feeders. The remaining 55 percent of the power is then stepped down to 12 kV through six 34.5 kV/12 kV transformers, and flows out of the substation through two 12 kV busses serving six network feeders, 12 radial feeders, and five tie cables that connect directly to, and provide the sole source of power to, Substation J.

The geographical areas served by Embarcadero Substation include South of Market and Rincon Hill; China Basin; Nob Hill; Chinatown; the Embarcadero; North Beach; Union Square; Telegraph Hill; and the Financial District. The area of service is shown in Figure 2-5, Area Served by Embarcadero Substation. The geographical area of service is roughly bounded by 7th street north to Pine, west along Pine to Larkin, north along Larkin to Vallejo, east on Vallejo to Jones Street, north to Greenwich Street, then east to Grant and north along Grant to the Bay, then south and east along the shoreline to China Basin.

Through a series of 12 kV distribution circuits, Embarcadero Substation and Substation J together serve approximately 30,000 PG&E account holders, including roughly 23,000 residential accounts. The number of PG&E account holders served by Embarcadero Substation undercounts the number of individuals and businesses served by Embarcadero Substation, because many office or retail commercial buildings in downtown San Francisco house multiple tenants, but have only one PG&E account holder, usually the building owner.

The peak demand on Embarcadero Substation has grown from about 160 MW in 1992 to 270 MW in 2008 – a growth rate of about 6 MW/year (Figure 2-6, Embarcadero Substation Peak Demand (Historical and Projected). Peak demand at Embarcadero Substation declined from the 270 MW peak in 2008 to between 250 and 260 MW in 2009-2012 due to the economic downturn and cooler weather. Based upon PG&E's current projections, the



Proposed Transmission Line
Substation

N
Scale: 1:3,600
0 150 300 Feet

FIGURE 2-4
Embarcadero Substation Area
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

PG&E

Source: PG&E 2012.

LEGEND

▲ Substation

FIGURE 2-5

Area Served by Embarcadero Substation

Embarcadero-Potrero 230 kV Transmission Project

San Francisco, CA

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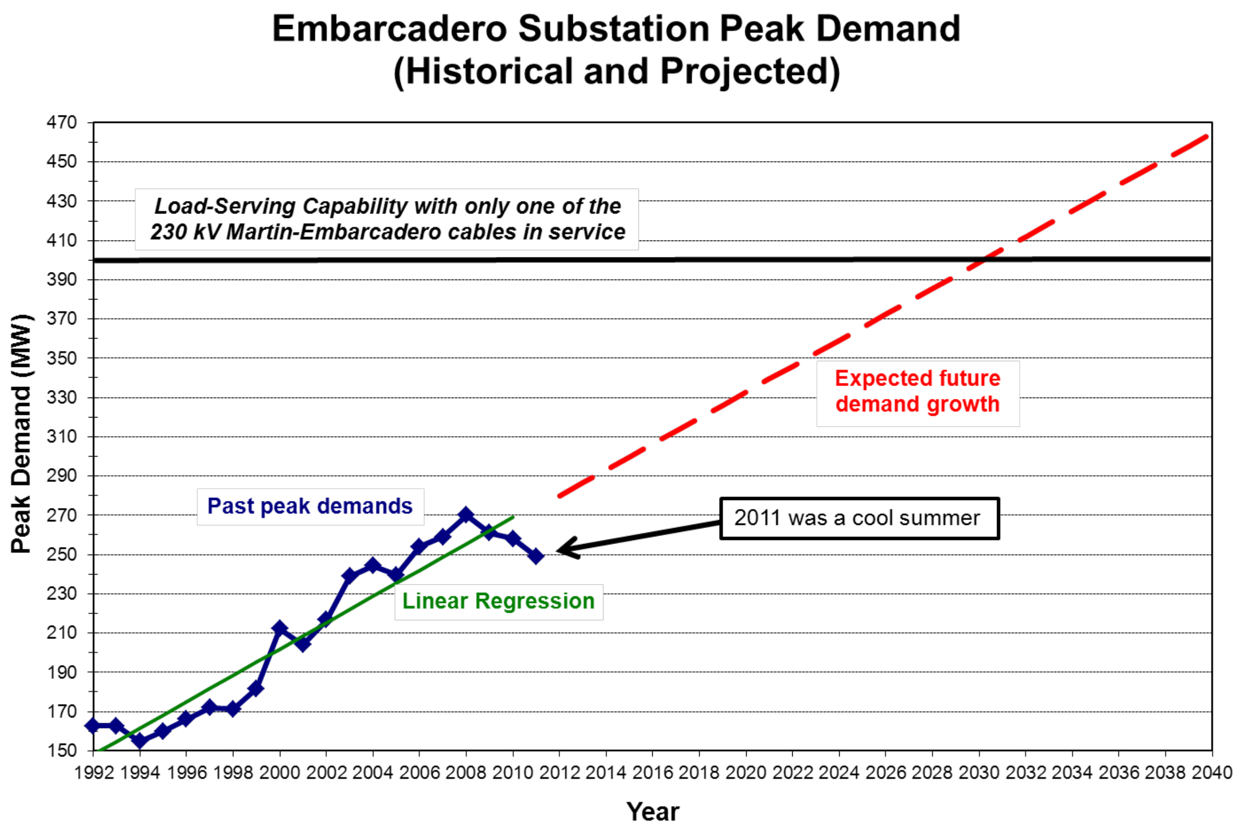


Source: PG&E, 2012

FIGURE 2-6
Embarcadero Substation Peak Demand (Historical and Projected)
Embarcadero-Potrero 230 kV Transmission Project

peak demand in 2016 will be approximately 305 MW. When in service, each of the existing Martin-Embarcadero 230 kV cables can provide 400 MW of electricity to Embarcadero Substation. If growth continues in the same linear trajectory, a single Martin-Embarcadero 230 kV cable will be insufficient to serve all Embarcadero Substation customers after approximately 2030. Because Embarcadero Substation is not tied into PG&E's 115 kV transmission network, if the two existing Martin-Embarcadero cables are out of service, only a very small number of the affected PG&E customers (approximately 10 MW of the 305 MW total load projected in 2016), which are served on a radial 12 kV distribution circuit, can be served from another distribution substation.

The majority of the commercial and industrial customers served by Embarcadero are classified as "essential" under the CPUC's guidelines. "Essential" load includes customers normally exempt from rotating outages because they provide essential public health, safety, and security services. These include customers providing essential fire, police, prison, and national security services. A complete list of essential customer categories is provided in Attachment B to the CPUC Decision ("D.") 02-04-060. For essential load customers, an outage "presents unacceptable jeopardy, or imminent danger, to public health and safety" (D.02-04-060 p. 75, fn. 21). Note that non-essential customers are exempt from rotating outages (i.e., are treated as essential load) when they share a circuit with an essential customer (D.02-04-060 p. 73). Thus, an entire circuit will be essential or non-essential.

2.1.2.4 PG&E's Potrero Switchyard

Potrero Switchyard is located on Illinois Street between 23rd and 22nd Streets in what is known as the Dogpatch neighborhood of San Francisco (see Figure 2-7, Potrero Switchyard Area). At the time it was built, it was designed mainly as the switchyard for PG&E's Potrero Power Plant. The power plant was sold to Mirant in the late 1990s

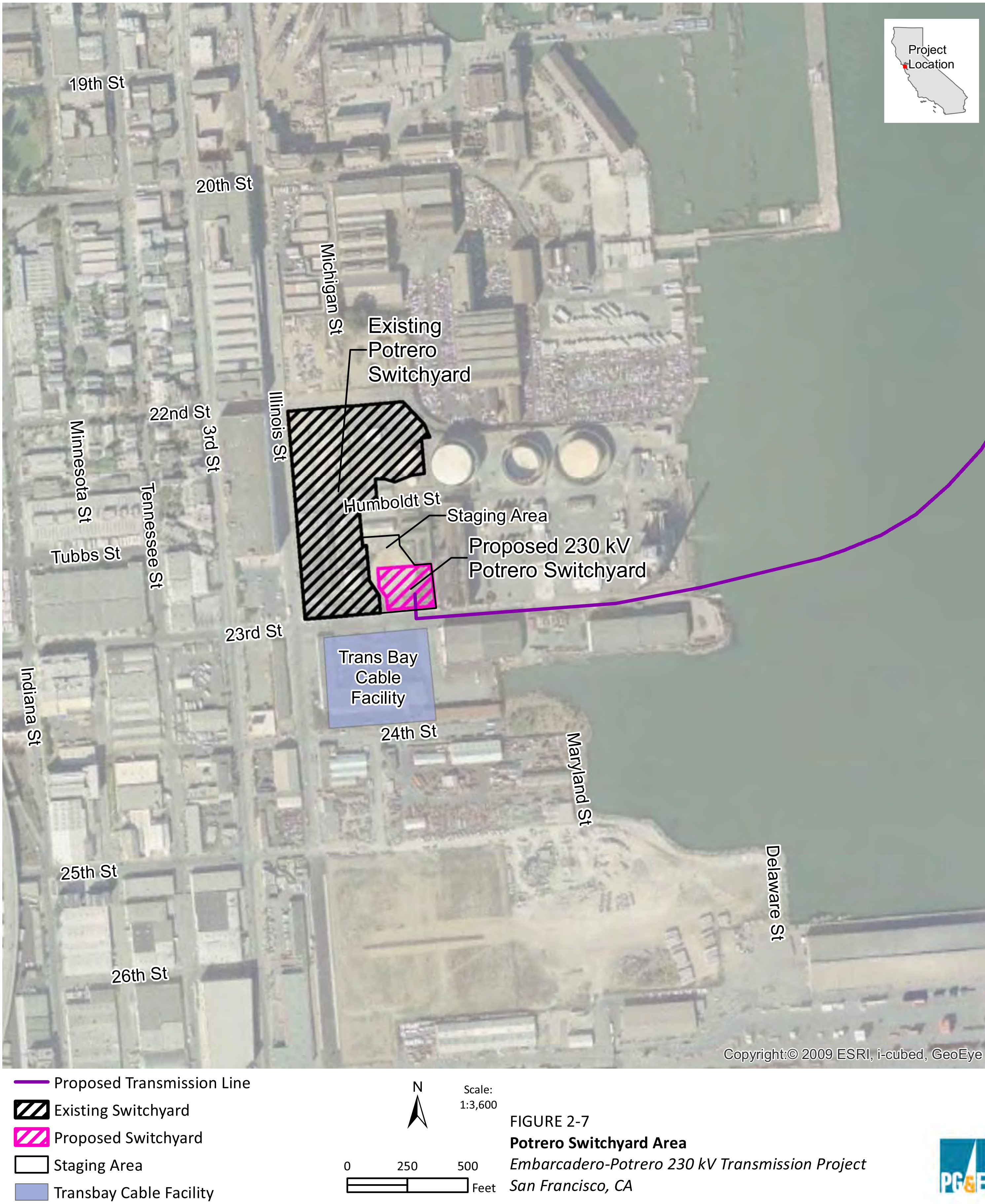


FIGURE 2-7

Potrero Switchyard Area

Embarcadero-Potrero 230 kV Transmission Project

San Francisco, CA

and decommissioned in March 2011 following completion of the TBC project. The facility currently operates as a substation; however, for naming consistency, the facility is still referred to as Potrero Switchyard.

Currently, there is no 230 kV equipment at the existing Potrero Switchyard. The existing 115 kV switchyard contains:

- Two 115 kV overhead connections to the decommissioned Potrero Power Plant
- Six 115 kV PG&E underground (UG) transmission lines
- Two 115 kV UG cable connections to the existing TBC high voltage direct current (HVDC) converter station with a single termination point
- One 115 kV Static Var Compensator installed in 2004 to replace use of two Hunters Point generating units as synchronous condensers
- Three 75-megavolt ampere reactive (MVAR) power steps of shunt capacitors for voltage support
- Three 115/12 kV distribution transformers and several 12 kV feeders serving local PG&E customers
- Two bus paralleling circuit breakers
- Two bus sectionalizing circuit breakers

2.2 Project Objectives, Purpose and Need

2.2.1 Statement of Project Objectives

The objectives of the project are to:

1) Improve reliability of PG&E's 230 kV transmission system in San Francisco by constructing a new 230 kV transmission line between Embarcadero Substation and Potrero Switchyard that provides a high likelihood of continued electric service to downtown San Francisco in the event of overlapping outages on both of the two existing 230 kV transmission lines running between PG&E's Martin and Embarcadero substations. Specifically:
    a. To increase substantially the likelihood of continued electric service to Embarcadero Substation in the event of concurrent unplanned outages of both existing 230 kV cables, such as might occur following a major seismic event.
    b. To provide a high likelihood of continued electric service to Embarcadero Substation in the event of a forced outage of one existing 230 kV cable while the other existing 230 kV cable is subject to a planned outage.
2) Construct an economically and technically feasible third 230 kV transmission line to PG&E's Embarcadero Substation along a route, and using construction methods and materials, that increase the likelihood that the new transmission line will remain operable following a major earthquake in the San Francisco Bay Area.
3) Interconnect PG&E's San Francisco 230 kV and 115 kV transmission systems at Potrero Switchyard so that each system reinforces the other system in the event of outages or replacements of existing underground cables.
4) Construct an economically and technically feasible third 230 kV transmission line to PG&E's Embarcadero Substation from Potrero Switchyard, which is the only PG&E substation on the San Francisco 115 kV network that has sufficient capacity to serve current and expected future Embarcadero loads in the event that both existing 230 kV cables into Embarcadero were out of service.
5) In the long term, after the load served from Embarcadero Substation exceeds the capacity of a single existing 230 kV transmission line, improve reliability of PG&E's San Francisco 230 kV transmission system by having in place a new 230 kV transmission line to PG&E's Embarcadero Substation that will allow PG&E to maintain electric service to all customers served from Embarcadero Substation, with any one of the 230 kV transmission lines serving Embarcadero Substation subject to a planned or forced outage.

6) Construct an economically and technically feasible third 230 kV transmission line to PG&E's Embarcadero Substation before either of the two existing 230 kV transmission lines to PG&E's Embarcadero Substation must be replaced, so that downtown San Francisco is not at risk of a single-cable outage causing a prolonged loss of electric service when one of the two existing 230 kV transmission lines must be replaced.

7) Construct a third 230 kV transmission line to PG&E's Embarcadero Substation so that PG&E may allow one of the two existing 230 kV transmission lines serving Embarcadero Substation to be de-energized to allow infrastructure construction without placing downtown San Francisco at risk of a single-cable outage causing a prolonged loss of electric service.

2.2.2 Project Purpose and Need

The Embarcadero-Potrero 230 kV Transmission Project will construct a new, single circuit, 230 kV transmission line between PG&E's Embarcadero Substation and PG&E's Potrero Switchyard. The project is intended to enhance the reliability of PG&E's electric service to San Francisco, and particularly to the downtown area served by Embarcadero Substation, given the significant adverse impacts that a service outage would have on the citizens and economy of San Francisco.

PG&E's Embarcadero Substation is the sole source of electricity to much of downtown San Francisco including the Financial District, Union Square, North Beach, The Embarcadero, Chinatown, Nob Hill, Telegraph Hill, and the South of Market and North of AT&T Park areas including Rincon Hill. Of the 30,000 accounts served by Embarcadero Substation and Substation J together, Embarcadero Substation alone directly serves 22,000 account holders, including many of San Francisco's financial and professional services industries, shopping and restaurant districts, major office buildings, hotels, and tourist destinations, as well as approximately 20,000 residential accounts. Embarcadero Substation will be the source of electricity to future development on Rincon Hill and the Transbay Terminal.

Embarcadero Substation is currently fed by two HPFF pipe-type 230 kV cables from Martin Substation, installed in 1974. PG&E's Martin-Embarcadero 230 kV cables, like PG&E's underground transmission lines generally, have been very reliable to date. At present, and projected through at least 2030, either one of the two existing 230 kV cables can deliver enough electricity to meet current and expected demand at Embarcadero Substation.

Nonetheless, this project addresses various low-probability but very high impact scenarios under which both Martin-Embarcadero cables are out of service, causing a potentially lengthy loss of electricity in downtown San Francisco. For example, both existing Martin-Embarcadero cables cross areas of high liquefaction potential (O'Rouke et al., 2006), leading to the possibility of a major earthquake causing overlapping failures of those cables. As noted above, unlike PG&E's other San Francisco substations, Embarcadero Substation is not tied into PG&E's 115 kV transmission network, so if the two existing Martin-Embarcadero cables are out of service, only a very small number of the affected PG&E customers (representing approximately 10 MW of 305 MW of total load projected in 2016) can be served from another distribution substation.

The time to restore an inoperable underground pipe-type cable can vary from approximately 8 hours or less (for return of a line in maintenance to service) to as long as 8 weeks (to repair a single point of physical damage to the cable) or longer. Repair of a damaged Martin-Embarcadero cable is likely to take 7-8 weeks, assuming PG&E has available skilled labor, equipment and replacement cable; repair of a single rupture of the pipe surrounding the cable without damage to the cable itself would take less time. In the event of an earthquake causing liquefaction that damages both Martin-Embarcadero cables, it is uncertain when a single cable could be placed back in service because there may be multiple damaged cable segments that are difficult to find, multiple oil leaks that are difficult to find, debris and other impediments to finding the damaged pipe and cable locations, and insufficient skilled manpower, equipment and spare cable available.

The immediate reliability risks arising from Embarcadero Substation's reliance on the two existing Martin-Embarcadero 230 kV cables as its sole source of electricity include:

- A major earthquake poses a significant risk of damage to both Martin-Embarcadero cables or the fluid-filled pipelines in which they are located because, although the cables are not co-located, both cables are located in areas of San Francisco expected to be subject to significant liquefaction risk. Physical damage to each cable could take weeks to months to fix, depending upon the type and quantity of damage, and availability of materials and skilled labor in a post-earthquake environment. PG&E's proposed new Embarcadero-Potrero cable would avoid the areas of high liquefaction potential traversed by the existing cables and is designed to remain operational after a major earthquake. The project increases the probability that at least one of three cables will remain operational.

- One existing Martin-Embarcadero cable may be out of service due to a planned outage for maintenance or to accommodate construction of other infrastructure. For example, the City of San Francisco recently requested that one of the Martin-Embarcadero cables be de-energized for approximately 4 months to accommodate a City sewer project. This project has been deferred temporarily to allow for the permitting and construction of the proposed Embarcadero-Potrero cable. Whenever one cable is on a planned outage, a forced outage of the other cable will force Embarcadero Substation out of service.
- An existing Martin-Embarcadero cable may be forced out of service due to mechanical damage to the fluid-filled pipe containing the cable or also to the cable itself (such damage may occur from a "dig-in" caused by a third party construction project), undetected corrosion, contamination of the pipe fluid, a failure of the pumping station, or faults caused by overheating. Depending upon the nature of the forced outage, it could take hours to months to restore the cable to service. During this time period, a forced outage of the other existing cable will force Embarcadero Substation out of service.

By connecting PG&E's Embarcadero Substation and Potrero Switchyard, the project will also provide an interconnection for PG&E's San Francisco 230 kV and 115 kV transmission systems. Such an interconnection would provide a number of benefits to PG&E operations and reliability, including: (a) provide the 115 kV system with an additional source of power when the Martin-Embarcadero cables are in operation; (b) facilitate the eventual replacement of the 115 kV cables, some of which are now 55-65 years old; and (c) provide power from the 115 kV system to the 230 kV system if the 115 kV system were operational, but both TBC and the Martin-Embarcadero cables were not.

In addition to providing an immediate assurance of increased reliability to customers served through Embarcadero Substation, the project has additional reliability benefits in the long run. At some point in the future, PG&E likely would be required to install a third cable to Embarcadero Substation to meet the North American Electric Reliability Corporation (NERC) transmission planning reliability standards approved by the Federal Energy Regulatory Commission (FERC) as well as the California Independent System Operator's (ISO's) planning standards. These additional reliability considerations include:

- At some point, after approximately 2030, unless downtown San Francisco energy usage stops growing, the customer load served by Embarcadero Substation will exceed the capability of one of the existing Martin-Embarcadero 230 kV cables. At that point, PG&E could be forced to drop service to some customers served by Embarcadero Substation if only one of the existing Martin-Embarcadero cables were out of service, depending upon the demand at the time of outage. Having to drop load following the loss of a single transmission line would be a violation of NERC Reliability Standard TPL-002-0b (Category B). Given that current peak load is approximately 280 MW and each existing cable's capability is approximately 400 MW, this situation is not expected soon. However, this situation is anticipated if Embarcadero Substation is served by only two cables. The project will mitigate this future reliability risk while having the immediate benefits noted above.
- At some point, in the long run, the existing Martin-Embarcadero 230 kV cables will need to be replaced. The cables were installed 39 years ago in 1973, have functioned reliably, and many pipe-type transmission cables have continued operating long past the manufacturer's estimated 40-year useful life. However, it is reasonable to expect that, at some point, each will need to be replaced. As the need for replacement becomes evident, PG&E will need to construct a third cable to Embarcadero Substation to ensure reliable electric service. Waiting until one cable is out of service (or suffering repeated failures) before starting a multi-year engineering, permitting, and construction project to install a new cable would not be prudent.

Without the project, during replacement of one of the existing cables, Embarcadero Substation would be forced out of service if the other existing Martin-Embarcadero cable failed. Having to drop load following the loss of a single transmission line would be a violation of NERC Reliability Standard TPL-002-0b (Category B). Constructing a third cable now would address the eventual need for a third cable when the existing cables must be replaced, as well as reduce or eliminate the current risk of overlapping outages of the existing cables.

PG&E has concluded that the value of making the reliability investment reflected in the project is warranted based upon the risk of an overlapping outage of both existing Martin-Embarcadero cables; the impact that such an outage would have upon its customers in San Francisco; the reduction of risk resulting from the project; and the estimated cost of mitigating the risk through the project. The project will provide a third cable into Embarcadero Substation from Potrero Switchyard rather than Martin Substation. The Embarcadero-Potrero cable also will connect PG&E's 230 kV and 115 kV systems in San Francisco. Potrero Switchyard has a separate source of energy, the Trans Bay Cable, which can provide power so long as it is in operation and a sufficient amount of power reaches Potrero Switchyard through PG&E's 115 kV network to feed the TBC converter station adjacent to Potrero Switchyard. Future projects contemplated by PG&E and TBC may eliminate even this reliance on the existing 115 kV network.

In its *2011-2012 Transmission Plan*, the California ISO similarly concluded: "While the likelihood of the simultaneous loss of both circuits is low, the consequences of the outage are severe and require mitigation" (California ISO, 2012; page 107). With respect to the project, the Transmission Plan states: "The ISO has determined that this project is needed to address the reliability requirements of the area and is expected to be in-service in 2015" (page 108).

2.3 Proposed Project

The project will increase the reliability of the existing system by installing a new single-circuit 230 kV AC transmission line between Potrero Switchyard and Embarcadero Substation that is designed to continue operating following a reasonably foreseeable seismic event in the San Francisco area. This design-basis earthquake event is assumed to be a moment magnitude (Mw) 7.8 earthquake on the San Andreas Fault (see also Section 3.6, Geology and Soils), with a peak ground acceleration (PGA) determined at the 84th percentile motions (1 standard deviation above the median). The three-phase (three conductor) transmission line is designed to carry a continuous load of 400 megavolt amperes (MVA) (1005 A) and a 48-hour emergency rating of 458 MVA (1150 A).

