Revised Table 4.6-1: Geological Formations within the Proposed Project Area

Geological Formation	Geologic Age	Length of Proposed Project Crossed by Geological Formation in the Proponent's Environmental Assessment (miles)	Revised Length of Proposed Project Crossed by Geologic Formation (miles)[1]	Mileposts (MPs), Laydown Yards, and Permanent Patrol Roads Crossed by Geological Formation[2]
Artificial fill	Late Holocene	0.16	0.19	23.7
Crystalline bedrock: Gabbro, undivided	Mid-Cretaceous	1.63	1.66	2.4 – 2.5 2.9 – 3.8 30.9 – 31.2 Rainbow Hills Road Yard Milepost 3.3 Patrol Road
Crystalline bedrock: Granodiorite, undivided	Mid-Cretaceous	1.58	1.5	33.9 – 34.4 34.9 – 35.0 35.2 – 35.5 37.1 37.9 – 38.0
Crystalline bedrock: Granodiorite of Indian Mountain	Mid-Cretaceous	1.03	1.04	7.1 9.6 – 10.4
Crystalline bedrock: Granite of Indian Springs	Mid-Cretaceous	0.08	Not crossed by revised alignment	Not crossed by revised alignment

[1] The length of the Pipeline Safety & Reliability Project (Proposed Project) crossed by geological formations has been revised to reflect the minor design refinements that were submitted to the California Public Utilities Commission (CPUC) on January 31, 2017.

[2] Geologic formation data were identified beneath each individual MP. Therefore, MP ranges may include additional geologic formations between the first and last MPs referenced in each MP range.

Geological Formation	Geologic Age	Length of Proposed Project Crossed by Geological Formation in the Proponent's Environmental Assessment (miles)	Revised Length of Proposed Project Crossed by Geologic Formation (miles)[1]	Mileposts (MPs), Laydown Yards, and Permanent Patrol Roads Crossed by Geological Formation[2]
Crystalline bedrock: Granodiorite of Jesmond Dean	Mid-Cretaceous	4.20	4.20	14.3 – 14.7 15.4 – 15.5 16.0 – 16.8 17.9 – 18.5 19.1 – 20.9
Crystalline bedrock: Monzogranite of Merriam Mountain	Mid-Cretaceous	2.24	2.24	13.7 – 14.1 14.8 – 14.9 15.1 – 15.2 16.9 – 17.8 21.0 – 21.4 Nutmeg Street and Montiel Yards
Crystalline bedrock: Granodiorite of Rainbow	Mid-Cretaceous	1.77	1.67	0 0.3 – 0.5 0.7 1.1 – 2.3 Rainbow Station and Rainbow Creek Road Yards
Crystalline bedrock: Tonalite, undivided	Mid-Cretaceous	5.38	5.79	3.9 – 4.2 4.5 – 4.7 8.5 – 8.6 10.5 – 12.7 29.9 – 30.0 30.8 31.3 – 32.6 32.8 33 – 33.2 33.4 33.6

Geological Formation	Geologic Age	Length of Proposed Project Crossed by Geological Formation in the Proponent's Environmental Assessment (miles)	Revised Length of Proposed Project Crossed by Geologic Formation (miles)[1]	Mileposts (MPs), Laydown Yards, and Permanent Patrol Roads Crossed by Geological Formation[2]
Crystalline bedrock: Granodiorite of Woodson Mountain	Mid-Cretaceous	1.87	1.83	25.7 – 26 26.4 – 26.9 27.1 – 27.6 27.8 28.1 Emmanuel Church Lot Yard
Crystalline bedrock: Metasedimentary and metavolcanic rocks, undivided	Mesozoic	1.15	1.26	2.6 – 2.8 5.5 – 6.0 9.2 – 9.5 21.5 395 Stewart Canyon and Montego Yards
Quaternary surficial deposits, landslide deposits, undivided	Holocene and Pleistocene	0.28	0.22	36.2 – 36.3 Arbolitos Field Yard
Old alluvial floodplain deposits, undivided	Late to middle Pleistocene	7.34	7.74	0.8 – 1.0, 7.2 – 7.3 7.5 – 8.4 18.6 – 19 21.6 – 23.6 23.8 – 24.3 24.5 – 25.6 26.1 – 26.3 28.2 – 28.3 28.5 – 30.7 Rainbow Creek Road, Montego, Lake Hodges West, Lake Hodges East, and Montiel Yards

Geological Formation	Geologic Age	Length of Proposed Project Crossed by Geological Formation in the Proponent's Environmental Assessment (miles)	Revised Length of Proposed Project Crossed by Geologic Formation (miles)[1]	Mileposts (MPs), Laydown Yards, and Permanent Patrol Roads Crossed by Geological Formation[2]
Very old paralic deposits, Unit 2	Middle to early Pleistocene	0.53	0.52	43.9 – 44.0 44.3, 45.1 Alliant Yard
Very old paralic deposits, Unit 3	Middle to early Pleistocene	0.05	0.05	44.7
Very old paralic deposits, Unit 4	Middle to early Pleistocene	0.14	0.14	45.6
River channel, wash deposits	Late Holocene	0.07	0.08	8.9