On land, the three phases will be installed in a single underground duct bank; in San Francisco Bay the three phases will be installed as three separate cables underneath the Bay floor. PG&E will interconnect the new transmission line into a termination on the upgraded 230 kV bus at Embarcadero Substation and will install a new 230 kV switchyard adjacent to the existing 115 kV Potrero Switchyard. An overview of the project is provided in Figures 2-1 and 2-2.

2.4 Project Components

The project involves both transmission and substation/switchyard construction activities consisting of three major elements:

1. Construction of an approximately 3.5-mile, single-circuit 230 kV three-phase cable system in a submarine configuration, with land-based interconnections to Embarcadero Substation and Potrero Switchyard. The transmission line includes the following (see Table 2-1):
   - 0.6 mile of underground 2500 thousand circular mils (kcmil) XLPE copper cable installed in a duct bank with PVC conduits from the substations to the landing point for the submarine cable, using open trenching
   - 0.4 mile of transitional sections, with 1400 square millimeter (mm^2) (2800 kcmil) XLPE copper cable installed in high-density polyethylene (HDPE) conduits using HDD methods, where the submarine cable transitions from on-shore to off-shore

- 2.5 miles of three parallel 1400 mm^2 (2800 kcmil) XLPE copper submarine cables laid underneath the sea floor of the San Francisco Bay

TABLE 2-1
Transmission Line Sections, Approximate Length
Embarcadero-Potrero 230 kV Transmission Project

Transmission Line Section	Approximate Length
Northern underground segment from Embarcadero Substation to transition manhole at Spear Street	0.4 mi
Northern HDD section	0.2 mi
Main north/south submarine section Typical Cable Burial Depth – Offshore	2.5 mi
Southern HDD section	0.2 mi
Southern underground segment from Potrero Switchyard to transition manhole on 23rd Street	0.2 mi
Overall Length, Embarcadero Substation to Potrero Switchyard	3.5 mi

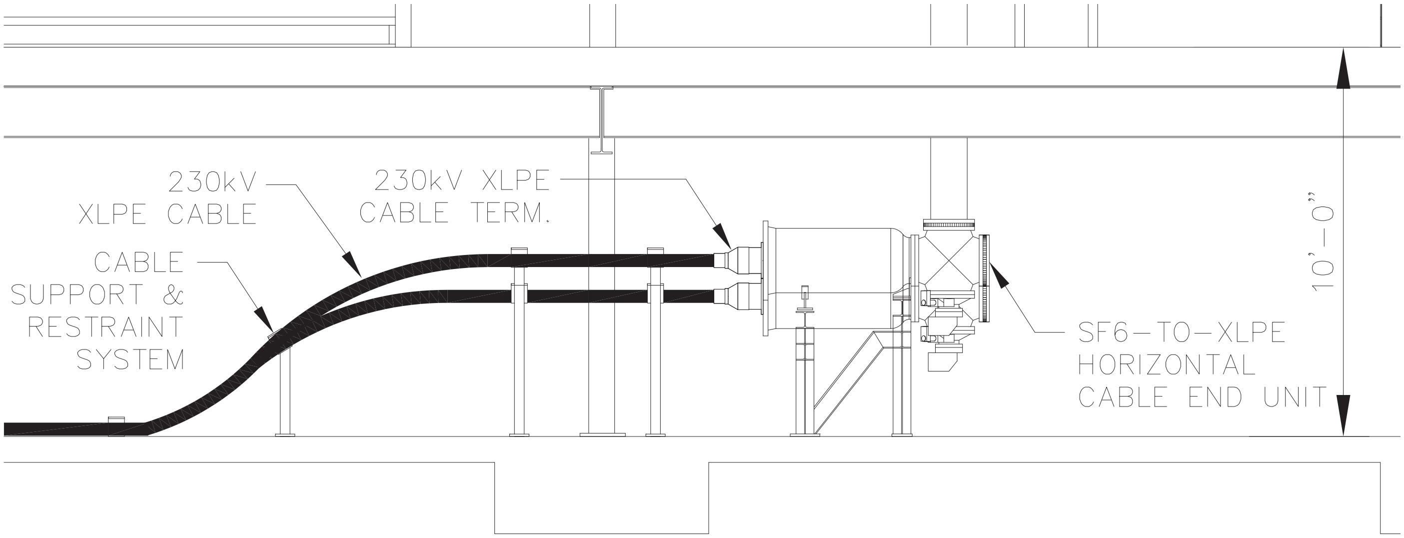
2. Termination of the new cable into the 230 kV bus at Embarcadero Substation. No new substation work at Embarcadero Substation is required beyond that already underway in a separate reliability project involving design changes and equipment replacement at Embarcadero Substation (the Embarcadero Substation 230 kV Bus Upgrade Project). See Figure 2-8, Typical 230 kV Cable Termination.
3. Construction of a new 230 kV switchyard near the existing Potrero Switchyard at the termination of the new cable and interconnection of the new 230 kV switchyard and the existing 115 kV Potrero Switchyard via two new 230/115 kV transformers (see Figure 2-7). The power to the new 230 kV switchyard is fed from the existing 115 kV switchyard.

In addition, construction will require equipment staging sites, laydown yards, equipment and material storage areas, and areas to temporarily store excavated materials near the substations and land routes.

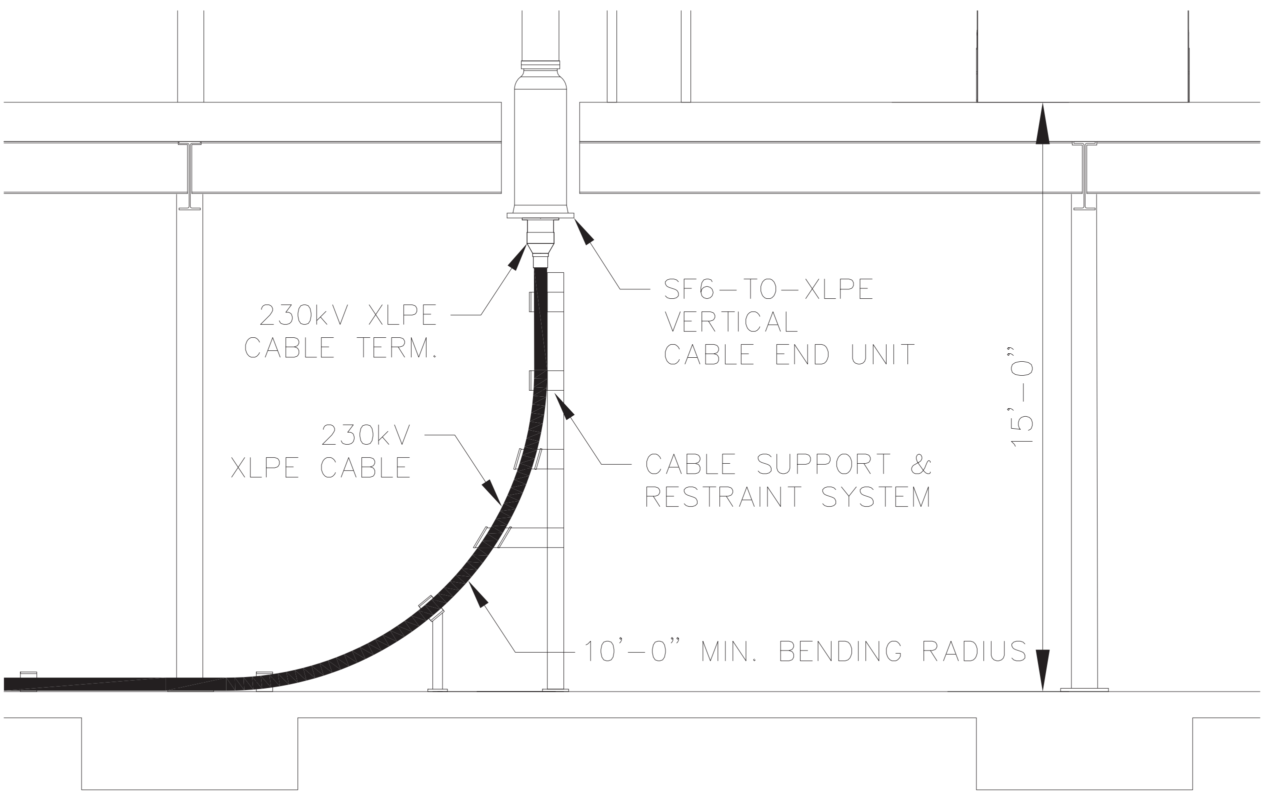
2.4.1 Underground Cable

The two short underground sections connecting Potrero Switchyard and Embarcadero Substation to their respective transition manholes will consist of solid-dielectric XLPE copper conductor underground land cables installed in a buried concrete-encased duct bank system. The dimensions of the duct bank will be approximately 3 feet 7 inches wide by 3 feet 4 inches in height (see Figure 2-9, Typical Duct Bank). The trench to be excavated to install the duct bank will be slightly larger, typically approximately 4 feet 6 inches wide by 10 feet deep. The underground cable system will consist of one 230 kV-rated circuit using one cable per phase. The three electrical cables will be contained within three 8-inch-diameter PVC conduits with one additional conduit left open as a spare for future use should a single cable fail. Fiber optic lines for system protection and communication will be housed in two 4-inch-diameter conduits that will be installed alongside the 8-inch-diameter conduits and within the concrete duct bank.

Most of the duct bank will be in a two-by-two duct configuration, as seen in Figure 2-9, with the potential for occasional transitions to a flat configuration to clear substructures in highly congested areas or to fan out to termination structures at the switchyards.



Horizontal Alternative

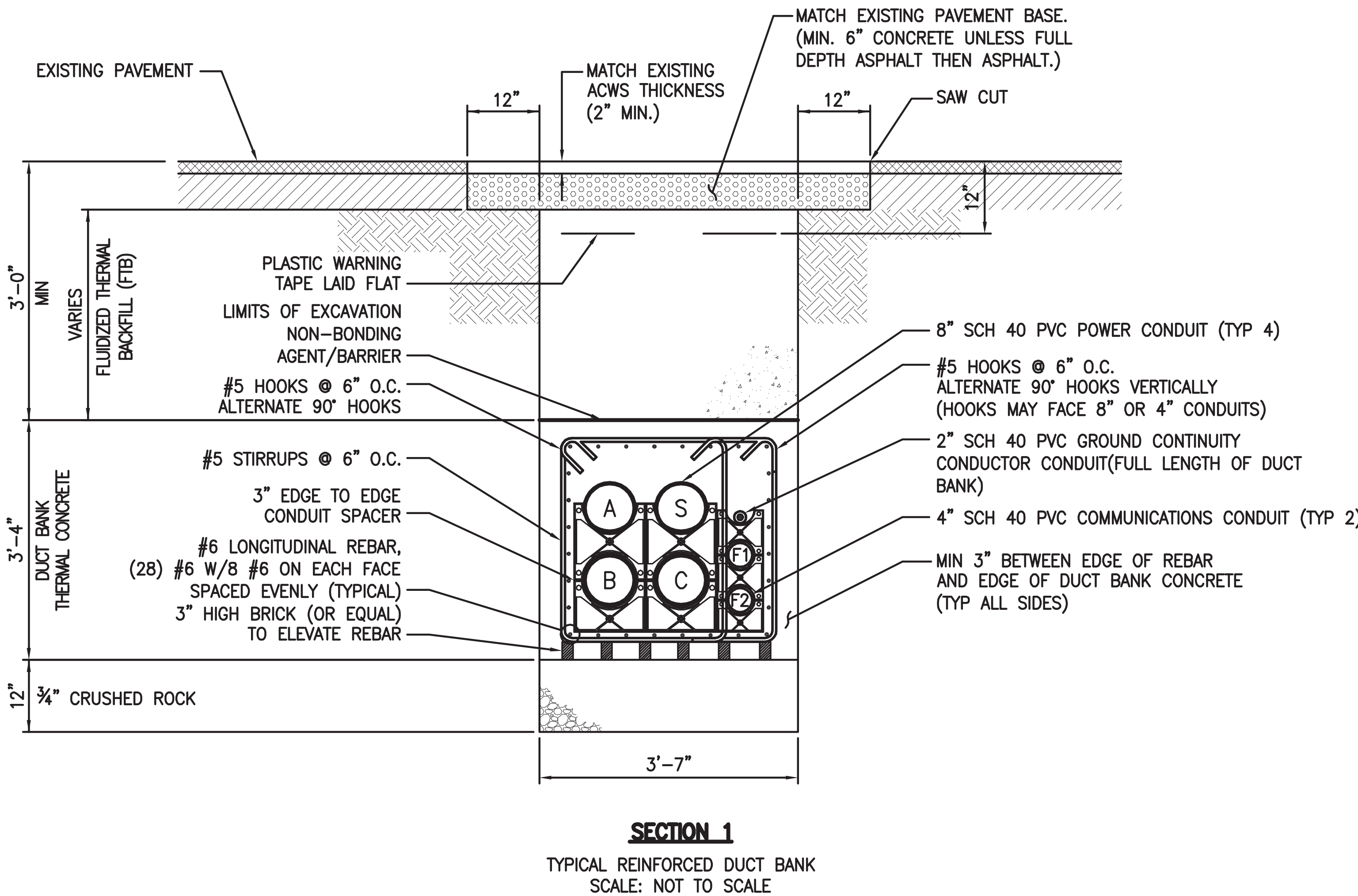


Vertical Alternative

Source: ABB, 2012.

FIGURE 2-8
Typical 230 kV Cable Termination
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

ES053112203245SFO Fig-2-8_Typical_230kV_Cable_Termination.ai ez 08.09.12



Source: Black & Veatch, 2012.

FIGURE 2-9
Typical Duct Bank
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

insulated switchgear substation at Embarcadero Substation via a concrete-encased vault, or into the existing 230 kV bus in the basement of Embarcadero Substation if the upgrade to the bus is not complete. See Section 2.4.4, Potrero Switchyard, for a description of the work planned as part of the project to interconnect the cables to Potrero Switchyard.

The three copper conductor extruded dielectric cables that make up one circuit will be capable of carrying 400 MVA at the normal conductor temperature rating of 90 degrees centigrade, and capable of carrying up to 458 MVA for 48 hours under emergency conditions with a conductor temperature of 105 degrees centigrade.

The southern underground segment out of Potrero Switchyard to the on-shore HDD location will be approximately 0.2 mile. The cable will exit along the southern boundary of the 230 kV Potrero Switchyard in an underground concrete duct bank and then turn east beneath 23rd Street. The route continues east for approximately 800 feet to the HDD location, approximately 200 feet from the shoreline.

The northern on-shore underground segment from the on-shore HDD location on Spear Street into Embarcadero Substation will be approximately 0.4 mile. This segment will extend from the HDD landing location on Spear Street, continuing northwest along Spear Street in a reinforced concrete duct bank.

The route turns southwest onto Folsom Street toward Embarcadero Substation, where the cables will be terminated into a gas-insulated switchgear (GIS) substation. Live equipment and bus-bars in GIS substations are housed in grounded metal enclosures that are sealed and filled with sulfur hexafluoride (SF_6) gas. SF_6 insulation properties allow GIS substations to occupy only 5–20 percent of the space occupied by an equivalent air-insulated switchgear (AIS).

Throughout the length of the cable, an approximately 12-foot minimum bending radius will be maintained, and proper support and cable restraint will be applied per PG&E UG Transmission Design Criteria (ETLS068192) and Installation Guide (ETLS072140) standards.

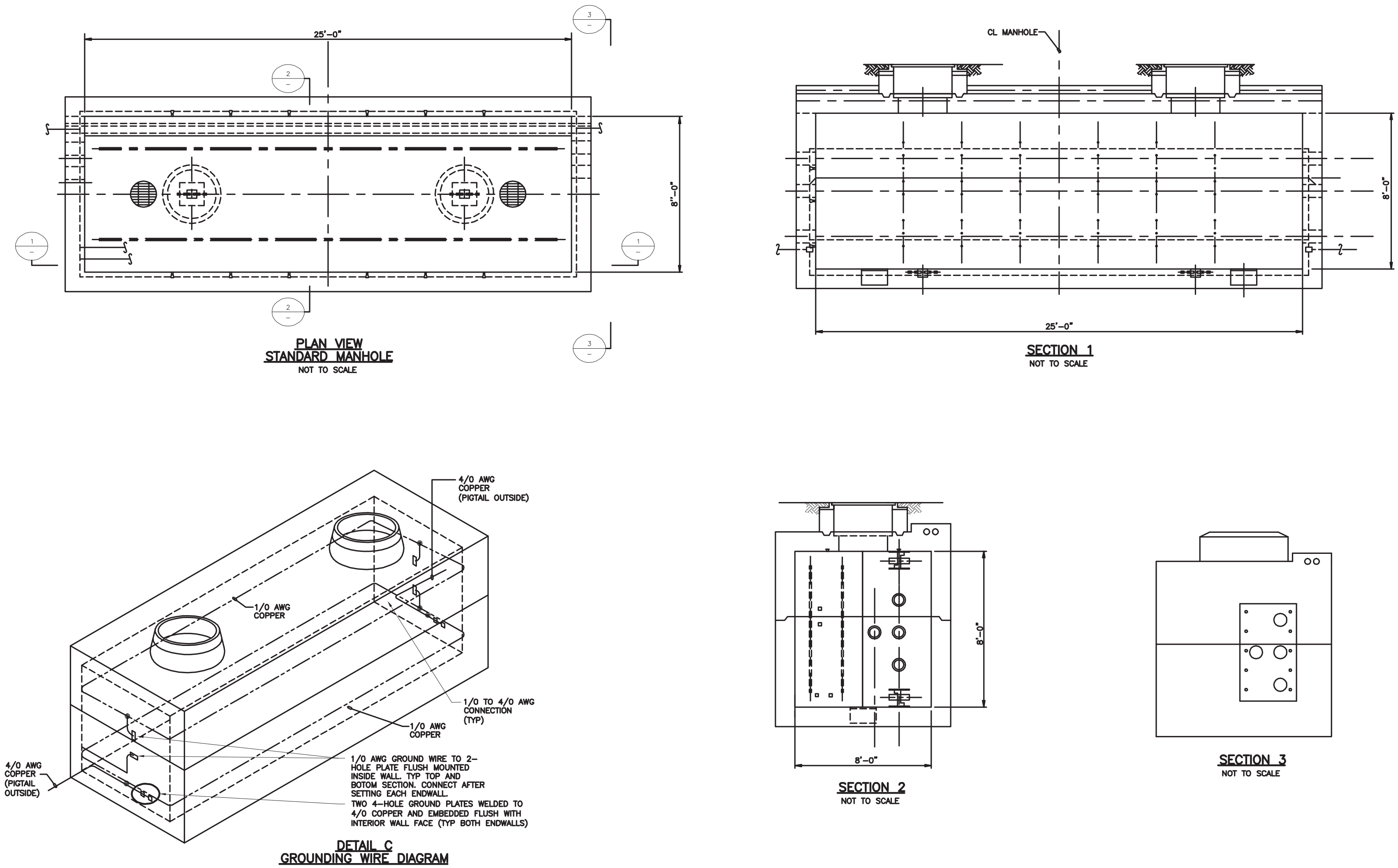
2.4.2 Submarine/Underground Transition Locations

The cables will make two transitions from land to the marine environment: one on the southern end of the route on 23rd Street near Potrero Switchyard (see Figure 2-11, Potrero HDD Transition Area) and one on the northern end of the route at Spear Street, en route to Embarcadero Substation (see Figure 2-12, Embarcadero HDD Transition Area). Each transition location will require three HDD borings approximately 1,000 feet in length to transition the three submarine cables, ground cable and communications cable to land. Three HDDs will be spaced at approximately 10 feet apart on land and gradually flared out to form an approximately 33- to 150-foot separation in water (Figure 2-13, Transition Area Cable Layouts)**.**

The submarine cables will be spliced to the underground land cables in the on-shore transition manholes.

2.4.2.1 Southern Submarine/Underground Transition (Potrero)

The southern landing near Potrero Switchyard will be in 23rd Street, approximately 200 feet from the water's edge. The location at 23rd Street avoids redevelopment plans for Pier 70 (see also Section 3.10 Land Use and Chapter 5. Cumulative Impacts) and will allow the submarine route to land north of the Trans Bay Cable and south of Potrero Switchyard. At this location, the underground duct bank will split into three single-phase manholes in 23rd Street for the purpose of transitioning from underground cable to submarine cable. Water depth in the Bay near the on-shore portion of the HDD boring is less than 10 feet for the first 400 feet; it then gradually slopes down and levels off to a depth of approximately 35 feet about 1,500 feet from the shoreline.



Source: Black & Veatch, 2012.

FIGURE 2-10
Typical Manhole
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

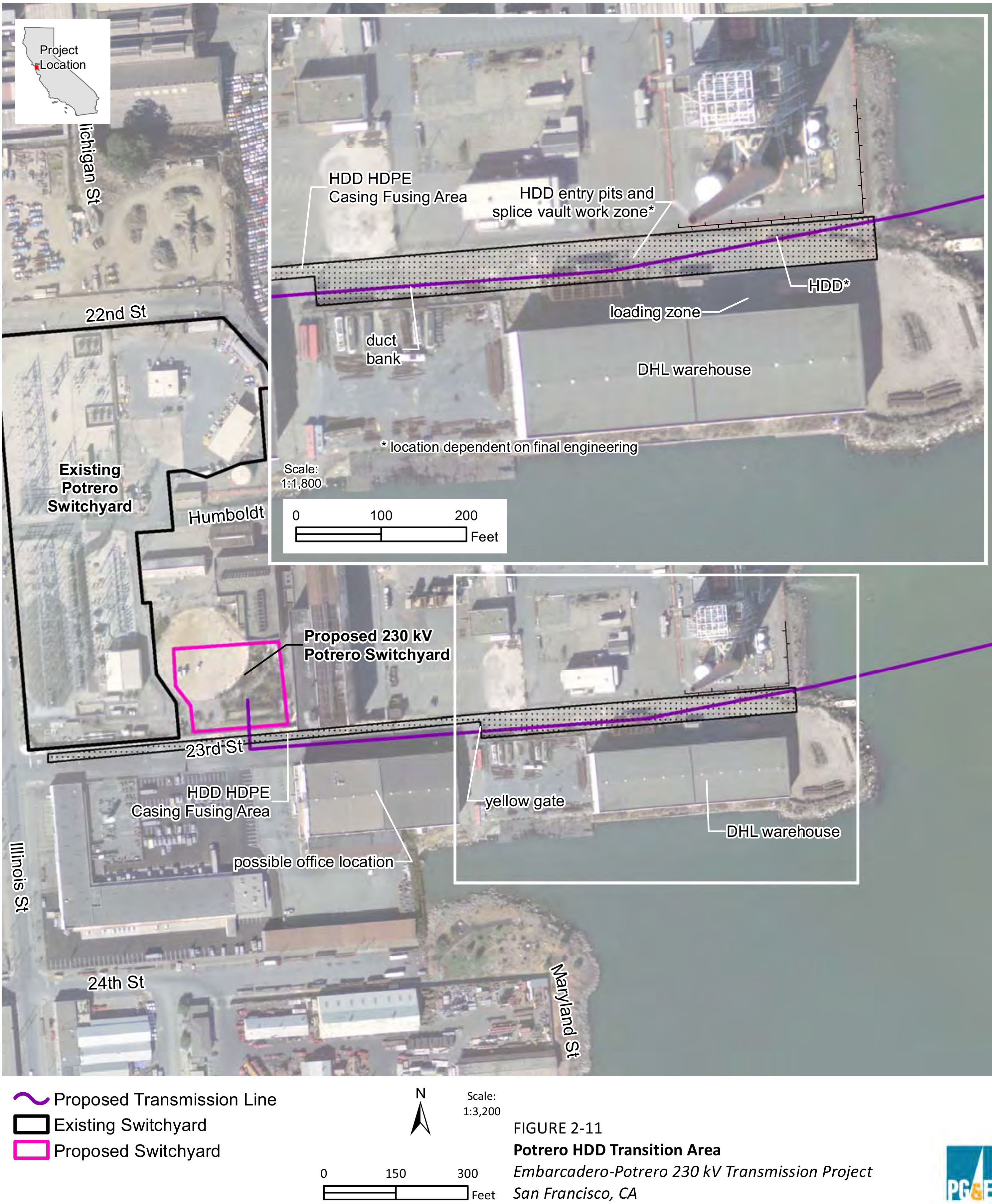


FIGURE 2-11

Potrero HDD Transition Area

Embarcadero-Potrero 230 kV Transmission Project

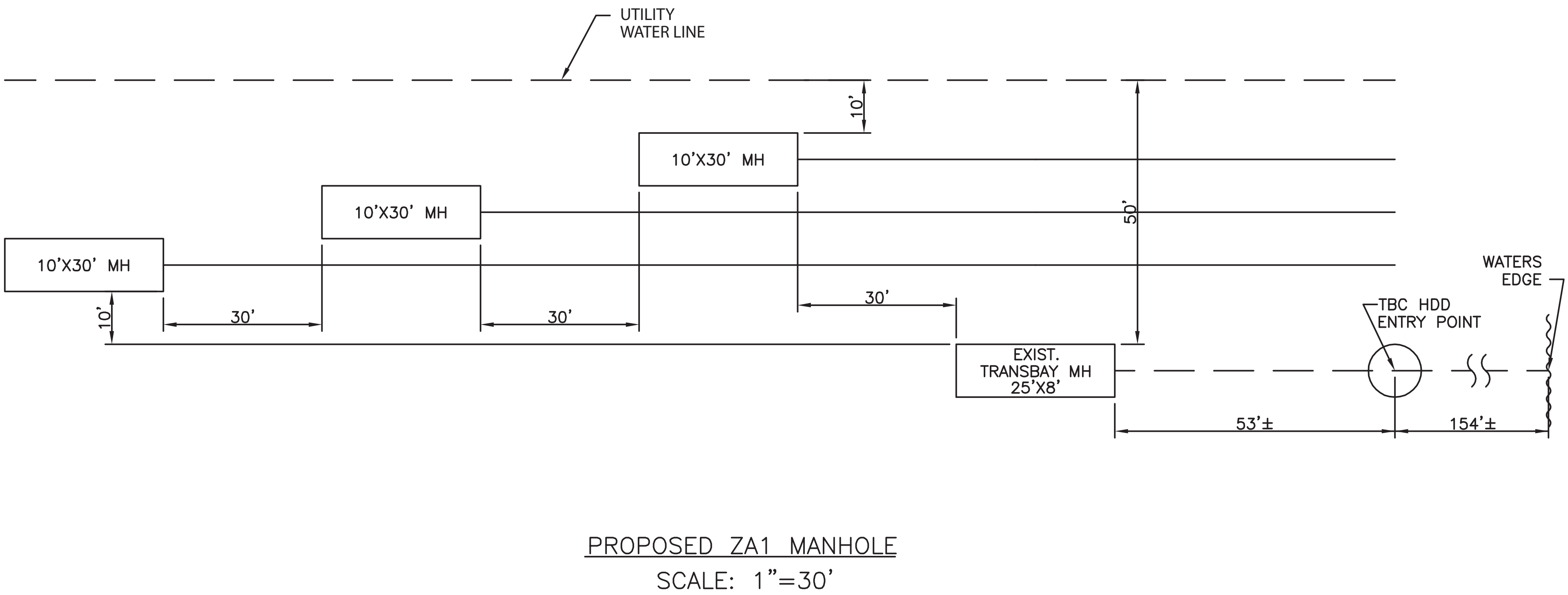
San Francisco, CA

FIGURE 2-12

Embarcadero HDD Transition Area

Embarcadero-Potrero 230 kV Transmission Project

San Francisco, CA



Source: Black & Veatch, 2012.

LEGEND

MH = Manhole
TBC = Trans Bay Cable

FIGURE 2-13
Transition Area Cable Layouts
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

2.4.2.2 Northern Submarine/Underground Transition (Embarcadero)

The HDD rig for the northern landing will be staged in the eastern-most block of Spear Street, directly under the Bay Bridge. This block of Spear Street is a cul-de-sac with no through traffic. The northern landing location on Spear Street also avoids plans to redevelop Piers 30/32 (see also Section 3.10 Land Use and Chapter 5. Cumulative Impacts) and will allow the submarine cables to more easily transition from water to land.

The transition onshore near Embarcadero Substation is steeper than near Potrero Switchyard. Water depth is near 80 feet about 850 feet east of Piers 28 and 30/32 and then slopes up steeply towards the seawall, climbing approximately 25 feet vertically over a 50-foot horizontal distance (See Figure 2-14, Geologic Profile of North Transition from Land to Marine). Given this steep transition zone, the HDD installation will be extended beyond the toe of this slope to locate the exit point within a flatter area. This extension improves constructability and avoids potentially creating, or being affected by, bay floor stability problems in the area of the steep slope.

2.4.3 Submarine Cable

For the submarine portion of the project, PG&E will install three parallel cables (one for each phase of the circuit); the circuit ground wire and the communications cable will each be bundled with separate phase cables. The cables will have a minimum separation of approximately 33 feet in the shallower water areas and a maximum separation of approximately 150 feet in the deeper water areas. Typically, submarine cables will be separated from one another by a distance equal to two or three times the water depth (see Figure 2-15, Typical Submarine Cable Layout). This separation provides mechanical protection and facilitates any necessary repair activities. Expected and typical project submarine cable components are shown in Table 2-2. At the northern HDD under The Embarcadero, the depth will be a minimum of 50 feet, which is greater than the typical depth shown, to avoid the existing sewer collection/transportation box and the rock dike at the shoreline.

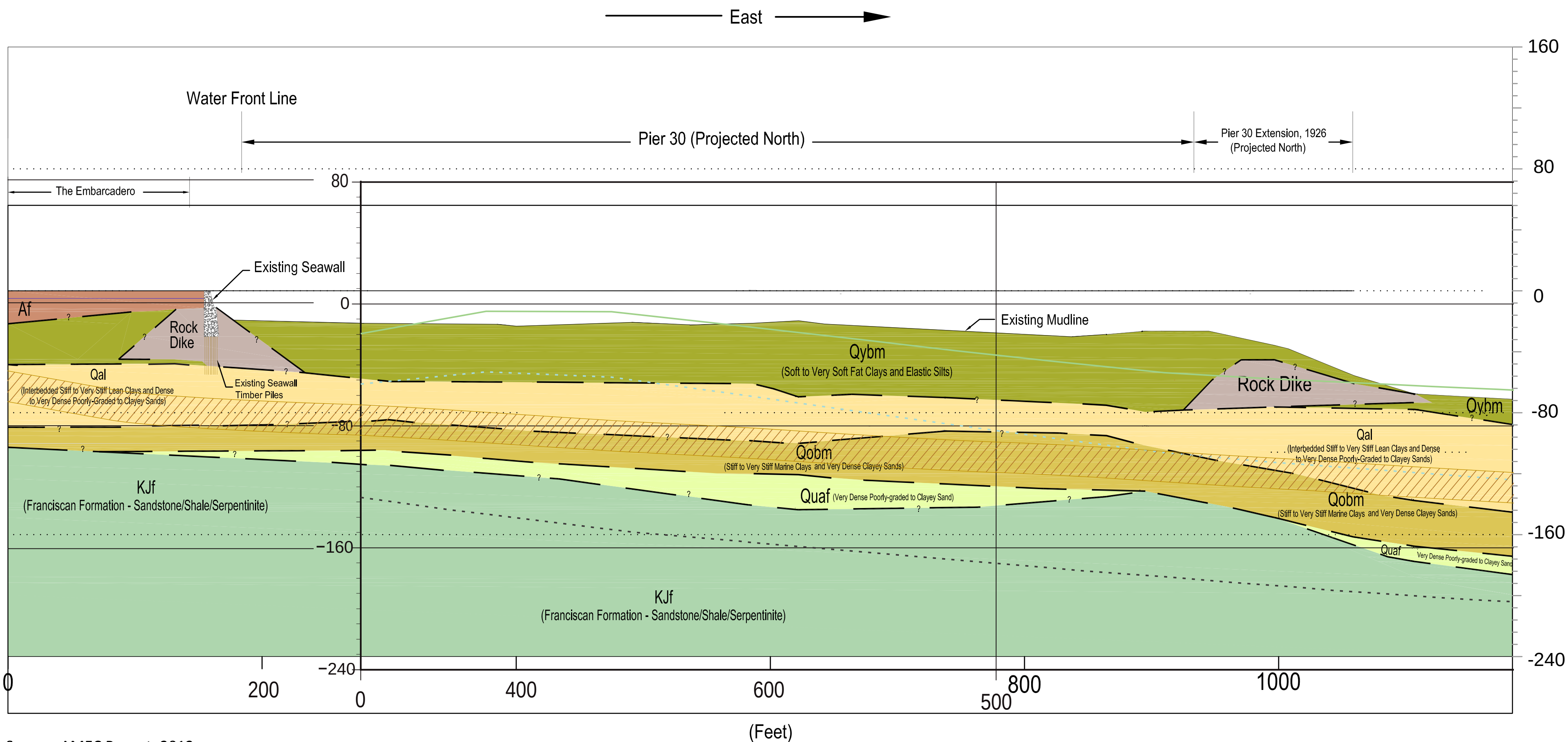
TABLE 2-2
Submarine Cable Project Components and Approximate Distances and Depths
Embarcadero-Potrero 230 kV Transmission Project

Submarine Cable Project Component	Approximate Distances and Depths
Approximate Submarine Cable Route	2.5 miles
Maximum Sea Water Depth	80 feet
Typical Cable Burial Depth – Offshore	6 - 10 feet
Typical Cable Burial Depth – HDD	30 feet
Expected Minimum Cable Spacing – Offshore	33 feet
Expected Maximum Cable Spacing – Offshore	150 feet
Expected Minimum Cable Spacing – HDD	10 feet

The submarine cable system will consist of one 230 kV-rated circuit using one single conductor cable per phase. The armored solid-dielectric, XLPE copper conductor submarine cables will be directly buried using a hydroplow into the bay floor to a depth of approximately 6 to 10 feet below the bay floor.

From the bayside termination of the southern HDD, the cables will turn north toward Embarcadero Substation while maintaining a minimum horizontal separation of approximately 33 feet. This northerly direction will continue for approximately 2.35 miles before gradually turning back to the west as it approaches the shoreline at Berth 30, between Piers 28 and 30/32.

As the route starts to turn north from the southern landing location, the water depth slopes gradually to 40 feet. The water depth in the center section of the route moving northward varies between 40 to 58 feet. Near the northern transition point, the water depth increases to 80 feet approximately 850 feet east of Piers 28 and 30/32.



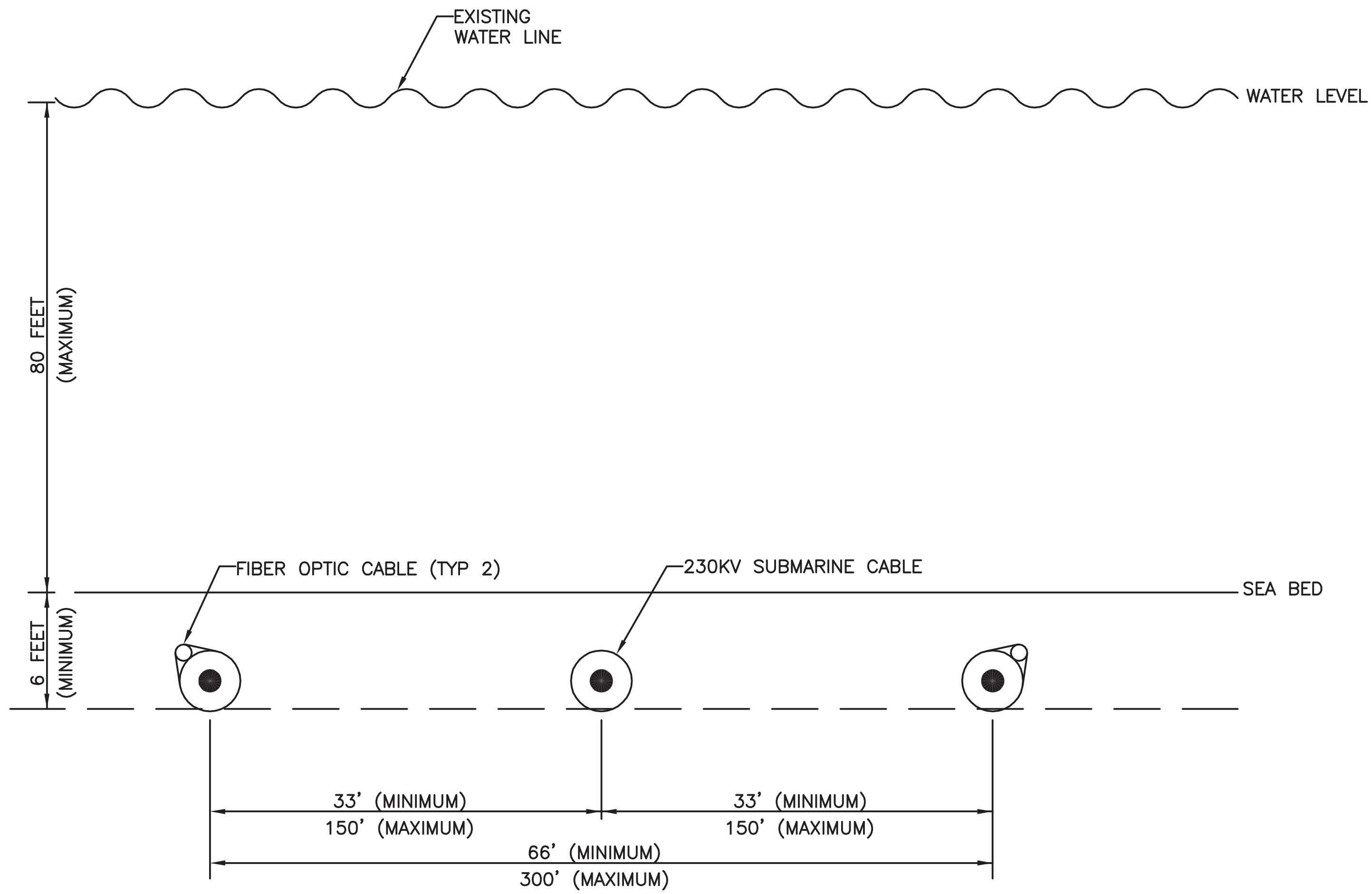
Source: AMEC Report, 2012.

LEGEND

- Af — Artificial Fill
- Rock Dike
- Qybm — Young Bay Mud
- Qal — Alluvial Deposits
- Qobm — Old Bay Mud
- Quaf — Alameda Formation
- KJf — Franciscan Formation - Shale
- Bottom of Bay Mud (CDMG 1969)
- Top of Bedrock (CDMG 1969)
- Bottom of Bay Mud from Nearby Explorations
- Top of Bedrock from Nearby Explorations
- HDD Path

FIGURE 2-14
Geologic Profile of North Transition from Land to Marine
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

ES053112203245SFO Fig-2-14_Geologic_Profile.ai ez 07.27.12



SUBMARINE CABLE INSTALLATION CROSS SECTION

NOT TO SCALE

Source: Black & Veatch, 2012.

FIGURE 2-15
Typical Submarine Cable Layout
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

The water depth decreases as the route approaches the seawall and is less than 10 feet at the seawall between the piers.

The route avoids charted wrecks and identified obstructions, including abandoned piers located in the northern portion of the route as well as established charted cable areas and the Trans Bay Cable. To reduce the risk of interference with maritime traffic, the route is located west of the established north/south shipping lanes used by commercial and naval traffic that travel into and out of the bay. Designated anchorage areas are located east and southeast of the submarine route. An armored 1400 mm^2 (2800 kcmil) cable with copper conductor, XLPE insulation, and a lead sheath will be used to meet the project ampacity requirements (Figure 2-16, Cross Section of the Proposed 230 kV XLPE Submarine Cable). Submarine cable sizes are expressed in square millimeters and English units because they are designed to International Electrotechnical Commission standards (non-US based standards). This sizing is based on the typical HDD depth and conservative design parameters. During detailed design, refined ampacity calculations will support final design parameters. The preliminary ampacity study size results are listed in Table 2-3.

TABLE 2-3
Required Cable Sizes for the Transmission Line
Embarcadero-Potrero 230 kV Transmission Project

Section	Required Cable Size
Marine Section	1400 mm^2 (2800 kcmil) Submarine Cable
HDD Sections	1400 mm^2 (2800 kcmil) Submarine Cable
Underground Sections	2500 kcmil Underground Cable

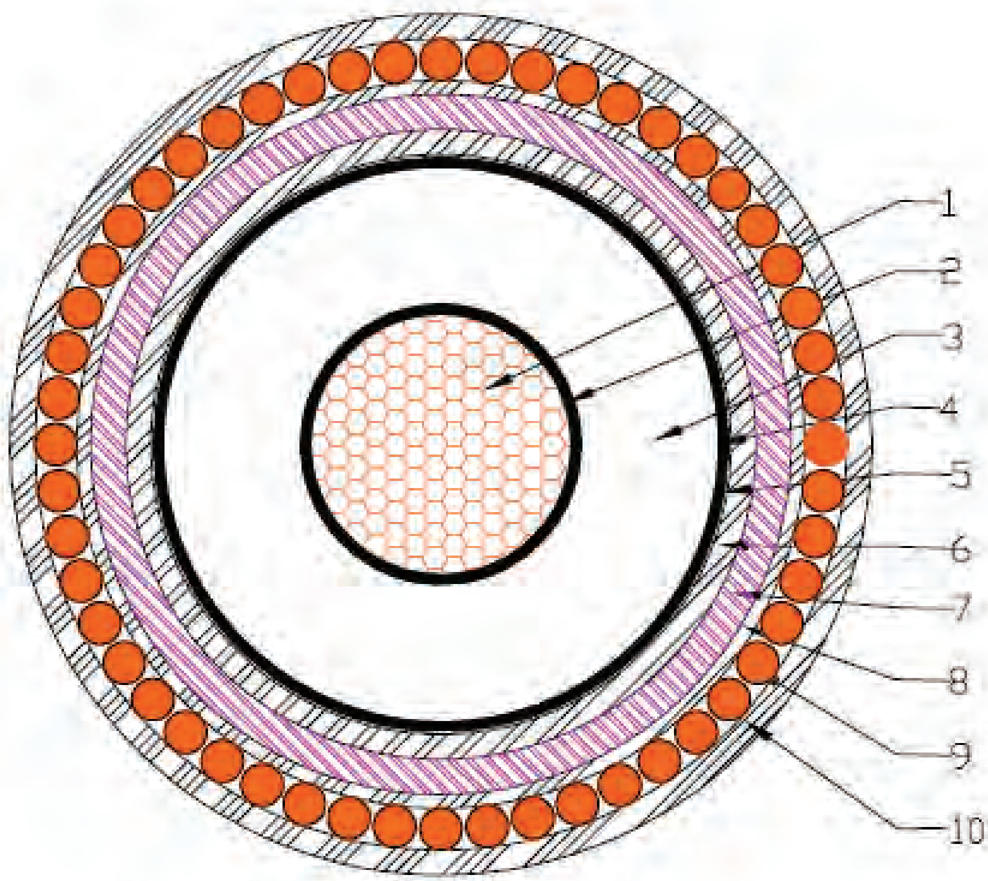
2.4.4 Potrero Switchyard

The existing Potrero Switchyard has no 230 kV equipment. Therefore, to accommodate the new incoming 230 kV cable, the project will include construction of a new 230 kV switchyard near the existing 115 kV switchyard. The proposed location for the new switchyard is on a parcel owned by GenOn Energy, Inc., located on 23rd Street, adjacent to and east of the existing switchyard (see Figure 2-7).

Due to space constraints, the new 230 kV switchyard (including a new 115 kV portion) will need to feature gas insulated switchgear equipment. The GIS equipment, associated Modular Protection, Automation and Control (MPAC), and station service systems will be housed in an estimated 8,500 square foot pre-engineered metal building with an equally large basement (see Figure 2-17, GIS Building Conceptual). The basement will contain electrical conduits, trays and cables to interconnect the electrical equipment on the main floor. The building will be approximately 40 feet above grade to accommodate the height and maintenance requirements of the electrical equipment. In addition, outdoor equipment will be partitioned from the GIS building with firewalls. The outdoor equipment includes one new 230/115 kV transformer, one new 230 kV shunt reactor, and their respective cable-to-air bushing connections. The design will include spare bays that allow for the future installation of an additional 230 kV transformer and shunt reactor. Duct banks to the existing 115 kV Potrero Switchyard, as well as for the new 230 kV ZA-1 cable, will enter the new substation building via the basement (see Figure 2-18, 230 kV Electrical Equipment).

At the existing Potrero Switchyard, new power cable connections will be made at the south end of 115 kV Bus Section "D" in existing Bay 3 via new cable transition structures. However, to make room for this connection, the bus-tie breaker 102 residing in Bay 3 may first need to be relocated to either Bay 11 or Bay 12 (see Figure 2-19, Interconnection with 115 kV System).

The new 230 kV switchyard will connect to the existing 115 kV switchyard through twelve underground 115 kV cables (i.e., two cables per phase). The cables will be connected to the existing 115 kV switchyard using six single-phase tubular steel termination poles, approximately 10 feet high (see Figure 2-19). The total height with the

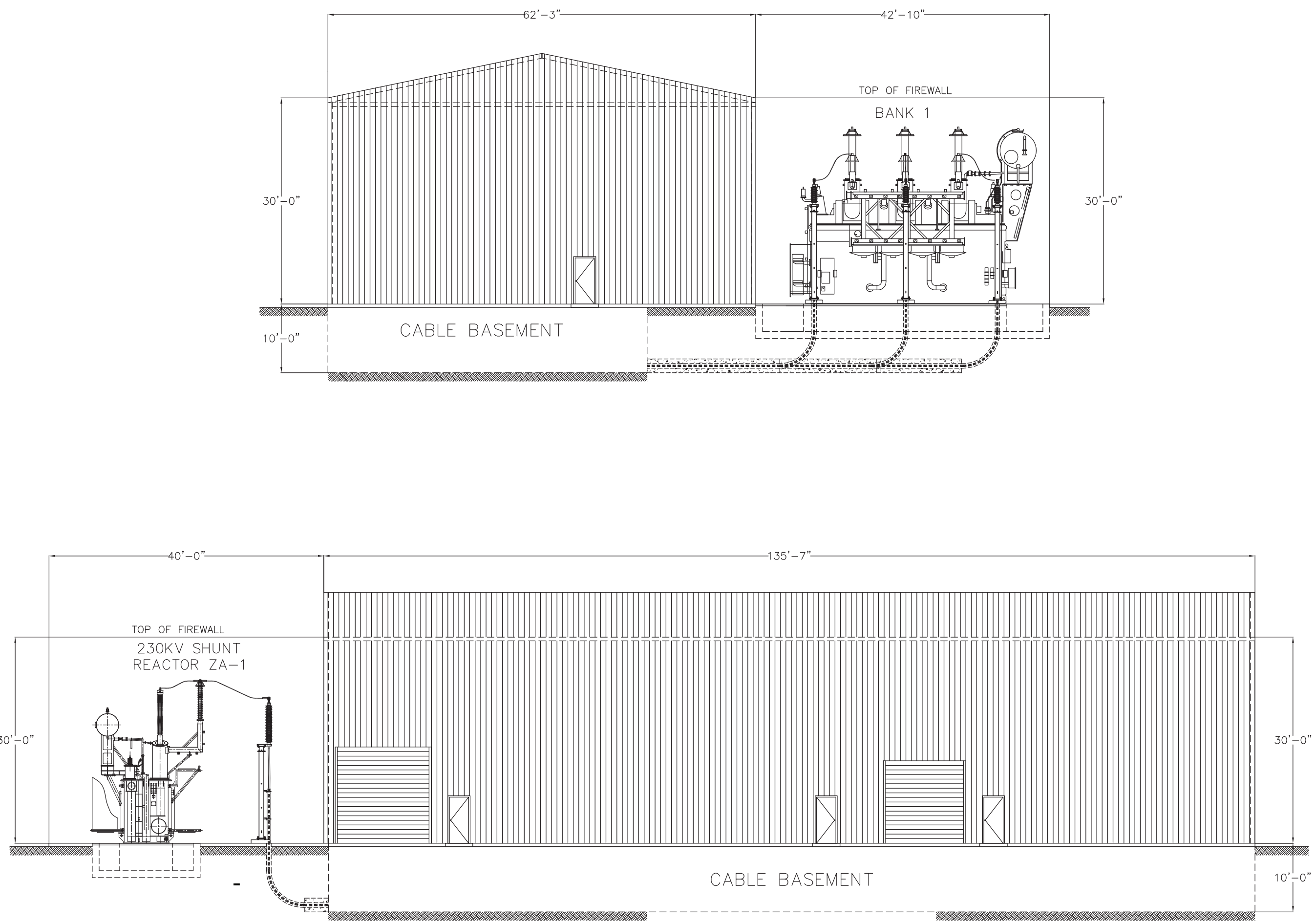


LEGEND

1. Water-blocked Conductor
2. Semi-conducting Conductor Screen
3. XLPE Insulation
4. Semi-conducting Insulation Screen
5. Longitudinal Water Barrier Layer
6. Lead Alloy Sheath
7. Black HD Polyethylene Sheath
8. Textile Bedding Layer
9. Copper Wire Armor
10. Polypropylene String Serving Layer

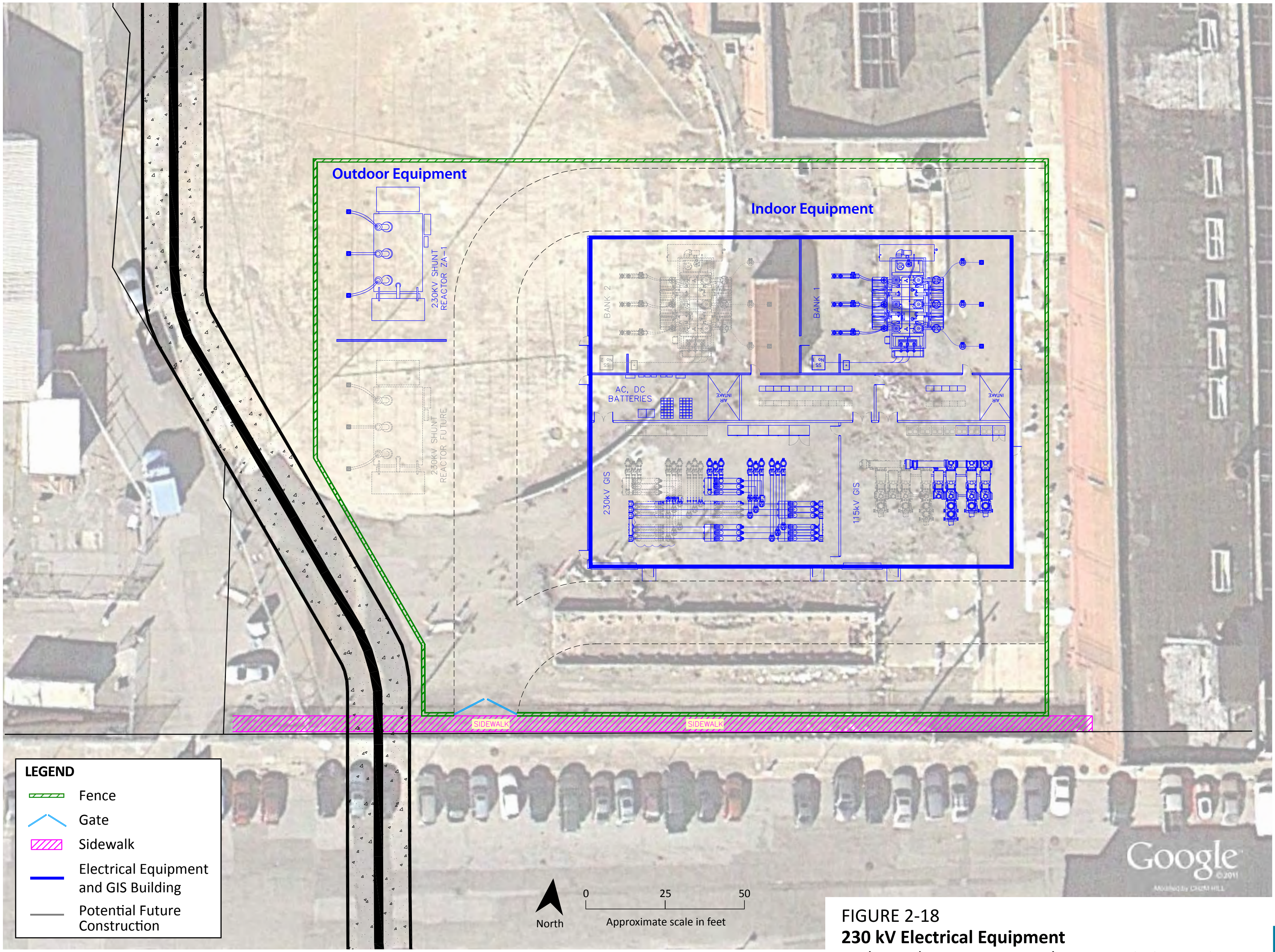
Source: PG&E, 230kV Submarine Cable Technical Specification, February 2012.

FIGURE 2-16
Cross Section of the Proposed 230 kV XLPE Submarine Cable
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA



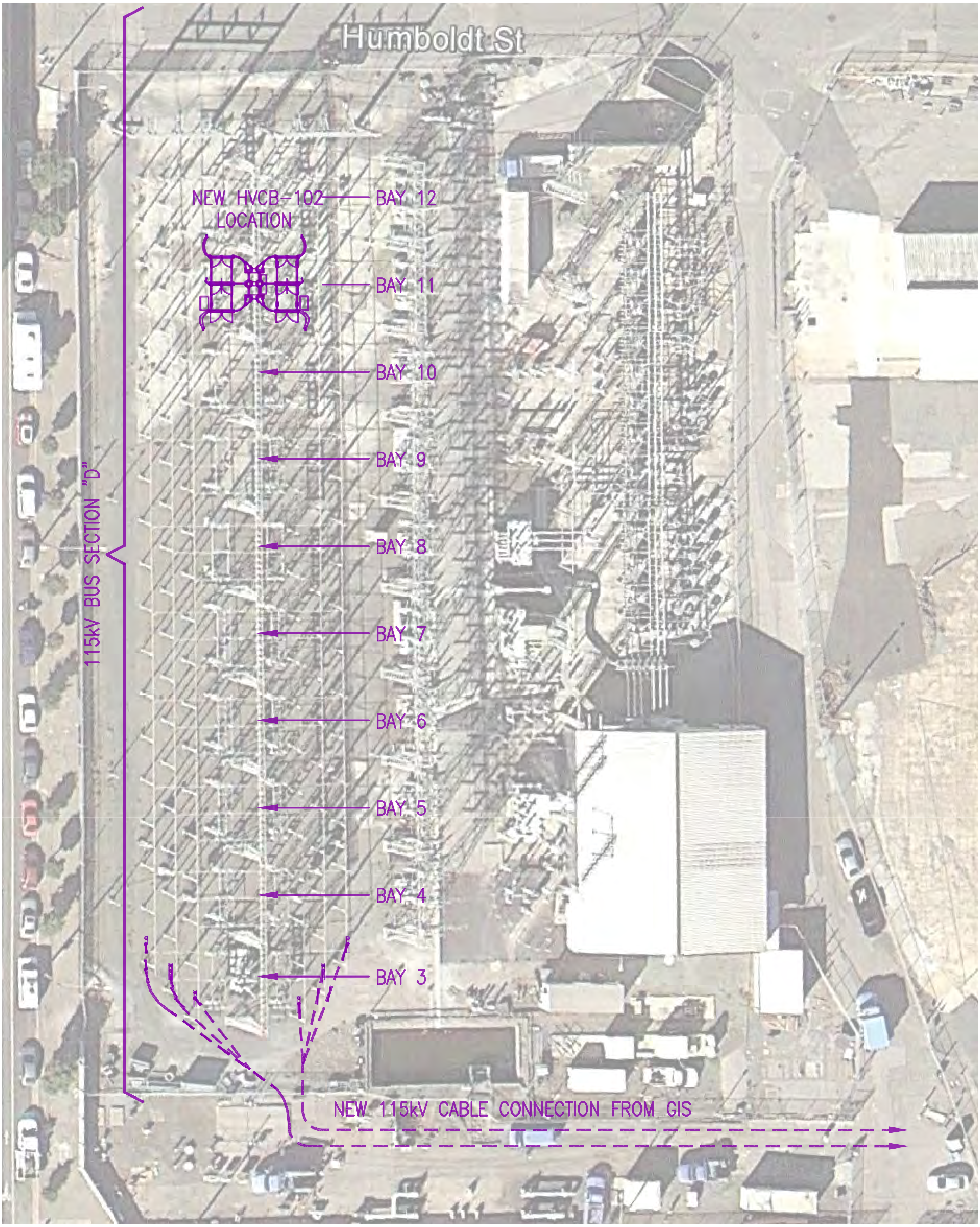
Source: ABB, 2012.

FIGURE 2-17
Potrero GIS Building Conceptual
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA



Source: Google Earth ©2011. Modified by CH2M HILL.

FIGURE 2-18
230 kV Electrical Equipment
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA



Source: Google Earth ©2011. Modified by CH2M HILL.

FIGURE 2-19
Potrero Interconnection with 115 kV System
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

termination potheads will be approximately 17 feet. The pothead will be connected to the existing 115 kV buses using flexible conductor. The height of the existing bus structure is approximately 34 feet.

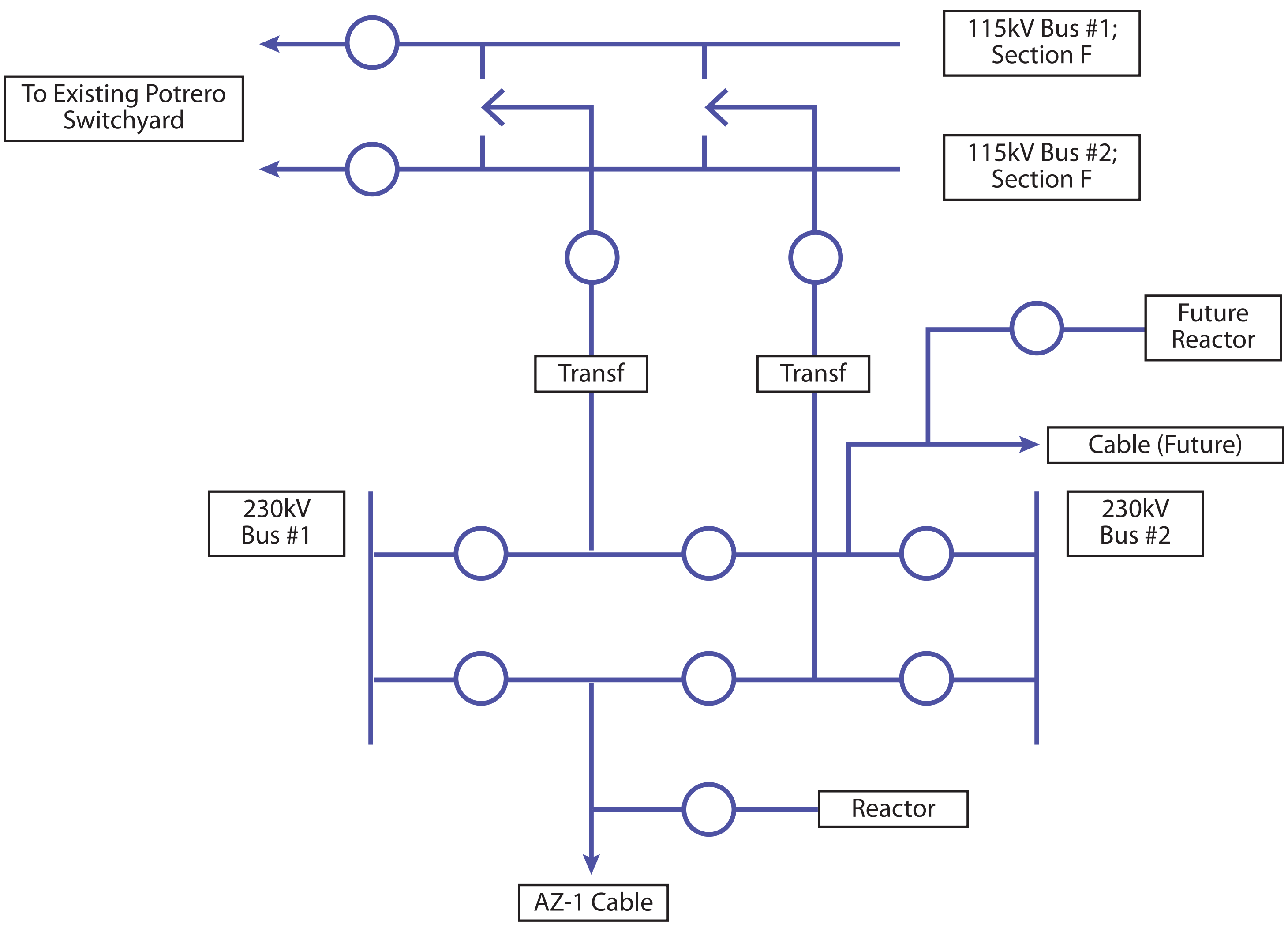
A non-pile driving method, such as the Tubex grout injection method, will be used to provide foundation support at Potrero Switchyard. The Tubex grout injection method uses a drill table to force a pile into the ground, then grout is injected under high pressure into the soil, a reinforcing cage or dowels are placed, and the pile is filled with concrete. This methodology produces no vibration, very low noise levels, and no soil removal is required for the foundation support, since the grout is injected into the native soil.

The new 230 kV GIS equipment is likely to be a two-bay, three-breaker ring bus, arranged to accommodate the future planned breaker-and-a-half (BAAH) configuration. The new 115 kV equipment would be one BAAH bay with two circuit breakers serving the new 230/115 kV transformer bank, with space for a future third circuit breaker and second 230/115 kV transformer bank. In a ring bus arrangement, circuit breakers are placed between transmission lines or transformer positions to form an interconnected ring; two circuit breakers are associated with each transmission line or transformer position, allowing removal of each circuit breaker for maintenance without affecting the operation of the transmission line or transformer position on either side of the circuit breaker. The BAAH bus arrangement consists of two main buses, connected through "bays" of three circuit breakers in series. Between each breaker are taps either for power coming in or loads going out. This arrangement allows power coming in to serve either or both busses, as well as allowing loads to be served by either or both busses. The failure of any one circuit breaker will not interrupt power for more than a brief time. The design also allows parts of the substation to be de-energized for maintenance and repairs without causing power interruption. An AIS BAAH configuration was also considered, but rejected as the space requirements would be more than double the space for a GIS system, as discussed in Section 5, Alternatives.

A single line diagram for the new 230 kV GIS switchyard is shown below in Figure 2-20, Single Line Diagram for New 230 kV Potrero Switchyard. The following major equipment will be installed in the new 230 kV switchyard or the existing 115 kV switchyard:

- Two 230 kV GIS BAAH bays, set up in ring bus arrangement with circuit breakers and disconnect switches (two breakers in one bay and one in the second bay for future BAAH equipment)
- One three-phase 230/115 kV, 420 MVA transformer bank with Load-Tap Change (LTC) and 12 kV station service transformers
- One 230 kV cable termination for the new Embarcadero-Potrero cable
- One spare position for a future 230 kV cable connection
- One 230 kV shunt reactor for the Embarcadero-Potrero cable with a circuit breaker and disconnect switch
- One spare position for a future 230 kV transformer bank, shunt reactor, circuit breakers, and disconnect switches
- Two 115 kV GIS Bus Sectionalizing breakers with associated disconnect switches
- One 115 kV GIS BAAH bay with circuit breakers and disconnect switches for the low-side of the 230/115 kV transformer bank, plus a spare position for the future bank
- Connection to the existing 115 kV substation
- 115 kV and 230 kV capacitance coupled voltage transformers (CCVTs) or potential transformers (PTs) as required
- An MPAC section for the 230 kV and the 115 kV equipment
- A battery to provide direct current (DC) power for the MPAC and the switchyard equipment

The new 230 kV cables will transition into and out of the switchyard via cable vaults and will be trained to cable connection points just below the 230 kV GIS. To provide the safest and most reliable interconnect, the cables will



Source: ABB 2012.

FIGURE 2-20
Single Line Diagram For New 230 kV Potrero Switchyard
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

be terminated into three single-phase cable-to-SF_6 GISs. All new equipment, including cable terminations, will be seismically qualified to the High Level of Institute of Electrical and Electronics Engineers (IEEE) 693. The new 230 kV Potrero switchyard building will meet the requirements of the California Building Code (CBC).

The sectionalizing breakers and relays will be located in the new switchyard. The GIS, MPAC, and stations service (i.e., AC power equipment to supply the building) will be contained inside a pre-engineered metal building similar to that used on the adjacent site for the TBC facility. A 12-foot by 12-foot rollup door will be used to access the 115 kV GIS, and a 14-foot by 14-foot rollup door will be used to access the 230 kV GIS. The transformer and shunt reactor bays will be outside of the building, but shielded from the street by the masonry wall around the perimeter of the facility. The walls of the metal building adjacent to the transformer and shunt reactor will incorporate 2-hour fire rated concrete masonry units.

2.4.5 Embarcadero Substation

2.4.5.1 The Existing Embarcadero Substation

Embarcadero Substation is located at the corner of Folsom and Fremont Streets in San Francisco. The substation is located in a multi-story building constructed in 1974. The exterior is clad in precast concrete architectural panels. The building is divided into three floors with 230 kV equipment and 230/34 kV and 34/12 kV transformer banks on the first floor; 12 kV metal clad switchgear, relay and control equipment, and station service and AC and DC equipment on the second floor; and 34 kV metal clad switchgear and capacitor banks on the third floor. The transformers are mounted on a reinforced concrete slab and beam floor system within compartments on either side of a central corridor.

Reinforced concrete columns support the first floor level, and extend to the basement floor, which is a reinforced concrete basement type foundation. The central corridor on the first floor level was designed to accommodate movement of the existing transformers. A basement lies beneath the entire building plan and is used for the medium voltage and 230 kV cable entry as well as the heating, ventilation, and air conditioning (HVAC) fans and motor control centers (MCC). At present, four 230/34 kV transformers terminals are connected to the 230 kV AIS buses through air-insulated tubing.

2.4.5.2 The Embarcadero Substation 230 kV Bus Upgrade Project

PG&E proposes to terminate the new Embarcadero-Potrero cable at a new 230 kV GIS that is under development as part of the separate Embarcadero Substation 230 kV Bus Upgrade Project. The Bus Upgrade is designed to address reliability risks associated with the existing bus configuration and is a separate project that will be undertaken whether or not this project is approved as proposed. The bus will include 230 kV equipment required for connection of the new Embarcadero-Potrero 230 kV cable, existing Embarcadero-Martin 230 kV cables, and connections to five 230/34 kV power transformers (four existing and one future). Although final design for the Embarcadero 230 kV Bus Upgrade Project has not been completed, PG&E currently anticipates that the new GIS equipment will be installed within a new above- or below-ground building on PG&E-owned land adjacent to the existing Embarcadero Substation, and thus become part of Embarcadero Substation. For more information on the Bus Upgrade Project, please see Section 4.2.1, Cumulative Impacts. If the Embarcadero Substation 230 kV Bus Upgrade Project is delayed beyond the date on which the Embarcadero-Potrero cable is ready to be interconnected, PG&E will modify the existing substation bus and ancillary equipment to allow for interconnection of the new cable into the existing substation until the 230 kV Bus Upgrade Project is complete and the cable can be relocated. The location of that alternative termination would be in the northwest corner of the existing substation, along Folsom Street.

2.5 Right-of-Way Requirements

The on-shore portions of the project, including the two HDD termination points, are located primarily in franchise in city streets or PG&E-owned property, with the exception of a portion of the southern landing area. No right-of-way (ROW) acquisition is required in public streets in franchise. The franchise (public ROW) extends from 23rd Street, terminating at the existing DHL private property gate, located approximately 760 feet from the San Francisco Bay shoreline. A Temporary Construction Easement (TCE) 50-feet wide will be acquired from the private property owner beyond the DHL gate, since it is private land. Upon completion of construction, a permanent easement 760 feet by 30 feet wide will be acquired for this piece of property for three landings and associated manholes.

In addition, the Potrero Switchyard site will be acquired in fee simple from landowner GenOn, and a License will be obtained from the Port for use of Port property (see Section 3.10, Land use and Planning).

At the northern landing area, the line will pass through City streets and areas owned by the State of California (Caltrans, for the portion under the Bay Bridge). The southeast end of Spear Street at the cul-de-sac is within franchise. The portion of the submarine route in the San Francisco Bay will require acquisition of land rights from the Port of San Francisco.

2.6 Construction

This section includes an overview of the construction methods typically used for construction of the underground and offshore portions of a 230 kV transmission line, and for work at Potrero Switchyard and Embarcadero Substation. This section includes discussion of the following:

- General construction considerations (Section 2.6.1)
- Underground transmission line construction, including vaults (Section 2.6.2)
- Substation and Switchyard construction (Section 2.6.3)
- Submarine construction, including the HDD sections (Section 2.6.4)
- Anticipated construction workforce and equipment (Section 2.6.5)

2.6.1 General Construction Considerations

2.6.1.1 Excavated Materials and Staging Areas

During construction, materials removed during trench excavation will be placed directly into trucks and removed from the area and disposed of off-site. The estimated total amount of materials to be disposed of is 6,000 cubic yards (cy) for duct bank and vaults, and 300 cy for the HDD pits. Materials that will be used for construction of the underground conduits, such as concrete, plastic conduit, and asphalt, will be stored on-site during construction or at a nearby industrial site leased from the Port of San Francisco or private property owners.

Project construction office space will either be located in existing commercial office space or in trailers to be located at one of these sites. Staging areas are typically used for office trailers, crew and equipment assembly areas, safety and tailboard training areas, equipment and materials storage, and vehicle parking. Depending on the particular site location, perimeter fencing may be used if none is currently in place. Staging areas could include portions of the existing or proposed Potrero Switchyard site, the Hoe Down Yard, or other paved or graveled sites. At the north end, staging could occur within city streets in closed lanes, or in one or more parking lots or other undeveloped areas near the project. Several areas of 1 to 3 acres would be preferred. Additional staging would occur in the locations shown as HDD work areas on Spear Street and at the foot of 23rd Street. Precise locations will be determined at the time of construction.

Precise locations will be determined based on what areas are available at the time of construction; the northern area in particular is in an area with ongoing development and the availability of a given area may change. It is anticipated that most of the staging areas would be located within 1 mile of the work areas. An off-site office in a developed area may also be sought, most likely in an industrial area.

Except for staging areas, electricity will be provided by portable "whisper-quiet" generators. The project will not require generators for the construction site office, given that the project will typically rent existing offices nearby. The project will not require generators at the Potrero Switchyard construction area, nor connection to the 115 kV bus, as the old power plant station service line and/or existing distribution lines will be used as temporary power sources.

2.6.1.2 Work Areas

The majority of the work areas are expected to be in franchise along the on-shore portion of the route and in the PG&E facilities at the Hoe Down and Laydown Yards (see Figure 2-7). Additional staging, laydown or work yards may be required at other existing industrial locations as well. In general, closure of one travel lane and one parking lane is expected during the duct bank construction, and approximately 150-300 feet of trench will be open at any one time. However, exact lane closures can only be determined following detailed investigations into existing utilities and final construction planning.

Trenching operations, including excavation and backfilling activities, would extend typically about 1,500 feet in length by 12 feet wide, based on a work crew progressively hauling off material as trench excavation is completed. Upon reaching final trench excavation depth, a second work crew secures the trench walls via shoring. Once the shoring process is complete for approximately 500 feet, another crew will install PVC conduit, providing a raceway for the electrical cable. Upon completion of PVC conduit laydown, the trench will be backfilled. This progression will continue to the point of termination at Embarcadero Substation and Potrero Switchyard. Final roadway restoration/ asphalt paving will be completed once all trenching operations are completed.

The lane closures areas and HDD work areas could require pavement saw cutting equipment, pavement grinder, excavators, dump trucks, HDD entry pits, splice vaults, HDD drill rig, a drilling mud return pit, poly tanks and frac tanks for groundwater and drill mud management, crew parking, sound barriers, water trucks, and similar construction equipment. Pavers would be used for restoration.

The HDD operation located at the Spear Street and 23rd Street landing site work areas would be approximately 500 feet by 60 feet at Spear Street to 800 feet by 50 feet at 23rd Street. These areas would be used for staging of material and equipment used for completing HDD work, including a platform drill rig, mud system for handling returns, mud pumps, vacuum trucks, and dump trucks.

Cable pulling will require an area approximately 200 feet by 12 feet for installation of the electrical cable. Cable installation will occur at the two consecutive manholes spaced approximately 1,800 feet apart. The reel trailer carrying the 12-by-6-foot wide reels will require the area previously described with the cable puller located approximately 1,800 feet away, requiring an area approximately 100 feet by 12 feet wide.

Cable splicing procedures will typically require a single crew truck directly adjacent to each manhole. Actual splicing will occur within the buried manhole with aboveground support. The work area required for this activity is typically approximately 75 feet by 12 feet.

2.6.1.3 Access Roads/Spur Roads

Existing San Francisco streets and state highways will be used to access the project area. No new access roads will be required since the onshore portion of the route is primarily in public roadways.

2.6.1.4 Vegetation Clearance

No vegetation clearance is expected for the project. All on-shore portions of the project will be underground, and all work areas will be in city streets or paved areas. In the event that vegetation clearance is needed, disturbance will be minimized to that needed for construction, and all temporarily disturbed areas will be restored to pre-construction condition once construction is completed.

Any roots from trees and deep-rooted shrubs will be pruned above the transmission line duct bank to avoid interference.

2.6.1.5 Erosion and Sediment Control and Pollution Prevention During Construction

PG&E will prepare and implement an Erosion and Sediment Control Plan as part of a Stormwater Pollution Prevention Plan (SWPPP) to be prepared for this project. Measures will address elements such as track-out controls, stockpile handling, dewatering discharge, drain inlet protection, and replacement of any disturbed pavement or landscaping. See Section 3.9, Hydrology and Water Quality, for additional information.

2.6.1.6 Cleanup and Post-Construction Restoration

Trash will be collected in bins or appropriate containers at the job site, then removed to the staging areas for off-haul to the appropriate solid waste facility. Soils are expected to be characterized for disposal in situ, and spoils and asphalt/concrete waste will be hauled off for appropriate disposal following characterization. All hazardous materials and hazardous wastes will be handled, stored, and disposed of in accordance with all applicable regulations, by personnel qualified to handle hazardous materials.

Areas used are expected to be paved for the most part, or could include graveled areas such as at the new or proposed Potrero Switchyard areas or the Hoe Down or Laydown Yards. Restoration typically consists of removal of equipment and materials and covering with gravel or paving depending on the original condition of the site.

All work areas, whether vegetated at the project's outset or not, will be restored to conditions equal to or better than pre-construction conditions. Vegetated areas disturbed by the project could include limited street- or landscaped areas that would be replanted per agreement with the City or landowner. As part of the final construction activities, PG&E will restore all removed curbs, gutters, and sidewalks, repave all removed or damaged paved surfaces, restore landscaping or vegetation as necessary, and clean up the job site.

2.6.2 Underground Transmission Line Construction

This section includes an overview of construction methods typically used for construction of underground transmission lines. The installation of the underground transmission line, duct banks, and splice vaults will be completed using a cut-and-cover method (open trenching) along the majority of the route. The following steps represent the major construction activities.

2.6.2.1 Step 1—Trenching/Duct Bank Installation

Prior to trenching, PG&E will notify other utility companies (via the Underground Service Alert [USA]) to locate and mark existing underground structures along the proposed alignments, and also will conduct exploratory excavations (potholing) to prove the locations for proposed facilities as needed. PG&E will apply for a ministerial Excavation Permit from the City for trenching in City streets. No complete long-term road closures are expected, although one-way traffic controls and short-term road closures will be implemented to allow for certain construction activities and to maintain public safety, as described in Section 3.16, Transportation and Traffic. After the route is marked, the pavement within the trenchline will be removed. The typical dimensions of a single circuit duct bank are approximately 3 feet 7 inches wide by 7 feet 4 inches deep, although typical dimensions may vary depending on soil stability and the presence of existing substructures (see Figure 2-9). The trench will be widened or shored where needed to meet California Occupational Safety and Health Administration (OSHA) safety requirements. Dewatering of the trench will be conducted using a pump or well points. The water will be pumped into containment tanks and tested for turbidity and pH values. The water will be discharged into the storm sewer system when the water meets quality standards; otherwise, it will be disposed of in accordance with state and federal standards.

An open trench length of 150 to 300 feet on each street will be typical at any one time, depending on the City of San Francisco's permitting requirements. Steel plating will be placed over the trench to maintain vehicular and pedestrian traffic across areas that are not under active construction. Traffic controls will also be implemented to direct local traffic safely around the work areas. PG&E will apply for a Special Traffic Permit from the City of San Francisco. PG&E will also coordinate provisions for emergency vehicle and local access with City personnel.

As the trench for the underground 230 kV cable is completed, PG&E will install the cable conduit and concrete encasement duct bank. The duct bank cover will measure at least 36 inches.

Where the electrical transmission duct bank crosses or runs parallel to other substructures (which have operating temperatures at earth temperature), a minimum radial clearance of 12 inches will be required. These substructures include gas lines, telephone lines, water mains, storm lines, and sewer lines. In addition, a 5-foot minimum radial clearance will be required where the new duct bank crosses another heat-radiating substructure at right angles. A 15-foot minimum radial clearance will be required between the duct bank and any parallel substructure whose operating temperature significantly exceeds the normal earth temperature. Such heat-radiating facilities may include other underground transmission circuits, primary distribution cables (especially multiple-circuit duct banks), steam lines, or heated oil lines.

PG&E will identify utilities during final design, evaluate their proximity and potential for induced current and/or corrosion, and in coordination with the utility-system owner, determine whether steps are necessary to reduce the potential to induce current or cause corrosion. PG&E will take the necessary steps in coordination with those utility system owners to minimize any potential effects through measures such as increased cathodic protection or utility relocation. The steps are summarized as follows:

- During final design, prepare study of corrosion and induced currents
- Send results of study to each affected Owner for review and comments
- Owners submit requirements for protection of each of their facilities
- PG&E makes changes accordingly or compensates owner for future protection measures, per their preference

Once the PVC conduits are installed, thermal-select or controlled backfill will be transported, placed, and compacted. A road base backfill or slurry concrete cap will be installed, and the road surface will be restored in compliance with the locally issued permits. While the completed trench sections are being restored, additional trenchline will be opened farther down the street. This process will continue until the entire conduit system is in place.

All backfilling material will be engineered material called flowable thermal concrete (FTC), and flowable thermal backfill (FTB). Each has unique properties specific to its application, while both are designed to have thermal characteristics for heat displacement. For a typical trench, the bottom 2 feet encases the PVC conduit with FTC, while the remainder of the trench is filled with City of San Francisco approved diggable "control density fill" FTB to the roadway sub-base level. From that point, all restoration is based upon matching the street's existing sub-base and surface, i.e., asphalt, concrete, or combination of the two.

Throughout construction of the trench, duct bank, and vaults, the asphalt, concrete, and other excavated material will be immediately hauled to a permanent disposal site. The excavated material will not be used as backfill. When necessary, clean backfill will be imported to the project area. Excavated materials will be tested and disposed of in accordance with applicable requirements.

The number of truck trips (see Section 3.16, Transportation and Traffic) will depend upon the rate of the trenching and the size of vault excavation. Jackhammers will be used when needed to break up sections of concrete that the saw-cutting and pavement-breaking machines cannot reach. Other miscellaneous equipment will include a concrete saw, various paving equipment, and pickup trucks. Table 2-4 in Section 2.6.5 below lists vehicles and equipment that are typically used to construct an underground transmission line project. In general, no equipment will be left at the trench site overnight, with the exception of an excavator.

2.6.2.2 Step 2—Vault Installation

The typical complete pre-cast vault installation usually takes 4 to 7 days, working 10 hours per day from breaking ground to finishing grade. An approximately 34 feet long, 14 feet wide and up to 15 feet deep excavation is performed using excavators. All excavated material is removed from the site, tested for appropriate disposal and hauled off to an appropriate land fill. Since numerous dump trucks are required for the hauling operation, trucks are staged near the construction site for rotating hauling activities. Staging and excavation requires approximately 1,500 square feet of work space. Dust control and wet sweeping best management measures are implemented during excavation.

This large vault excavation requires shoring components such as driven sheet piles, or slide rail steel sheeting. Once the initial excavation and shoring is installed, preparation of the sub base consists of the installation of crushed rock for leveling purposes. If present, ground water is tested then either pumped out to a controlled containment and discharge, or filtered and discharged directly into the ground. Control containment discharge can be performed in a variety of ways on site, such as using holding tanks (aka "Baker tanks") that allow acceptable de-sedimentation prior to discharge. Other control containment and discharge methods include pumping ground water directly to water trucks for haul off to a treatment facility, or with prior agreement and permits, can be discharged to a sewer. As is customary on similar projects, a special request for discharge and treatment of the estimated amount and cost of discharge will be developed and submitted to the SFPUC Bureau of Environmental Regulation Management. The water is expected to be sump pumped and discharged into the City's sewer system. The anticipated flows will be developed during final design. See also Section 3.9, Hydrology and Water Quality.

Once the vault preparation steps (excavation, shoring and finish grade leveling) are completed, setting the vault is performed via sectional lifts of the three vault pre-cast sections using either a hydraulic or a lattice type crane. With all sections of the vault set in place, backfilling can start as the shoring is removed.

The major equipment required for this construction phase consists of an excavator, pickup trucks, end dump trucks, stake trucks for material, 75 ton crane, crane riggers truck, tractor trailers for sheet piling delivery, tractor trailers for delivery of precast concrete manhole sections, and possibly water trucks and/or containment water tanks (Baker tanks).

Appropriate traffic control configuration is set up and in place ahead of the work described above and may include, without limitation: typical traffic control cones, candles, electronic signage board and temporary fixed warning signs for workmen prior to work zone in both directions, and Type III barricades for total road closures.

2.6.2.3 Step 3—Cable Pulling, Splicing, and Termination

This cable system consists of three major components: the cable, splices that connect cable sections, and terminators that connect the cable to the equipment at the substations.

Cable Pulling

A cable consists of three individual conductors (one per electrical phase) and a communication fiber optic cable. Pulling between two vaults typically takes approximately 2 to 3 days, working 10 hours per day. To pull each conductor through the duct bank, a cable reel is placed at the end of a duct bank section in a vault, and a pulling rig is placed at the other end of the duct bank section in another vault. With a small rope called a "fish line," a larger rope is pulled into the duct. The large rope is attached to pulling eyes on a conductor end, and the large rope pulls the conductor into the duct. To ease pulling tensions, a lubricant is applied to the conductor as it enters the duct. The three electric phases and one communication cable are pulled through their individual ducts at the rate of two of the three sections between vaults per day.

Cable Splicing

Prior to starting the actual splicing, the vault is outfitted with steel racks that will ensure the cable splices are securely affixed to the vault's inner walls. This activity usually is completed within 2 days. A splice trailer is positioned adjacent to the vault manhole openings. A mobile power generator will be located directly behind the trailer. The vaults must be kept dry twenty four hours per day to prevent water or impurities contamination of the unfinished splices. Splicing at one vault typically takes 5 days, working 10 hours per day. Therefore, installation of racking and splicing at each vault takes a total of approximately 7 days to complete.

Cable Termination

At the southern end of the route, the cable continues underground into the new Potrero Switchyard and connects to a transition structure approximately 10 feet in height. At the northern end of the route, the cable terminates into the Embarcadero transmission bus building in an underground configuration. Terminating the cable takes a similar amount of time as do the splices.

2.6.2.4 Jack and Bore or Microtunneling Construction

Jack and bore construction methods will be used if traditional open trenching cannot be used or existing utilities must be avoided. The trenchless construction method expected on this project will be HDD for the submarine to underground transition, as described further in Section 2.6.4.3, Submarine to Land Transitions.

If a jack and bore installation is required, a casing will be advanced into the soil while the soils are removed by an auger rotating inside the casing. A steel casing will be used initially while the hole is being drilled and is then replaced by a final casing. To minimize power losses from magnetic induction, the final casing will normally be made of nonmagnetic materials such as HOBAS® fiberglass reinforced polymer mortar. The internal PVC conduits will then be installed in the casing using plastic spacers to keep the conduits separated. The annular space between conduits and casing will then be filled with thermal grout.

Microtunneling uses a remotely controlled boring machine combined with the pipe jacking technique to directly install cable underground. This process avoids the need to have long stretches of open trench for pipe laying. Typical microtunnel equipment includes the boring machine, a hydraulic jacking system to jack the conduit, a closed loop slurry system to remove the excavated tunnel spoil, a slurry cleaning system to remove the spoil from the slurry water, a lubrication system for the exterior of the pipeline during installation, and a guidance system to provide installation accuracy.

2.6.3 Potrero Switchyard and Embarcadero Substation Construction

2.6.3.1 Potrero Switchyard

Step 1 — Site Preparation

Activities needed to prepare for switchyard and substation construction include contractor equipment and personnel mobilization, utility locations, surveys, and similar construction support. Any necessary permits will be finalized and construction areas delineated, which would likely include portions of the GenOn site, existing switchyard, and PG&E's Hoe Down and/or Laydown Yard sites (see Figure 2-11). Public safety systems (fencing, signage, etc.) will be put in place as part of final preparations before beginning construction work.

Soil contamination is known to exist at the proposed switchyard location and is addressed in Section 3.8, Hazards and Hazardous Materials. The extent of soil removal necessary will be determined prior to mobilization, and is estimated at less than 8,000 cy. Soil export and import activities will be completed before below-grade construction activities begin. Adequate laydown space will be prepared to receive materials required for initial construction activities, most likely at a combination of the Gen On site and nearby Hoe Down and Laydown yards. Off-site storage at existing PG&E or other existing industrial facilities may be secured for larger equipment or construction materials not immediately incorporated into the work.

Step 2 — Potrero Switchyard Building and Perimeter Fencing

This includes all work related to the installation of the pre-engineered metal building and access on 23rd Street, and preparation for the installation of the transformers and shunt reactor. Including the outdoor equipment, the new Potrero Switchyard will cover an area of approximately 190 feet x 110 feet with added room for maintenance vehicle access. The switchyard will be secured by a 10-foot-high wall around the perimeter with a minimum of one 20-foot-wide access gate. The perimeter wall will be setback 3 feet away from the property line to allow for landscaping.

Step 3 — 115 kV/230 kV System Interconnection

This includes work related to the 115 kV connection between the new 230 kV switchyard and the existing Potrero Switchyard. A duct bank will be constructed from the new switchyard building to the existing 115 kV busses at the south end of Potrero Switchyard. The work requires coordination with existing underground features.

Step 4 — Potrero Switchyard Modifications

Potrero Switchyard modifications pertain to work required to connect the 115 kV cables from the new switchyard to the existing 115 kV buses. Relocation of existing circuit breakers and other equipment will be necessary to secure adequate space to install new high voltage cable terminations, switches, and related structures.

Step 5 — Equipment Installation and Testing

Equipment installation will begin following completion of the switchyard building. The conceptual building design provides for multiple installation functions to proceed concurrently. Cabling and equipment testing can take place alongside assembly work. Much of the cable installation work at the switchyard building will take place in the vault beneath the equipment.

Step 6 — Cable Connection, Energizing, and Commissioning

The new 230 kV cables will then be connected into the new switchyard and substation equipment. Energization and final testing will then take place, and immediately following termination and testing, the cables may be energized and final switchyard tests performed. The switchyard may be commissioned and tests associated with the interconnection with Potrero Switchyard completed; alternatively, in the event the Embarcadero-Potrero 230 kV cable is not available for use, 115 kV power may be sourced from Potrero Switchyard for testing of the 230 kV switchyard equipment.

2.6.3.2 Embarcadero Substation

Since the connections and work at Embarcadero Substation will be made in an already existing structure, Steps 1 through 5 described above are not needed. The underground cable will be brought directly into the GIS cable connection point in the upgraded bus at Embarcadero Substation. The new 230 kV cable is then connected into the new substation equipment. Energization and final testing take place, and immediately following termination and testing, the cable may be energized and final tests performed.

2.6.4 Submarine Cable Installation

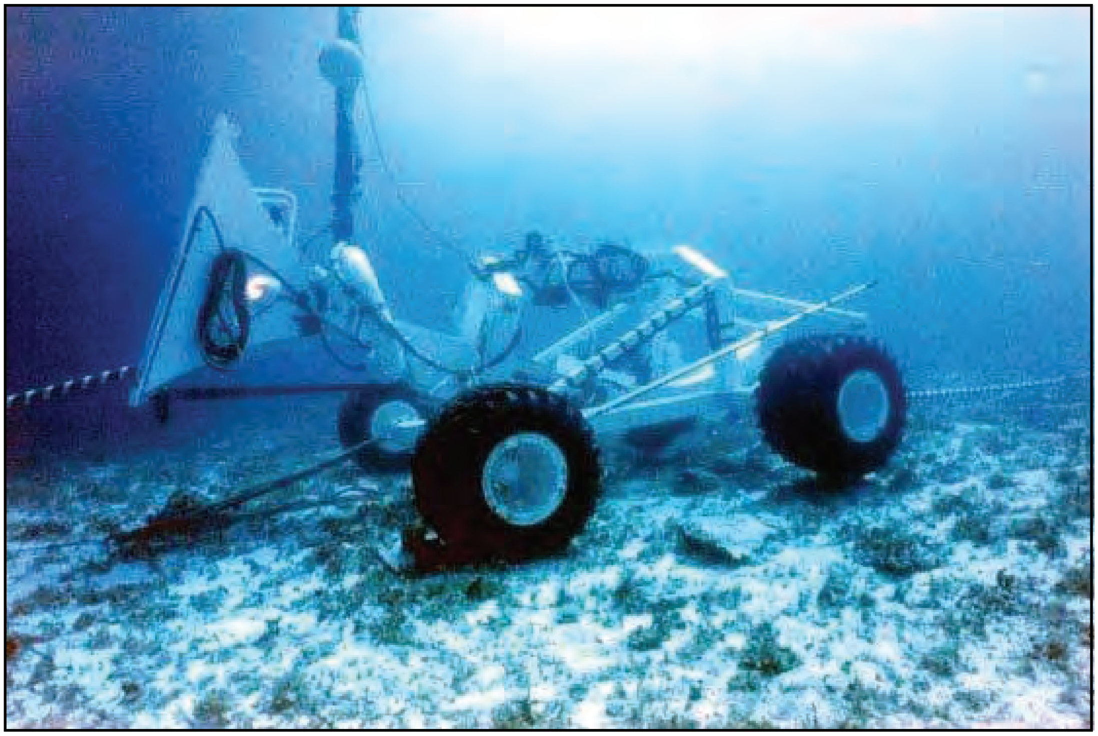
The cables will be installed into the bottom sediments of the Bay by hydroplow or other similar cable-burying technique, at a depth varying from approximately 6 to 10 feet below the floor of the bay. A typical hydroplow apparatus is illustrated in Figure 2-21, Hydroplow. Deck-mounted water pumps supply water to the plow for jetting; the pumps draft water from a vertical HDPE suction line that is set approximately 3 feet below the surface. The intake line is equipped with a wire-mesh screen to screen debris and reduce potential entrainment.

2.6.4.1 Submarine Cable Installation Procedures

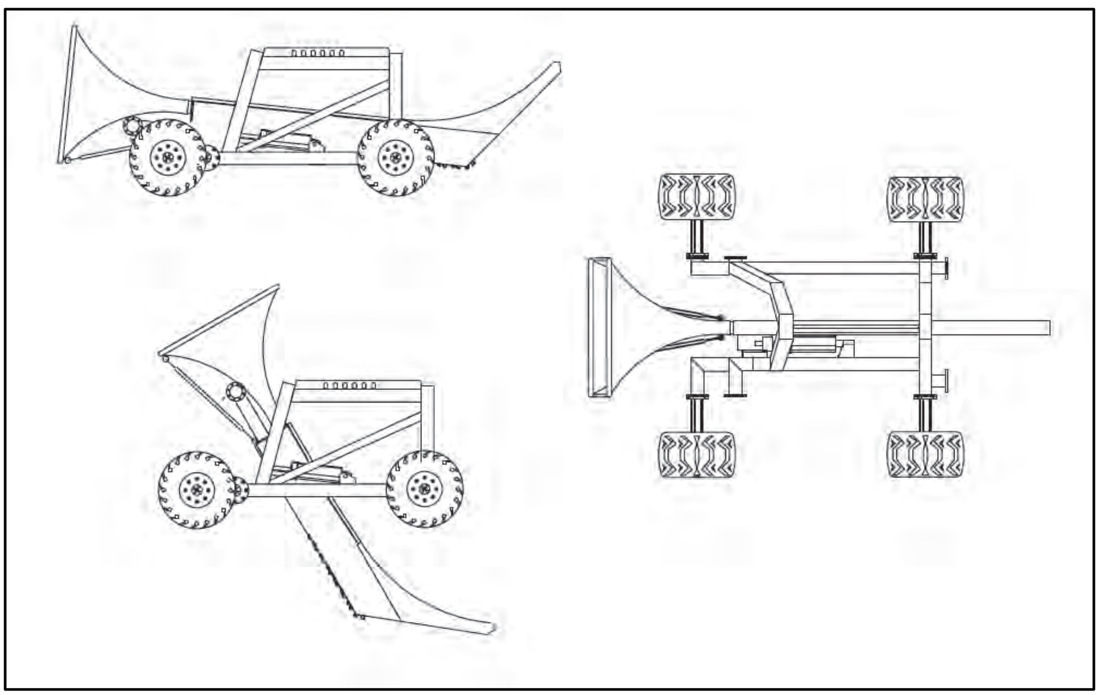
The transmission cables will be buried a minimum of 6 feet, or as specified by permitting agencies, under the surface of the sediments to protect the cables from mechanical damage. Cables are expected to be installed by using a hydroplow that is pulled along the seabed behind a barge. The barge will typically be pulled into position via two commercial tugboats, and the barge anchors will be positioned to allow the barge to kedge between them along the cable route. Once in position, the moored barge will be propelled via two diesel engines – one for steering, the other for kedging anchor. Kedging is a process by which a ship is moved slowly along the surface of the water towards the fixed point of the anchor.

The barge will tow a water jet that consists of a long blade mounted to either a sled- or tire-mounted submerged vehicle, the hydroplow. The blade contains water nozzles on the leading edge that displace the sediment using high pressure water. The submarine cable is fed from the barge down to the seabed through the blade and exits at the foot of the blade to be laid directly into the sea bottom sediments. The length and angle of the blade determines the burial depth of the cable. As the blade moves forward and the cable is placed in the momentarily-opened trench, the majority of the fluidized sediments behind the blade fall back into the trench, effectively burying the cable. This cable-laying method causes considerably less environmental disturbance than traditional mechanical trenching methods. The cable laying process is expected to require 24-36 hours of plowing time for each of the three cables, with 1 day needed before and after the hydroplowing to mobilize and demobilize. A team of approximately 21 people will be needed in-water and at the project site to perform the installation.

It is expected that crews will need to board crew boats from an existing commercial marina such as the Yerba Buena Island Marina and be taken to the designated anchoring locations of other project vessels. Given that anchoring locations vary each day based on local traffic, project vessels and barges will be directed daily regarding



Actual hydroplow used in Trans Bay Cable project.



Source: Trans Bay Cable project.

FIGURE 2-21
Hydroplow
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

anchoring locations via the Vessel Traffic Service of San Francisco and the U.S. Coast Guard. No specific anchoring points or locations are known at this time.

The hydroplow takes in water from the Bay through a water intake hose typically placed about three feet under the water surface; a mesh screen is placed on the intake to avoid entrainment and impingement of fish and debris.

2.6.4.2 Alternative Submarine Cable Installation Procedures

The submarine cable route identified in preliminary design avoids known rocky soil conditions and any existing buried cables so that the proposed three submarine cable phases are expected to be buried by hydroplow for their entire lengths. Nonetheless, either rocky soil conditions or existing (but unknown) cables crossing the route may not physically allow the cables to be buried. At these locations, the cables would be laid directly on the bottom of the Bay for a short distance until they can again be buried into the sediments. To protect such segments of exposed cable from damage by anchors, fishing gear, etc., concrete "blankets" or steel half-pipe sections would be placed over them. Typically, this might be done for 100 feet to either side of a crossing, at 50 feet in width (200 feet by 50 feet total area). Preliminary engineering indicates that no such blankets or pipe is needed. Final design review prior to construction will include a review of existing conditions. However, to allow flexibility should the need arise in final design evaluations, PG&E is assuming up to 5% of the line, or 650 feet in length by 50 feet, may need to be covered.

2.6.4.3 Submarine to Land Transitions

HDD methods will be used to install the submarine-to-land transition conduit because this method minimizes potential environmental impact and avoids disturbance of the shoreline. Each of the three phases of submarine cable will transition from land to water in separate HDPE conduits installed by HDD methods from a predetermined location inland to an exit point on the bottom of the bay. On the land side, the HDD conduit will transition to duct bank conduits and into a transition manhole. From the Bay side, the submarine cable will be pulled through the conduits and spliced to a land cable type inside this vault. The land cable type will then be routed to the substation within a duct bank system.

HDD installations utilize a guided drill head to open the initial hole and use a series of increasingly larger drill bits to bring the opening to the desired final diameter. After the hole is at the specified diameter, the internal conduits are bundled together and pulled at one time through the hole. The detailed design of the HDD installation is done during the final design stage of a project. For purposes of this description, a slick bore installation (meaning without a casing) is assumed.

HDD operations at each landing zone are expected to last for approximately 6 weeks, starting with securing the area around the HDD pit, which generally includes closing one lane and banning street parking at least on one side. PG&E will coordinate construction with DHL at the southern transition along 23rd Street or its extension into the DHL facility to ensure continued access during construction. Work includes the following steps:

- Excavating the HDD pit and inserting the HDD rig
- Drilling the HDD bore holes
- Excavating an adjacent 3-foot by 5-foot pit at the exit of the bore hole to capture mud, which is pumped up to a barge and disposed of per appropriate regulations (see also Section 3.8, Hazards and Hazardous Materials, and 3.9, Hydrology and Water Quality)
- Pulling fused sections of HDPE pipe into the bore holes
- Connecting the ends of HDPE pipes into the transition splice vaults
- Pulling the submarine cables back through the HDPE pipes and then into the splice vaults
- Splicing the submarine cable to the underground land cable in the splice vault
- Restoring the area to pre-construction conditions

The horizontal drilling rig and support equipment will be rigged up within the available temporary workspace. Visqueen will be placed under the drill rig and any support equipment that could have a potential for a hydraulic, fuel or oil leak. Silt fence, erosion control and containment devises will also be implemented around the drilling equipment in order to ensure no run-off will leave from the site. A temporary chain link fence will be installed around all of the drilling equipment.

Prior to the drill reaching the exit, the fluids are circulated through the HDD back to the drill rig and collected and cleaned for reuse. Before the end of the drilling operation, the HDD exit location will be identified and a localized excavation will be made in the Bay sediments at the exit point to receive the heavy drilling fluids when the pilot hole is exited and during the pipe pulling operations. Divers will attach the submarine cable to the end of the HDD and the cable will be pulled back onshore (see Figure 2-22). After installation of the cable, divers will pump these fluids into tank(s) on the barge for transfer by vacuum trucks to an approved disposal site.

At the north landing zone, the HDD entry points will be determined during final design; they are likely to be approximately 400 feet from the shoreline and continuing another approximately 1,000 feet to the exit point at the bottom of the bay floor. The HDD will transition to a depth of between 40 to 80 feet below ground, and more than 50 feet deep where needed to pass below both the sewer transport/storage box under The Embarcadero and the seawall between Piers 28 and 30/32. This path is above the bedrock layer, below the piles that support the seawall, and within Colma Formation clayey sand deposits and Bay muds (see Figure 2-14). It is also a sufficient distance away from the steep off-shore slope, permitting a smooth transition to direct burial of the cable within the bay floor.

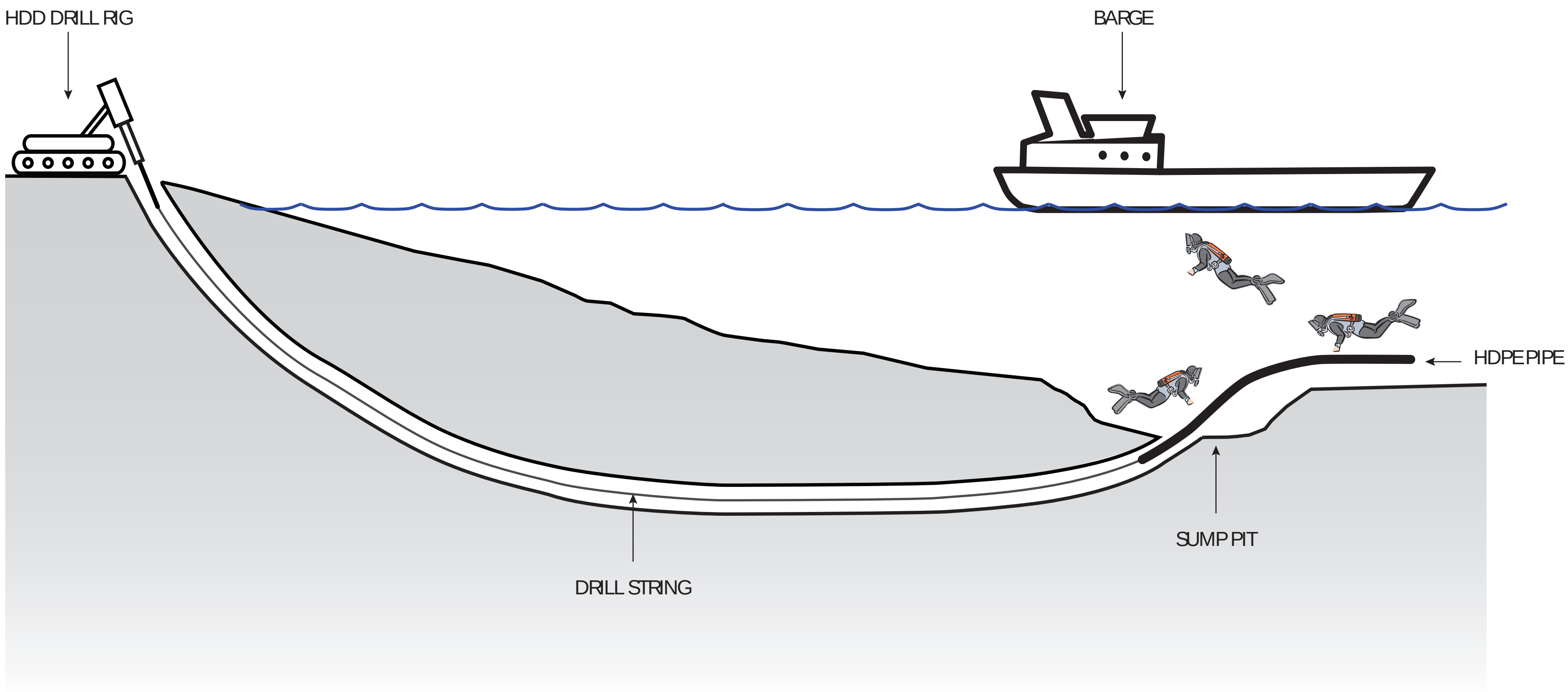
At the southern landing zone, the HDD will begin at an entry point to be determined during final design, likely between 150 to 250 feet from the shoreline in an HDD pit excavated in the continuation of 23rd Street, transitioning to a depth of approximately 30 to 50 feet below ground level and proceeding approximately 700 to 900 feet to the exit point at the bottom of the bay floor. This path stays above the bedrock layer, and is within soft clays. No seawall or deep pile obstructions are expected along this section of shoreline. Another similar high voltage cable, the TBC, was recently installed near this same area. Please see Section 3.8, Hydrology and Water Quality, for additional discussion of HDD methods.

HDD entry pits are up to about 5 feet wide, 8 feet long, and 6 feet deep and will be covered with steel plates during non-working hours. These pits are used only for fluid containment before the fluid is pumped to the solids control equipment for cleaning and re-circulation. Exit (receiving) pits in the Bay will be up to about 24 feet by 12 feet long and 7 feet deep.

Excavation of entry pits will require saw cutting the asphalt and excavating with a backhoe. Receiving pits would be excavated using a clamshell from a work barge anchored above the exit points. Shoring would be used for the entry (containment) pit, but no shoring will be undertaken in the exit (receiving) pits. The sides of the offshore pits will be sloped sufficiently such that shoring will not be necessary.

Pilot hole drilling is typically discontinued approximately 50 to 75 feet away from the exit point, leaving a "plug" of soil between the drilled hole and the sea floor. At that location, the drill pipe will be tripped out of the hole and the hole will be forward-reamed to a diameter of about 20 inches (assuming a 14-inch outside diameter HDPE pipe is used). Reaming will be followed by "swabbing" to test the condition of the hole. Drilling fluids will be pumped into the hole during both of these operations. As a result of leaving the 50-foot to 75-foot plug in the bottom of the hole, all drilling fluids used during these processes will flow back to the entry point through the bore-hole annulus for re-circulating.

After swabbing the hole, the final 50 feet to 75 feet will be exited to the sea floor at which time some fluids will drain into the containment sump. The HDPE pipeline will be floated into place, the front end sunk and hooked up to drill pipe, and the pullback will proceed. As the pipe is pulled into the drilled hole, it will displace its volume of drilling fluids to the containment sump for approximately half the length of the pipeline, at which time the flow will begin to turn around to the entry pit where it will be contained in frac tanks for either re-use or disposal. In addition to the displacement volume, additional drilling fluid will be pumped during the pullback and will flow to the exit containment sump.



Source: CH2M HILL

FIGURE 2-22
HDD Outfall
Embarcadero-Potrero 230 kV Transmission Project
San Francisco, CA

2.6.5 Construction Workforce and Equipment

It is expected that the project will employ approximately 30 construction personnel and approximately 8 truck drivers for excavation and conduit installation using two excavation crews. Approximately 20 construction personnel will be employed during cable installation, 15 construction personnel during the HDD installations, and 25 construction personnel during the submarine cable installation. The number of employees will peak at approximately 75 construction personnel and will include switchyard workers, supervisors, and inspectors. PG&E expects to hire approximately 20 percent of its construction workforce locally (roughly 10 to 15 employees).

PG&E contractors will be required to make a good faith effort to establish a local hiring plan in collaboration with PG&E and City Build, a City of San Francisco agency created to develop local jobs and hiring in the City. Equipment expected to be used during project construction is summarized in Table 2-4.

TABLE 2-4
Equipment Expected to be Used During Project Construction
Embarcadero-Potrero 230 kV Transmission Project

Equipment	Quantity	Use (Duration)
Small motor craft for moving people and as safety watch	2	HDD Operation (129 days)
Barge to serve as work platform, may have generator to power drilling mud vacuum and other tools	1	
Tug or other vessel to position barge	1 to 2 intermittent	
Small motor craft	3	Cable Laying (22 days)
Cable laying barge	1	
Tug or other vessel to position barge	1 to 2 intermittent	
Rigging truck	1	Underground Delivery and Setup
Mechanics truck	1	
Small mobile crane	1	
Shop van	2	
2-ton flat bed truck	1	
Pickup trucks	2	Transport construction personnel
2-ton flatbed truck	1	Haul materials
Flatbed boom truck	2	Haul and unload materials
Rigging truck	2	Haul tools and equipment
Mechanic truck	1	Service and repair equipment
Winch truck	1	Install and pull rope into position in conduits
Cable puller truck	1	Pull transmission cables through conduits
Cement trucks	2	Transport and pour backfill slurry
Shop vans	2	Store tools
Crawler backhoe	2	Excavate trenches (excavate around obstructions)
Large backhoe	2	Excavate trenches (main trencher)
Dump trucks	4	Haul trench and excavation materials/import backfill
Large mobile crane	2	Lift/load/set 20-ton cable reels and prefabricated 40-ton splice vaults and lift cable ends on terminating structures
Small mobile cranes (<12 tons)	2	Load and unload materials
Cable reel trailers	2	Transport cable reels and feed cables into conduits
Splice trailer (40-foot)	1	Splicing supplies/air condition manholes

TABLE 2-4
Equipment Expected to be Used During Project Construction
Embarcadero-Potrero 230 kV Transmission Project

Equipment	Quantity	Use (Duration)
Air compressors	Variable	Operate air tools
Air tampers	Variable	Compact soil
Rollers	1	Repave streets over trench and manhole locations
Portable generators	1-2	Construction power
Horizontal dry boring equipment	1	For horizontal bores
Baker (water) storage tanks	As needed	Store water pumped from trenches, if needed
Pumps	As needed	Remove water from trench, if needed
Shoring boxes	Variable	Maintain trench walls, prevent collapse of loose soils or sand
Tank trucks	As needed	Transport water from Baker tanks, to process/disposal facility

2.7 Permitting and Construction Schedule

The estimated construction duration for the project is approximately 15 months, as shown below in Table 2-5. PG&E seeks to complete construction and place the line in service by December 2015.

TABLE 2-5
Preliminary Proposed Construction Schedule
Embarcadero-Potrero 230 kV Transmission Project

Task Name	Proposed Schedule
CPUC/Certification of Public Convenience and Necessity (CPCN) process	
CPUC conducts CEQA review, including public review	Dec 2012-Jul 2013
Evidentiary hearings, if necessary	Aug 2013
CPUC issues Proposed Decision, subject to public comments	Nov 2013
CPUC grants a CPCN and certifies the CEQA document	Dec 2013
Permitting (resource and responsible agency permits)	Dec 2013-Sept 2014
Ministerial permits	Jan-May 2014
ROW acquisition	Aug 2012-Sept 2014
Transmission Line Construction	
Onshore Installation	Sep 2014 - Apr 2015
Offshore to Onshore Transition	Oct 2014 - May 2015
Offshore Construction Moratorium	Oct 2014 - Dec 2014
Offshore Installation	Jun 2015 - Nov 2015
Testing & Commissioning	Dec 2015

TABLE 2-5
Preliminary Proposed Construction Schedule
Embarcadero-Potrero 230 kV Transmission Project

Task Name	Proposed Schedule
Potrero Switchyard Construction	
Soil Removal/Replacement & Site Preparations	Feb 2014 - Jun 2014
Building Construction	Jun 2014 - Feb 2015
Substation Interconnection	Oct 2014 - Mar 2015
Substation Installation	Dec 2014 - Nov 2015
Testing & Commissioning	Dec 2015

The construction activities included in the abovementioned estimate include the construction of short on-shore underground land sections from substations to submarine cable ends; HDD construction for the submarine cable landing; submarine cable transportation and installation; and overall cable system testing and commissioning. The duration also conservatively includes hydroplow work only during the San Francisco Central Bay dredging work windows to minimize potential impacts to marine species (see Section 3.4, Biological Resources), if feasible.

Construction will typically occur between 7 a.m. and 8 p.m., or during times that will be set through coordination with the City and County of San Francisco. If trenching work will cause traffic congestion, the project may require nighttime work to avoid traffic disruption. All applicable city, county, state, federal, and railroad regulation, ordinances, and restrictions will be identified and complied with prior to and during construction.

2.8 Operation and Maintenance

2.8.1 Monitoring and Control

Monitoring and control functions for the new facilities will be connected to the existing PG&E computer system by a telecommunication circuit. The new line will be monitored and protected by a set of relays located at each end of the line. The required constant communication between protective relays at each end will be over redundant channels of fiber optic cables. The relays will also be connected into PG&E's Supervisory Control and Data Acquisition (SCADA) system. Any alarms resulting from relay(s) action(s) will be promptly annunciated at the Transmission Operations facility at PG&E's Grid Control Center (GCC) located in Vacaville. In the event of an alarm, required corrective actions can be quickly initiated by operators on round-the-clock duty at the GCC. In the event of a fault on the line, digital fault recorders at both ends of the line will retain detailed data that can be downloaded remotely (as well as locally) for the purpose of analysis.

Data collection devices for the SCADA system may include remote terminal units, microprocessor relays, data concentrators, and fault recorders. The devices will be capable of storing data for download via local and/or remote access.

2.8.2 Maintenance and Facility Inspection

Regular inspection of transmission lines, substations, instrumentation and control, and support systems is critical for safe, efficient, and economical operation. Early identification of items needing maintenance, repair, or replacement will assure continued safe operation of the project. Aboveground components will be inspected at least annually for corrosion, equipment misalignment, loose fittings, and other common mechanical problems. The underground portion of the line will be inspected regularly from inside the vaults; therefore, inspections will not significantly disturb traffic using city streets.

Typical line, termination, and cable inspections are summarized as follows:

- Underground and Terminations:

  - Routine: Once every 3 months: Visual inspections of terminals.
  - Detailed: Once every 2 years: Video inspection of inside vaults for anchor bolts and/or splice displacements, corrosion of the racking system. Note that PG&E uses video rather than visual to avoid having to de-energize the line as safety rules prohibit entering an energized electric transmission vault. PG&E also performs infrared inspection of the terminations to detect hot spots, every 2 years.

- Submarine:
  - Routine/detailed: The submarine cable (as well as the underground cable) will be monitored with the use of a Distributed Temperature Sensing system. This automated system will be installed during construction. It consists of a fiber optic sensor cable integrated in the body of the electrical cable and control units at the cable terminations. Laser light pulses generated within the control units are launched across the entire surface of the cable. As the light pulse encounters temperature features along the fiber, the pattern of back-scattered light is analyzed to provide a real time temperature footprint. This information can then be automatically transmitted to the PG&E operations GCC via supervisory controls and data acquisition system (SCADA).
  - Because of the dynamic nature of the Bay sea floor, PG&E will monitor the location of the cables annually through a contract with a marine surveyor. PG&E will also use a marine monitoring system that will automatically notify PG&E should a vessel remain in place over the cables for a particular length of time.

To facilitate any required repair of the submarine cable, PG&E will store a length of spare cable and repair joints, and will establish a stand-by agreement with a marine contractor to provide transportation and technical support on an as-needed basis.

2.9 Applicant-Proposed Measures

PG&E proposes to implement the APMs listed in Table 2-6 to avoid or further minimize potential less-than-significant project impacts. The APMs are discussed in context with their respective environmental resources in the Applicant-Proposed Measures subsection within each resource category subsection in Chapter 3.

TABLE 2-6
Applicant-Proposed Measures Summary Table
Embarcadero-Potrero 230 kV Transmission Project

Applicant-Proposed Measures

3.1 Aesthetics

APM Aesthetics (AE)-1: Nighttime Lighting to Minimize Potential Visual Impacts. The new switchyard may include outdoor lighting for safety and security purposes. Design and layout for new outdoor lighting at the switchyard will incorporate measures, such as use of non-glare or hooded fixtures and directional lighting, to reduce spillover into areas outside the switchyard site and minimize the visibility of lighting from offsite locations. The new lighting will be operated only as needed and will be designed to avoid casting light or glare offsite.

3.2 Agricultural and Forest Resources

There are no agricultural or forest lands in the vicinity of the project. Therefore, no Applicant-Proposed Measures are recommended for agricultural resources.

3.3 Air Quality

APM Air Quality (AQ)-1: Minimize Fugitive Dust. Consistent with Table 2 of the BAAQMD CEQA Guidelines, PG&E will minimize dust emissions during construction by implementing the following measures:

- Water all active construction areas at least twice daily.
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard.
- Pave, apply water three times daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas, and staging areas at construction sites.
- Sweep daily (with water sweepers) all paved access roads, parking areas, and staging areas at construction sites.
- Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets.
- Post a publicly visible sign with the telephone number and person to contact regarding dust complaints. This person will respond and take corrective action within 48 hours. The BAAQMD's phone number will also be visible to ensure compliance with applicable regulations.

Since these measures are consistent with the BAAQMD CEQA Guidelines, construction emissions are considered to be less than significant (BAAQMD, 1999; BAAQMD, 2012c). Note that implementation of the first measure listed above would not apply to paved areas with no exposed soil or when rains are occurring.

APM AQ-2: Minimize Construction Exhaust Emissions. The following measures will be implemented during construction to further minimize the less-than-significant construction exhaust emissions:

- Encourage construction workers to take public transportation to the project site where feasible.
- Minimize construction equipment exhaust by using low-emissions or electric construction equipment where feasible. Develop a plan demonstrating that the off-road equipment (more than 50 horsepower) to be used would achieve a project-wide fleet-average 20 percent NO_x reduction and 45 percent PM reduction compared to the most recent CARB fleet average. Acceptable options for reducing emissions include the use of late model engines, low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, add-on devices such as particulate filters, and/or other options as such become available.
- Minimize unnecessary construction vehicle idling time. The ability to limit construction vehicle idling time is dependent upon the sequence of construction activities and when and where vehicles are needed or staged. Certain vehicles, such as large diesel-powered vehicles, have extended warm-up times following start-up that limit their availability for use following start-up. Where such diesel-powered vehicles are required for repetitive construction tasks, these vehicles may require more idling time. The project will apply a "common sense" approach to vehicle use, such that idling is reduced as far as possible below the maximum of five consecutive minutes required by regulation (13 CCR 2485). If a vehicle is not required for use immediately or continuously for construction activities or other safety-related reasons, its engine will be shut off.
- Minimize welding and cutting by using compression or mechanical applications where practical and within standards.
- Encourage use of natural gas or electric powered vehicles for passenger cars and light-duty trucks where feasible and available.

TABLE 2-6
Applicant-Proposed Measures Summary Table
Embarcadero-Potrero 230 kV Transmission Project

Applicant-Proposed Measures

APM AQ-3: Minimize Potential Naturally Occurring Asbestos (NOA) Emissions. The following measures will be implemented prior to and during construction to minimize the potential for NOA emissions:

- Prior to commencement of construction, samples of the Potrero Switchyard construction area will be analyzed for presence of asbestos, serpentinite or ultramafic rock
- If asbestos, serpentinite or ultramafic rock is determined to be present, implement all applicable provisions of the Airborne Toxic Control Measure (ATCM) for Construction, Grading, Quarrying and Surface Mining Operations (17 CCR 93105), including:

  For disturbed areas of 1.0 acre or less

  - Construction vehicle speed at the work site will be limited to 15 miles per hour or less
  - Prior to any ground disturbance, sufficient water will be applied to the area to be disturbed to prevent visible emissions from crossing the property line
  - Areas to be graded or excavated will be kept adequately wetted to prevent visible emissions from crossing the property line
  - Storage piles will be kept adequately wetted, treated with a chemical dust suppressant, or covered when material is not being added to or removed from the pile
  - Equipment will be washed down before moving from the property onto a paved public road
  - Visible track-out on the paved public road will be cleaned using wet sweeping or a High Efficiency Particular Air filter equipped vacuum device within 24 hours

  For disturbed areas of greater than 1.0 acre

  - Submit an Asbestos Dust Mitigation Plan to the BAAQMD and obtain approval prior to commencement of construction
  - Implement and maintain the provisions of the approved Asbestos Dust Mitigation Plan from the beginning of construction through the duration of the construction activity

3.4 Biological Resources

APM Biological Resources (BIO)-1: General Measures. Environmental awareness training will be conducted for onsite construction personnel prior to the start of construction activities. The training will explain the APMs and any other measures developed to prevent impacts on special-status species, including nesting birds. The training will also include a description of special-status species and their habitat needs, as well as an explanation of the status of these species and their protection under the ESA, CESA, and other statutes. A brochure will be provided with color photos of sensitive species, as well as a discussion of any permit measures. A copy of the training and brochure will be provided to CPUC at least 30 days prior to the start of construction for project files. This APM also includes the following measures:

- Biological monitor: A qualified biological monitor will verify implementation and compliance with all applicant-proposed measures. The monitor will have the authority to stop work or determine alternative work practices where safe to do so, as appropriate, if construction activities are likely to impact sensitive biological resources.
- Litter and trash management: All food scraps, wrappers, food containers, cans, bottles, and other trash from the project area will be deposited in closed trash containers. Trash containers will be removed from the project area at the end of each working day.
- Parking: Vehicles and equipment will be parked on pavement, existing roads, and previously disturbed or developed areas or work areas as identified in this document.
- Pets and firearms: No pets or firearms will be permitted at the project site.

APM BIO-2: Preconstruction Surveys. Preconstruction bird nesting surveys will be conducted in the project area no more than 15 days before work is performed in the nesting season February 1 to August 15. Surveyors will search for all potential nest types (e.g. ground, cavity, shrub/tree, structural, etc.) and determine whether or not the nest is active. A nest will be determined to be active if eggs or young are present in the nest. Upon discovery of active nests, appropriate minimization measures (e.g., buffers or shielding) will be determined and approved by the biologist. PG&E's biological monitor will determine the use of a buffer or shield and work may proceed based upon: acclimation of the species or individual to disturbance, nest type (cavity, tree, ground, etc.), and level and duration of construction activity.

In the unlikely event a listed species is found nesting nearby in this urban environment, CDFG and USFWS will be notified if a nest of a listed species is identified in the area of analysis, and the CPUC will be provided with nest survey results, if requested. When active nests are identified, monitoring for significant disturbance to the birds will be implemented.

Nest checks will occur each day construction is occurring, documented in a nest check form to be included in the Worker's Environmental Awareness Training package. Typically a nest check will

TABLE 2-6
Applicant-Proposed Measures Summary Table
Embarcadero-Potrero 230 kV Transmission Project

Applicant-Proposed Measures
have a minimum duration of 30 minutes, but may be longer or shorter, or more frequent than one check per day, as determined by PG&E's biological monitor based on the type of construction activity (duration, equipment being used, potential for construction-related disturbance) and other factors related to assessment of nest disturbance (weather variations, pair behavior, nest stage, nest type, species, etc.). The biological monitor will record the PG&E construction activity occurring at the time of the nest check and note any work exclusion buffer in effect at the time of the nest check. Non-PG&E activities in the area should also be recorded (e.g. adjacent construction sites, roads, commercial/industrial activities, residential activities, etc.). The biological monitor will record any sign of disturbance to the active nest, including but not limited to parental alarm calls, agitated behavior, distraction displays, nest fleeing and returning, chicks falling out of the nest or chicks or eggs being predated as a result of parental abandonment of the nest. Should the PG&E biological monitor determine project activities are causing or contributing to nest disturbance that might lead to nest failure, the PG&E biological monitor will coordinate with the Construction Manager to limit the duration or location of work, and/or set other limits related to use of project vehicles, helicopters, chainsaws, and/or heavy equipment. Should PG&E's biological monitor determine that project activities are not resulting in significant disturbance to the birds, construction activity will continue and nest checks while work is occurring will be conducted periodically. **APM BIO-3: Seasonal Work Windows.** Where feasible, hydroplow cable installation will be conducted between March 1 and November 30, based on the seasonal work windows for steelhead, Chinook salmon, and Pacific herring (USEPA et al., 1996). If work is planned to occur outside of this work window, PG&E will coordinate any additional measures, such as monitoring for herring spawn, with NMFS, USFWS, and CDFG. **APM BIO-4: Herring Spawning Protection.** If work occurs within the Bay in December, January, or February, a qualified observer shall monitor hydroplow and HDD connection activities when in proximity (about 660 to 980 feet, or 200 to 300 meters) to potential Pacific herring spawning sites. Herring spawning sites are generally located in shallow water near the surface, and are visible as a large mass of herring eggs, which are adhesive, and attach most commonly to eelgrass or other algae, and can also attach to piers and other features; no eelgrass beds occur in the work areas. If herring spawning sites are observed within 660 feet (200 meters) of the work site by a qualified monitor stationed on a nearby boat, pier, or beach, all in-water activities such as hydroplowing shall be stopped within that distance or as otherwise specified by the resource agencies for 2 weeks. **APM BIO-5: Aquatic Habitat Protection.** PG&E will acquire the necessary permits to conduct cable installation activities in the San Francisco Bay. PG&E will comply with all conditions and requirements of these permits and certification. **APM BIO-6: Fish Screen.** All hydroplow water jet intakes will be covered with a mesh screen to minimize the potential for impingement or entrainment of fish species.
3.5 Cultural Resources
Cultural Resources **APM CUL-1: Pre-Construction Worker Cultural Resources Training.** Prior to construction, PG&E will design and implement a Worker Cultural Resources Training Program for all project personnel who may encounter and/or alter historical resources or unique archaeological properties. Construction supervisors, workers, and other field personnel will be required to attend the training program prior to their involvement in field operations. The program will be conducted in conjunction with other environmental awareness training and education for the project. The cultural resources training session will be led by a qualified instructor meeting the Secretary of Interior's Professional Qualification Standards as listed beginning on page 44716 of Volume 48 of the Federal Register and as may be updated by the National Park Service. This Program will minimally include: • A review of the environmental setting (prehistory, ethnography, history) associated with the project; • A review of Native American cultural concerns and recommendations during project implementation; • A review of applicable federal, state, and local laws and ordinances governing cultural resources and historic preservation; • A review of what constitutes prehistoric or historical archaeological deposits and what the workers should look out for; • A discussion of site avoidance requirements and procedures to be followed in the event unanticipated cultural resources are discovered during construction; • A discussion of procedures to follow in the event human remains are discovered during construction; • A discussion of disciplinary and other actions that could be taken against persons violating historic preservation laws and PG&E policies; • A discussion of eligible and potentially eligible built environment resources and procedures to follow regarding minimizing vibration from equipment in designated areas; and

TABLE 2-6
Applicant-Proposed Measures Summary Table
Embarcadero-Potrero 230 kV Transmission Project

Applicant-Proposed Measures
• A statement by the construction company or applicable employer agreeing to abide by the program conditions, PG&E policies, and applicable laws and regulations.
APM CUL-2: Resource Avoidance. There are no known archaeological or historical resources within the direct impact areas defined for the proposed route. In keeping with the intent of the NHPA and CEQA, PG&E's preferred approach for archaeological resources and historical resources is avoidance of impacts to significant (or unevaluated) resources. Where avoidance is not feasible, potential impacts to significant cultural resources must be treated in a way that is acceptable to PG&E, the State Historic Preservation Officer (SHPO), and if applicable, the local Native American community. Treatment might include data recovery excavations, public interpretation/education, Historic American Buildings Survey (HABS)/Historic American Engineering Record (HAER) recordation, or other measures. If there is an unanticipated discovery of a buried archaeological deposit or human remains, or unanticipated impacts to a historical building cannot be avoided, PG&E will implement APM CUL-4, -5, and -7.
APM CUL-3: Construction Monitoring. Areas of high sensitivity for prehistoric or historical buried resources, as presented in Appendix D, will be monitored by a professional archaeologist meeting the Secretary of the Interior's Professional Qualifications Standards. In particular, a monitor will be present during all ground-disturbing work within 100 feet (30 meters) of the unrecorded historical-era features west of Embarcadero Substation. Areas of moderate sensitivity will be spot-checked (i.e., visited by a qualified archaeologist one or more times per day) during construction. The exception to this is that all excavation at the Potrero GIS structure location should be monitored. The majority of the structure location is highly sensitive for buried historical resources while the remaining portion is moderately sensitive.
APM CUL-4: Unanticipated Discoveries of Cultural Deposits. In the event that previously unidentified archaeological, cultural, or historical sites, artifacts, or features are uncovered during implementation of the project, work will be suspended within 100 feet (30 meters) of the find and redirected to another location. PG&E's cultural resources specialist or designated representative will be contacted immediately to examine the discovery and determine if additional work is needed. If the discovery can be avoided or protected and no further impacts will occur, the resource will be documented on California Department of Parks and Recreation 523 forms and no further effort will be required.
If the resource cannot be avoided and may be subjected to further impacts, PG&E or their representative will evaluate the significance of the discovery following federal and state laws outlined above and implement data recovery or other appropriate treatment measures if warranted. Evaluation of historical-period resources will be done by a qualified historical archaeologist while evaluation of prehistoric resources will be done by a qualified archaeologist specializing in California prehistoric archaeology. Evaluations may include archival research, oral interviews, and/or field excavations to determine the full depth, extent, nature, and integrity of the deposit.
APM CUL-5: Unanticipated Discovery of Human Remains. If human remains or suspected human remains are discovered during construction, work within 100 feet of the find will stop immediately and the construction foreman shall contact the PG&E cultural resources specialist, who will then call the City and County of San Francisco Medical Examiner. There shall be no further excavation or disturbance of the site, or any nearby area reasonably suspected to overlie adjacent remains, until medical examiner has determined that the remains are not subject to provisions of Section 27491 of the Government Code. If the medical examiner determines the remains to be Native American, he/she shall contact the NAHC within 24 hours. The NAHC will appoint a Most Likely Descendent for recommendations on the treatment and disposition of the remains (Health and Safety Code Sect. 7050.5, Public Resources Code Sect. 5097.24).
APM CUL-6: Vibrations to Historical Structures. Historical buildings are present near the project route and may be vulnerable to damage from heavy equipment vibrations. To ensure that resources are not inadvertently damaged or impacted during construction implementation, the crews will be informed of historical structure locations and instructed to confine all excavation and backfill work to the existing city streets right-of-way (historical structure locations are depicted in Appendix D as part of APM-CUL-1).
Project construction in proximity to Station A will include the use of Tubex and the smallest possible machinery to minimize vibration effects. A structural engineer will check the condition of the building prior to construction. Once activities that result in vibration have begun, the engineer will check the condition of the building to monitor Station A during construction (at 25 percent, 50 percent, 75 percent, and 100 percent completion of excavation using heavy equipment) and assess the effects on the building. If the structural engineer determines that structural integrity is compromised, the interior of the building will be documented following the procedures outlined in APM-CUL-7.
APM CUL-7: Record to Historic American Building Survey/Historic American Engineering Record Standards. Station A's setting will be affected by construction of the GIS building. The currently visible exterior façade on the west side of the main turbine building may be blocked from view.
Prior to construction, the setting and exterior of the Station will be documented using HAER standards. These standards include large format photography of the structures, photo reproduction of historical plans, mapping, and a descriptive and historical narrative. The resulting documentation will be archived with PG&E, the SHPO, the Bancroft Library at the University of California Berkeley, the San Francisco Landmarks Preservation Advisory Board files at the San Francisco Planning Department, the Foundation for San Francisco's Architectural Heritage, and the San Francisco Public Library.

TABLE 2-6
Applicant-Proposed Measures Summary Table
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Paleontological Resources

APM Paleontological Resources (PR)-1: Worker Environmental Awareness Program Paleontological Resources Module. The project's worker environmental awareness program, which all workers will complete prior to beginning work on the project site, will include a module on paleontological resources (fossils). The module will discuss the laws protecting paleontological resources, recognition in the field and types of paleontological resources that could be encountered on the project, and the procedures to be followed if a paleontological resource is discovered. A copy of the project's worker environmental awareness training will be provided to the CPUC for recordkeeping prior to the start of construction.

APM PR-2: Unanticipated Paleontological Resource Discovery. If fossils are observed during excavation, work in the immediate vicinity of a paleontological find will be halted or redirected to avoid additional impact to the specimen(s), and to allow a professional paleontologist to assess the scientific importance of the find and determine appropriate treatment. If the discovery is significant, the qualified paleontologist will implement data recovery excavation to scientifically recover and curate the specimen.

3.6 Geology and Soils

APM Geology and Soils (GS)-1: Appropriate soil stability design measures implementation. Based on available references, artificial fills, fine sands, silts, and bay mud are the primary soil types expected to be encountered in the excavated areas as project construction proceeds. Potentially problematic subsurface conditions may include soft or loose soils. Where soft, loose, or liquefiable soils are encountered during design studies or construction of the onshore portion of the route, appropriate measures will be implemented to avoid, accommodate, replace, or improve soft or loose soils and liquefaction hazards encountered during construction. Such measures may include the following:

- Locating construction staging and operations away from areas of soft and loose soil.
- Over-excavating soft or loose soils and replacing them with suitable non-expansive engineered fill.
- Increasing the density and strength of soft or loose soils through mechanical vibration and/or compaction.
- Treating soft or loose soils in place with binding or cementing agents.
- Construction activities in areas where soft or loose soils are encountered may be scheduled for the dry season, as necessary, to allow safe and reliable equipment access.
- Physical ground improvement such as in-situ soil mixing, drain piles, or sheet piles.
- Deepening of trench and/or the HDD to place the transmission line beneath liquefiable fills and/or potential for lateral spreading, where feasible.

APM GS-2: Appropriate seismic safety design measures implementation. As part of conceptual design investigation, site-specific seismic analyses were performed to evaluate PGAs for design of project components. Because the proposed transmission cables will be lifeline utilities, the 84th percentile motions (i.e., one standard deviation above the median; see Table 3.6-2), were used (B&V 2012). The project will be designed based on current seismic design practices and guidelines.

APM GS-3: Appropriate erosion-control measures implementation. Best Management Practices (BMPs) will be implemented to minimize and avoid surface runoff, erosion, and pollution (see APM WQ-1 and WQ-2).

3.7 Greenhouse Gas Emissions

To further reduce the less-than-significant impacts of the project, PG&E is proposing the three GHG-related APMs identified below. Because GHG emissions from the project are less than significant without mitigation, GHG reductions anticipated from implementation of these APMs have not been quantified.

APM GHG-1: Minimize Construction Exhaust Emissions. The following measures will be implemented during construction to further minimize the less-than-significant construction GHG emissions:

- Encourage construction workers to take public transportation to the project site where feasible.
- Minimize construction equipment exhaust by using low-emissions or electric construction equipment where feasible.
- Minimize unnecessary construction vehicle idling time. The ability to limit construction vehicle idling time is dependent upon the sequence of construction activities and when and where vehicles are needed or staged. Certain vehicles, such as large diesel-powered vehicles, have extended warm-up times following start-up that limit their availability for use following start-up. Where such diesel-powered vehicles are required for repetitive construction tasks, these vehicles may require more idling time. The project will apply a "common sense" approach to vehicle

TABLE 2-6
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Applicant-Proposed Measures
use, such that idling is reduced as far as possible below the maximum of five consecutive minutes required by California regulation (13 CCR 2485). If a vehicle is not required for use immediately or continuously for construction activities, its engine will be shut off. • Minimize welding and cutting by using compression or mechanical applications where practical and within standards. • Encourage use of natural gas or electric powered vehicles for passenger cars and light-duty trucks where feasible and available. • Encourage the recycling of construction waste where feasible. **APM GHG-2: Avoid and Minimize Potential SF_6 Emissions.** PG&E will include Potrero Switchyard in PG&E's system-wide SF_6 emission reduction program, which includes inventorying and monitoring system-wide SF_6 leakage rates and employing X-ray technology to inspect internal circuit breaker components to eliminate dismantling of breakers and reduce accidental releases. New circuit breakers installed at Potrero Switchyard and Embarcadero Substation will have a manufacturer's guaranteed SF_6 leakage rate of 0.5 percent per year or less and will be maintained in accordance with PG&E's maintenance guidelines. In addition to these APMs, PG&E is implementing the following voluntary company-wide actions to further reduce GHG emissions: • PG&E is an active member of the SF_6 Emission Reduction Partnership for Electric Power Systems, a voluntary program between the USEPA and electric power companies that focuses on reducing emissions of SF_6 from transmission and distribution operations. Since 1998, PG&E has reduced its SF_6 leakage rate by 89 percent and absolute SF_6 emissions by 83 percent. • PG&E supports Natural Gas STAR, a program promoting the reduction of CH4 from natural gas pipeline operations. Since 1998, PG&E has avoided the release of thousands of tons of CH4. • On April 24th, 2012, PG&E submitted a proposal to state regulators for a new clean energy program that would give its electric customers an opportunity to support 100 percent renewable energy for an average of a few dollars a month. If approved, the "Green Option" would be totally voluntary, and customers could enroll in and/or leave the program as they wish. If approved, PG&E will buy renewable energy certificates to match the portion of each participating electric customer's energy that is not already covered by PG&E's eligible renewable energy deliveries. PG&E is asking the California Public Utilities Commission to approve the Green Option by early 2013.
3.8 Hazards
APM Hazardous Materials (HM)-1 (also see APM WQ-1 and APM WQ-3 in Section 3.9.4.2): Implementation of Hazardous Material and Emergency Response Procedures. PG&E will implement construction controls, training and communication to minimize the potential exposure of the public and site workers to potential hazardous materials during all phases of project construction. These construction practices include construction worker training appropriate to the site worker's role (see APM HM-3), and containment and spill control practices in accordance with the Stormwater Pollution Prevention Plan (see APM WQ-1). If it is necessary to store chemicals, they will be managed in accordance with all applicable regulations. Material safety data sheets will be maintained and kept available on site, as applicable. Soil that is suspected of being contaminated (on the basis of existing analytical data or visual, olfactory, or other evidence) and is removed during trenching or excavation activities will be segregated, tested, and if contaminated above hazardous levels, will be contained and disposed of offsite at a licensed waste facility. The presence of known or suspected contaminated soil will require testing and investigation procedures to be supervised by a qualified person, as appropriate, to meet state and federal regulations. All hazardous materials and hazardous wastes will be handled, stored, and disposed of in accordance with all applicable regulations, by personnel qualified to handle hazardous materials. Practices during construction will include, but not be limited to, the following: • Proper disposal of potentially contaminated materials. • Site-specific buffers for construction vehicles and equipment located near sensitive resources/receptors. • Emergency response and reporting procedures to address any potential hazardous material spills as described in Section 3.9, Hydrology and Water Quality. • Stopping work at that location and contacting the CUPA (SFDPH Environmental Health Section; see Section 3.8.2.1 above) immediately if unanticipated visual evidence of potential contamination or chemical odors are detected. Work will be resumed at this location after any necessary consultation and approval by the CUPA or other entities as specified by the CUPA. For the O&M phase of the project, existing operational hazardous substance control and emergency response plans will be updated as appropriate to incorporate necessary modifications resulting from this project.

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Applicant-Proposed Measures Summary Table
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Applicant-Proposed Measures
APM HM-2: Development and Implementation of a Health and Safety Plan. PG&E will prepare a project-specific health and safety (H&S) plan prior to project construction. The purpose of the plan is to minimize potential safety hazards to site construction workers. The H&S plan will outline the project team H&S responsibilities; present job safety analyses, H&S procedures, and personal protective equipment requirements; establish worker training and monitoring requirements; and describe emergency response procedures relevant to project activities. Each contractor will be responsible for preparing and submitting to PG&E their own H&S Plan specific to their activities using the PG&E Plan for project-specific information. For the O&M phase of the project, existing H&S plans for Potrero Switchyard and Embarcadero Substation will be modified and adhered to as appropriate. **APM HM-3: Adherence to Applicable Site-specific RMPs and SMPs.** In addition to following its own project-specific procedures during the construction phase, PG&E will adhere to any applicable site-specific plans such as the SMP for the former Potrero Power Plant (see Section 3.8.3.1), as well as the Maher Ordinance (see Section 3.8.2.1). **APM HM-4 (also see APM WQ-4). Emergency Spill Supplies and Equipment.** Oil-absorbent material, tarps, and storage drums will be available on the project site during construction and used to contain and control any minor releases of oil. In the event that excess water and liquid concrete escapes during pouring, it will be directed to lined and bermed areas adjacent to the borings, where the water will evaporate and the concrete will begin to set. Once the excess concrete has been allowed to set up, it will be removed and transported for disposal, according to applicable regulations. **APM HM-5 (also see APM WQ-5). Soil, Groundwater, and Underground Tank Characterization.** In areas where existing data are not available, soil and groundwater sampling and potholing will be conducted in onshore project areas before construction begins. Appropriate handling, transportation, and disposal locations will be determined based on results of the analyses performed on soil and groundwater. In addition, results will be provided to contractor and construction crews to inform them about soil and groundwater conditions and potential hazards. The location, distribution, and/or frequency of the borings will give adequate representation of the conditions in the construction area. If suspected hazardous substances are unexpectedly encountered during trenching or other construction activities (using indicators such as sheen, odor, soil discoloration), work will be stopped until the material or tank is properly characterized and appropriate measures are taken to protect human health and the environment. Appropriate personal protective equipment will be used and waste management will be performed in accordance with applicable regulations. If excavation of hazardous materials is required, the materials will be disposed of in accordance with applicable regulations. If necessary, groundwater will be collected during construction, contained, and disposed of in accordance with all applicable regulations. If underground or aboveground storage tanks are found to be located along the project route and the route cannot be adjusted to avoid disturbance, the tanks will be removed prior to project construction. If it is determined that removal and disposal of tanks is necessary, a separate workplan describing the proper decommissioning and removal of the tanks and removal of any associated impacted soil will be prepared prior to removal. **APM HM-6 (also see APM WQ-6 and APM WQ-7). Horizontal Directional Drilling (HDD) drilling fluid and cuttings monitoring and management.** HDD operations will include provisions for monitoring for loss of drilling fluids. Spill response measures shall include reducing fluid pressures and thickening the fluid mixture. Both the drilling technique and early detection and response shall be used to minimize release of fluids to the environment. A Frac-out Plan will be developed and prepared based on site specific conditions and specific contractor methods and equipment. **APM HM-7 (also see APM WQ-8). Sediment Testing Program for Submarine Cable Installation.** As discussed above, sediments along the submarine cable route are located near known contaminated sediment areas (SFEI, 2012), and a Sampling and Analysis Plan will be prepared in coordination with the Dredged Material Management Office (DMMO) of the U.S. Army Corps of Engineers. Sediment sampling shall be performed at the locations where the HDD emerges into the Bay, and the results would be considered and addressed prior to commencement of construction near these locations. Potential contaminants such as PAHs and heavy metals are generally insoluble or have low solubility in water. Conducting sediment analysis of samples before the installation of the submarine cable will establish baseline conditions along the project route. The sediment testing program will be used to develop appropriate construction control measures that may include controlling turbidity during construction through adjustment of hydroplow jet controls and flows, turbidity monitoring during construction in certain areas, and appropriate handling and disposal of any sediment that may be removed as part of the submarine transitions to HDD installation.
3.9 Hydrology
APM WQ-1. Development and Implementation of a Stormwater Pollution Prevention Plan (SWPPP). Stormwater discharges associated with project construction activities are regulated under the General Construction Permit. Cases in which construction will disturb more than one acre of soil require submittal of a Notice of Intent, development of a SWPPP (both certified by the Legally Responsible Person (LRP)), periodic monitoring and inspections, retention of monitoring records, reporting of incidences of noncompliance, and submittal of annual compliance reports. PG&E will comply with all General Construction Permit requirements.

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Following project approval, PG&E will prepare and implement a SWPPP, which will address erosion and sediment control to minimize construction impacts on surface water quality. The SWPPP will be designed specifically for the hydrologic setting of the proposed project in proximity to the San Francisco Bay. Implementation of the SWPPP will help stabilize graded areas and reduce erosion and sedimentation. The SWPPP will designate BMPs that will be adhered to during construction activities. Erosion and sediment control BMPs, such as straw wattles, erosion control blankets, and/or silt fences, will be installed in compliance with the SWPPP and the General Construction Permit. Suitable soil stabilization BMPs will be used to protect exposed areas during construction activities, as specified in the SWPPP. During construction activities, BMPs will be in place to address construction materials and wastes. BMPs, where applicable, will be designed by using specific criteria from recognized BMP design guidance manuals. Erosion and sediment-minimizing efforts will include measures such as the following: • Defining ingress and egress within the project site to control track-out • Implementing a dust control program during construction • Properly containing stockpiled soil Identified erosion and sediment control measures will be installed in an area before construction begins and inspected and improved as needed before any anticipated storm events. Temporary sediment control measures intended to minimize sediment transport from temporarily disturbed areas, such as silt fences or wattles, will remain in place until disturbed areas are stabilized. In areas where soil is to be temporarily stockpiled, soil will be placed in a controlled area and managed with similar erosion-control techniques. Where construction activities occur near a surface water body or drainage channel, the staging of construction materials and equipment and excavation spoil stockpiles will be placed at least 50 feet from the water body and properly contained, such as with berms and/or covers, to minimize risk of sediment transport to the drainage. Any surplus soil will be transported from the site and appropriately disposed of. A copy of the SWPPP will be provided to the CPUC for recordkeeping. The plan will be maintained and updated during construction as required by the SWRCB.
APM WQ-2. Implementation of a Worker Environmental Awareness Program. The project's worker environmental awareness program will communicate environmental issues and appropriate work practices specific to this project to all field personnel. These will include spill prevention and response measures and proper BMP implementation. The training program will emphasize site-specific physical conditions to improve hazard prevention (such as identification of flow paths to nearest water bodies) and will include a review of all site-specific water quality requirements, applicable portions of erosion control and sediment transport BMPs contained in the SWPPP (APM WQ-1) and the health and safety plan (see APM HM-2 in Section 3.8.4.2). A copy of the project's worker environmental awareness training record will be provided to the CPUC for recordkeeping. An environmental monitoring program will also be implemented to ensure that the plans are followed throughout the construction period.
APM WQ-3 (also see APM HM-1). Implementation of Hazardous Material and Emergency Response Procedures. PG&E will implement construction controls, training and communication to minimize the potential exposure of the public and site workers to potential hazardous materials during all phases of project construction. These construction practices include construction worker training appropriate to the site worker's role (see APM HM-3), containment and spill control practices in accordance with the SWPPP (see APM WQ-1), and emergency response to ensure appropriate cleanup of accidental spills. If it is necessary to store chemicals, they will be managed in accordance with all applicable regulations. Material safety data sheets will be maintained and kept available on site, as applicable. The project SWPPP (APM WQ-1) will identify areas where refueling and vehicle-maintenance activities and storage of hazardous materials, if any, will be permitted.
APM WQ-4 (also see APM HM-4). Emergency Spill Supplies and Equipment. Materials will be available on the project site during construction to contain, collect and dispose of any minor spill (for example, absorbent material, tarps, and storage drums). In the event that excess water or liquid concrete escapes during pouring activities, it will be directed to lined and bermed areas adjacent to the borings, where the water will evaporate and the concrete will begin to set. Once the excess concrete has been allowed to set up, it will be removed and transported for disposal, according to applicable regulations.
APM WQ-5 (also see APM HM-5). Soil Sampling/Wastewater and Groundwater Characterization. Soil sampling and potholing will be conducted in onshore project areas before construction begins, and soil information will be provided to construction crews to inform them about soil conditions and potential hazards. If hazardous substances are unexpectedly encountered during trenching, work will be stopped until the material is properly characterized and appropriate measures are taken to protect human health and the environment. If excavation of hazardous materials is required, they will be handled in accordance with applicable regulations. Prior to initiating excavation activities along the underground transmission cable routes, soil borings will be advanced to identify areas where contaminated groundwater may be contacted. The location, distribution, and/or frequency of the borings will give adequate representation of the conditions in the construction area. If suspected contaminated groundwater is encountered at the

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depths of the proposed construction, samples will be collected and submitted for laboratory analysis of petroleum hydrocarbons, metals, volatile organic compounds, and semi-volatile organic compounds. If necessary, groundwater will be collected during construction, contained, and disposed of in accordance with all applicable regulations. Appropriate personal protective equipment will be used and waste management will be performed in accordance with applicable regulations. Non-contaminated groundwater will be released to one of the city's combined sanitary and stormwater drainage systems (with prior approval) or contained, tested, and disposed of in accordance with applicable regulations.
APM WQ-6 (also see APM HM-6 and APM WQ-7). Horizontal Directional Drilling (HDD) Monitoring and Management.
HDD operations will include best management practices for monitoring for loss of drilling fluids, spill containment and response measures. Monitoring and response measures specific to the site subsurface conditions and construction equipment will be included in a Frac-out Plan. The objectives of this monitoring program are to quickly identify any unplanned release of drilling fluids during drilling; determine the size, extent, and location of the release; and evaluate and implement appropriate containment and cleanup measures after a release has occurred. Routine monitoring will be conducted at regular intervals during all drilling activities. More intensive monitoring will be implemented if drilling fluid circulation to the HDD endpoints is lost or an unplanned release is detected.
In general, both the drilling technique and early detection and response shall be used to minimize release of fluids to the environment. Techniques to minimize potential loss of drilling fluids include termination of the pilot hole short of the exit into the bay, monitoring of fluid pressures, and adjustments to the drilling fluid mix (see Section 2.6.4, Submarine Cable Installation.) To minimize any potential impacts to water quality, drilling muds (which are heavier than water) shall consist of naturally occurring materials such as water and bentonite clay, plus inert, non-toxic polymers. Monitoring measures that will be included in the Frac-out Plan include use of dyes in the fluid, use of a fluorometer to determine dye concentrations in the water column, and monitoring by divers or side scan sonar in the event of loss of circulation of the fluid; potential responses to a release include measures such as reductions in drilling pressure, thickening of the fluid mixture, and in the event of an emergency, cessation or substantial reduction of drilling and fluid circulation. On land, measures would include installation of spill control berms and pits. For a release in the water column, divers and side scan sonar will be used to track the extent and location of the release. Appropriate containment and clean-up measures will be employed depending on the amount and location of the release, including disposal of material. Waste drilling fluids will be collected in a manner that is in accordance with all local, state and federal regulations.
APM WQ-7. Prevention of Contaminant Migration along HDD Route. The project will be designed to prevent contaminants along the HDD route from leaching to the shoreline or bay via the boreholes of the HDD. In areas of contamination (as determined by soil and sediment sampling) the HDD conduit can be sealed to effectively plug voids that might permit movement of contaminants down the HDD drill path after the HDD initial drill is established and the HDD conduit is being pulled into position. In the event that contaminants are found during pre-construction sampling, in areas where contaminants are found and where there are potential voids between the conduit and surrounding soil the voids will be filled with grout or similar material to prevent any potential preferential pathway for the passage of contaminants, as described below.
APM WQ-8 (see also APM HM-7). Sediment Testing Program and Sediment Controls for Submarine Cable and Offshore HDD Intercept. Sediments along the submarine cable route are located near known contaminated sediment areas (SFEI, 2012), and may be contaminated with PAHs, metals, and/or pesticides. These compounds are generally insoluble or have low solubility in water. Sediments will be temporarily disturbed during hydroplow operations and during excavation of the HDD exit pits. In coordination with the DMMO, PG&E will prepare a Sampling and Analysis Plan for the sampling and analysis of sediment along the submarine cable route and where the HDD exits into the Bay. As part of preparation and implementation of the Sampling and Analysis Plan, surveys will be conducted to examine water depths, slopes, sediment types, potential contaminants, and any other activities or obstacles. Sensitive habitats, cultural resources, existing and abandoned pipelines, old cables, and material discarded on the bottom of the Bay will be located to ensure the new cable will be installed so as to avoid these conflicts or obstacles. In cases where a cable must cross a pipeline or existing cable, arrangements will be made with the owner of the existing installation to establish necessary separations between each installation (ICPC, 2009).
The HDD offshore exits were selected far enough into the Bay to minimize the potential for encountering near-shore contaminated sediments. At an HDD exit location, it is a common practice to deploy divers to excavate a collection pit approximately 100 to 400 square feet and 6 feet deep at the exit point depending on final design. The results of the sediment sampling will be used to plan the appropriate handling of sediment resulting from the excavation of the HDD pit as determined in consultation with the DMMO. As the HDD is installed, drilling muds, which are heavier than water, will collect in this excavated collection pit. A barge on the surface is used during HDD installation to pump these drilling muds into a containment tank on the barge/ship for appropriate disposal. Hydroplow installation causes temporary disturbance of sediments. Most of the fluidized material falls back behind the hydroflow jets and increases in turbidity along the narrow path of the jets are minimized. Turbidity is limited by controlling the pressure of the jets and the rate of hydroplow advancement. The hydroplow is instrumented to enable measurement and control of pressure and tow tension.
APM WQ-9. Project Site Restoration. As part of the final construction activities, PG&E will restore all removed curbs and gutters, repave, and restore landscaping or vegetation as necessary.

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3.10 Land Use and Planning
The project will have no impact to land use and planning. However, to further reduce short-term disturbance to the surrounding neighborhoods during construction, PG&E is proposing the following applicant-proposed measures (APMs).
APM Land Use (LU)-1. Provide Construction Notification and Minimize Construction Disturbance. A public liaison representative will provide the public with advance notification of construction activities, between two and four weeks prior to construction. The announcement shall state specifically where and when construction will occur in the area. Notices shall provide tips on reducing noise intrusion, for example, by closing windows facing the planned construction. PG&E shall also publish a notice of impending construction in local newspapers, stating when and where construction will occur.
All construction activities will be coordinated with the City and Port of San Francisco at least 30 days before construction begins in these areas. Work will be coordinated to minimize any potential conflicts with other construction or recreational projects.
APM LU-2. Provide Public Liaison Person and Toll-Free Information Hotline. PG&E shall identify and provide a public liaison person before and during construction to respond to concerns of neighboring residents about noise, dust, and other construction disturbance. Procedures for reaching the public liaison officer via telephone or in person shall be included in notices distributed to the public as described above. PG&E shall also establish a toll-free telephone number for receiving questions or complaints during construction.
3.11 Mineral Resources
Since economically viable sources of rock materials are not mapped along or adjacent to any portion of the project route, no mineral resource-related Applicant-Proposed Measures are proposed for this project.
3.12 Noise
APM Noise (NO)-1: Noise Minimization with Portable Barriers. Compressors and other small stationary equipment used during construction will be shielded with portable barriers if located within 200 feet of a residence.
APM NO-2: Noise Minimization with Quiet Equipment. Quiet equipment (for example, equipment that incorporates noise-control elements into the design; e.g., quiet model compressors can be specified) will be used during construction whenever possible.
APM NO-3: Noise Minimization through Direction of Exhaust. Equipment exhaust stacks and vents will be directed away from buildings where feasible.
APM NO-4: Noise Minimization through Truck Traffic Routing. Truck traffic will be routed away from noise-sensitive areas where feasible.
APM NO-5: Noise Disruption Minimization through Residential Notification. In the event that nighttime construction is necessary because of clearance restrictions, affected residents will be notified in advance by mail, personal visit, or door-hanger and informed of the expected work schedule.
APM NO-6: HDD Noise Minimization Measures. Temporary barriers utilizing materials such as intermodal containers or frac tanks, plywood walls, mass-loaded vinyl (vinyl impregnated with metal) or hay bales will be used to reduce noise generated by the onshore HDD operations. If night-time HDD activities are required, the project will monitor actual noise levels from HDD activities between 8:00 p.m. and 7:00 a.m. If the noise levels created by the HDD operation are found to be in excess of the ambient noise level by 5 dBA at the nearest property plane, PG&E will, within 24 hours of the excess measurement, employ additional minimization measures necessary to limit the increase to 5 dBA. Such measures may include ensuring semi-permanent stationary equipment (generators, lights, etc) are stationed as far from sensitive areas as practicable, utilize "quiet" or "Hollywood/Movie Studio" silencing packages, and/or modify barriers to further reduce noise levels.
APM NO-7: Noise Minimization Equipment Specification. PG&E will specify general construction noise reduction measures that require the contractor to ensure all equipment is in good working order, adequately muffled and maintained in accordance with the manufacturers' recommendations.
3.13 Population and Housing
No applicant-proposed measures are proposed for population and housing because project construction, operation, and maintenance will have no impact on these resources.

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Applicant-Proposed Measures
3.14 Public Services
No applicant-proposed measures are suggested for public services because project construction, operation and maintenance will have no impact on these public services.
3.15 Recreation
No applicant proposed measures are suggested for recreation because project construction, operation, and maintenance will have no impact on recreational resources.
3.16 Transportation
APM Transportation and Traffic (TR)-1: Traffic Management Implementation. PG&E will follow its standard safety practices, including installing appropriate barriers between work zones and transportation facilities, posting adequate signs, and using proper construction techniques. PG&E will coordinate construction traffic access at Embarcadero Substation and Potrero Switchyard with SFMTA during project construction. PG&E is a member of the California Joint Utility Traffic Control Committee, which published the *California Joint Utility Traffic Control Manual* (2010). PG&E will follow the recommendations in this manual regarding basic standards for the safe movement of traffic on highways and streets in accordance with Section 21400 of the CVC. These recommendations include provisions for safe access of police, fire, and other rescue vehicles. In addition, PG&E will apply for an Excavation Permit and a Special Traffic Permit from the City of San Francisco, and will also submit a Traffic Management Plan to the City as part of his application. The Traffic Management Plan will include the following elements and activities: • Consult with SF Muni at least one month prior to construction to coordinate bus stop relocation (as necessary) and to reduce potential interruption of transit service, especially to the Transbay Temporary Terminal. • Include a discussion of work hours, haul routes, limits on lengths of open trench, work area delineation, traffic control and flagging. • Identify all access and parking restrictions and signage requirements, including any bicycle route or pedestrian detours, should the need for these arise during final design. • Lay out a plan for notifications and a process for communicating with affected residents and businesses prior to the start of construction. Advance public notification would include postings of notices and appropriate signage of construction activities. The written notification shall include the construction schedule, the exact location and duration of activities within each street (i.e., which lanes and access points/driveways would be blocked on which days and for how long), and a toll-free telephone number for receiving questions or complaints. • Include a plan to coordinate all construction activities with emergency service providers in the area at least one month in advance. Emergency service providers shall be notified of the timing, location, and duration of construction activities. All roads shall remain passable to emergency service vehicles at all times. • Include the requirement that all open trenches be covered with metal plates at the end of each workday to accommodate traffic and access. • Specify the street restoration requirements pursuant to PG&E's franchise agreements with the City and County of San Francisco. • Identify all roadway locations where special construction techniques (e.g., horizontal boring, directional drilling, or night construction) would be used to minimize impacts to traffic flow. • Develop circulation and detour plans to minimize impacts to local street circulation. This may include the use of signing and flagging to guide vehicles through and/or around the construction zone. These plans will also address loading zones. **APM TR-2: Marine Traffic Management Implementation.** PG&E and its contractors will coordinate with the USCG VTS to establish a Vessel Safety Zone, and will provide information for the appropriate notices to mariners for cable laying work. The USCG requires 90-day notification for establishment of the Vessel Safety Zone. This information is then disseminated by the USCG to mariners and other parties.
3.17 Utilities and Service Systems
APM Utilities and Service Systems (UTIL)-1: Coordination with SFPUC Regarding Stormwater System Facilities. One of the extremely large SFPUC stormwater transport/storage boxes underlies The Embarcadero, where the northern HDD is planned. In this area, the HDD depth will be coordinated with SFPUC, in order to prevent damaging the storage box.

2.10 Required Approvals

The CPUC is the lead agency under CEQA for this project. This PEA is being prepared as part of an application to obtain a Certification of Public Convenience and Necessity (CPCN) for the project from the CPUC. The additional approvals that may be required for this project are listed in Table 2-7.

TABLE 2-7
Agencies To Be Consulted
Embarcadero-Potrero 230 kV Transmission Project

Agency	Potential Permit
State Water Resources Control Board (SWRCB)	NPDES Stormwater Construction Permit
San Francisco Bay Conservation and Development Commission (BCDC)	Administrative Permit
Port of San Francisco	License
State Lands Commission	None per consultation with SLC.
U.S. Army Corps of Engineers (USACE)	Clean Water Act Section 404/Rivers and Harbor Act Section 10 permit
San Francisco Bay Area Regional Water Quality Control Board (RWQCB)	Clean Water Act Section 401 water quality certification
National Marine Fisheries Service (NMFS)	Endangered Species Act Section 7 technical assistance
U.S. Fish and Wildlife Service (USFWS)	Endangered Species Act Section 7 technical assistance
California Department of Fish and Game (CDFG)	California Endangered Species Act coordination, or Section 2080.1 or 2081 ITP or Consistency Determination
U.S. Coast Guard	Establishment of Vessel Safety Zone

During the U.S. Army Corps of Engineers (USACE) 10/404 permit review process, the USACE as a federal agency may consult with National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) if they determine the project may affect an endangered species (see Section 3.5 for additional information on permitting).

Because the project will disturb more than one acre of land, PG&E will apply for a National Pollutant Discharge Elimination System (NPDES) Stormwater Construction Permit for discharges of stormwater associated with Small Linear Underground/Overhead Construction Projects (General Permit) from the State Water Resources Control Board (SWRCB), in addition to the aforementioned Excavation Permit from the City and County of San Francisco to construct within roadways.

The San Francisco Department of Public Works will be consulted for approval and acquisition of the excavation permit required for trenching from the two landings through franchise to the Embarcadero and Potrero substation termination points. The Transbay Joint Powers Authority, San Francisco Municipal Transportation Agency (SFMTA), and San Francisco Planning Department have no independent permitting jurisdiction relative to this route. However, the Transbay Joint Powers Authority and SFMTA will be involved with review of the contractor's Traffic Control Plan, where relevant. It is not expected that permits or approvals from the San Francisco Planning Department will be required, but they typically will participate in the CPUC process.

2.11 Electric and Magnetic Fields (EMF) Discussion

Recognizing that there is public interest and concern regarding potential health effects from exposure to electric and magnetic fields (EMF) from power lines, this document provides some general background information in Appendix C regarding EMF associated with electric utility facilities. However, EMF is not addressed here as an environmental impact under CEQA. The CPUC has repeatedly recognized that EMF is not an environmental impact to be analyzed in the context of CEQA because (1) there is no agreement among scientists that EMF creates a potential health risk; and (2) there are no defined or adopted CEQA standards for defining health risk from EMF. See, for example, CPUC Decision No. 04-07-027 (Jul. 16, 2004); Delta DPA Capacity Increase Substation Project Final Mitigated Negative Declaration and Supporting Initial Study (November 2006), A.05-06-022, Section B.1.14.1, page B-31, adopted in Decision 07-03-009 (March 1, 2007).

Section X(A) of the CPUC's General Order 131-D, CPUC Decision No. D.06-01-042 ("EMF Decision"), and PG&E's EMF Design Guidelines prepared in accordance with the EMF Decision, require PG&E to prepare a Field Management Plan that indicates the no-cost and low-cost EMF measures that will be installed as part of the final engineering design for the project. The Field Management Plan will evaluate the no-cost and low-cost measures considered for the project, the measures adopted, and reasons that certain measures were not adopted. A copy of the Preliminary EMF Management Plan and Substation Checklist for this project will be included as an exhibit to the Embarcadero-Potrero 230 kV Project Application provided to the CPUC.

2.12 References

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