Geological Formation	Geologic Age	Length of Proposed Project Crossed by Geological Formation in the Proponent's Environmental Assessment (miles)	Revised Length of Proposed Project Crossed by Geologic Formation (miles)[1]	Mileposts (MPs), Laydown Yards, and Permanent Patrol Roads Crossed by Geological Formation[2]
Young alluvial floodplain deposits	Holocene and late Pleistocene	8.30	8.0	0.1 – 0.2 0.6 4.3 – 4.4 4.8 – 5.4 6.1 – 7.0 7.4 8.7 – 9.1 12.8 – 13.6 13.9 – 14.0 14.2, 15.0, 15.3 15.6 – 15.9 24.4 29.6 – 29.8 30.1 – 30.4 35.1, 36.1 36.5 – 37.0 37.2 – 37.8 38.1 – 38.4 38.7 – 38.8 39.3 – 39.4 39.6, 42.3, 43.6, 44.6, 44.9, 45.4, 46.2 Rainbow Station, 395 Stewart Canyon, and Boulder Knolls Road Yards MP 3.3 Patrol Road, MP 43.5 Patrol Road

Geological Formation	Geologic Age	Length of Proposed Project Crossed by Geological Formation in the Proponent's Environmental Assessment (miles)	Revised Length of Proposed Project Crossed by Geologic Formation (miles)[1]	Mileposts (MPs), Laydown Yards, and Permanent Patrol Roads Crossed by Geological Formation[2]
Young colluvial deposits	Holocene and late Pleistocene	1.47	1.29	27.0, 27.7 27.9 – 28.0 28.4 – 29.5 32.4, 32.7, 32.9, 33.3, 33.5 33.7 – 33.8
Sedimentary deposits: Claystones, siltstone, Friars Formation, nonmarine and lagoonal sandstone and claystone	Middle Eocene	1.94	1.91	34.5 – 34.8 35.6 – 36.0 36.4 – 36.6 38.9 – 39.2 39.5 Arbolitos Field Yard
Sedimentary deposits: Sandstones, Mission Valley Formation, marine and nonmarine sandstone	Middle Eocene	1.07	0.86	40.5, 40.9 41.0 – 41.2 45.5 45.8 – 46.0
Sedimentary deposits: Conglomerates, Stadium Conglomerate	Middle Eocene	4.38	4.94	39.7 – 40.4 41.3 – 42.2 42.4 – 43.5 43.7 – 43.8 44.1 – 44.2 44.4 – 44.5 44.7 – 44.8 45.0 45.2 – 45.3 45.7 46.1 – 46.6 MP 43.5 Patrol Road

Geological Formation	Geologic Age	Length of Proposed Project Crossed by Geological Formation in the Proponent's Environmental Assessment (miles)	Revised Length of Proposed Project Crossed by Geologic Formation (miles)[1]	Mileposts (MPs), Laydown Yards, and Permanent Patrol Roads Crossed by Geological Formation[2]
Torrey sandstone	Middle Eocene	0.29	0.28	40.6 – 40.8

Source: United States (U.S.) Geological Survey (USGS) 2017

Revised Table 4.6-4: Soils in the Proposed Project Area

Soil Type	Soil Map Unit[3]	Slope (percent)	Permeability	Erosion Potential	Length of Soil Type Crossed by Proposed Project (miles)	Revised Length of Soil Type Crossed by Proposed Project (miles)[4]	MPs, Laydown Yards, and Permanent Patrol Roads Crossed by Soil Type
Arlington coarse sandy loam	AvC	2 to 9	Slow	Moderate	0.98	0.98	0.7 – 1.6 Rainbow Creek Road Yard
Bonsall Sandy Loam	BlC	2 to 9	Very slow	Moderate	0.61	0.62	31.9 – 32.4
	BmC	2 to 9					
Bosanko clay	BsD	9 to 15	Slow	Moderate	0.58	0.59	34.7 – 35.2
Chino silt loam, saline	CkA	0 to 2	Moderately Slow	Slight	0.62	0.70	28.3 – 28.6 33.3 – 33.5 Lake Hodges East Yard
Cieneba coarse sandy loam	ClD2	5 to 15	Moderately Rapid	Moderate	0.45	0.64	11.9 – 12.3 21.7 Montego Yard
	ClE2	15 to 30					
	ClG2[5]	30 to 65	Moderately Rapid	Severe		None	
Cieneba rocky coarse sandy loam	CmE2	9 to 30	Moderately Rapid	Severe	0.62	0.52	2.1 17.7 – 17.8 21.1 – 21.2

[3] Soil map units are utilized by the National Resources Conservation Service (NRCS) to identify and display specific soils and/or groups of soils on a map based on their soil profile, soil type, relationship to other soils, or suitability for various uses.

[4] The length of the Proposed Project crossed by soils has been revised to reflect the minor design refinements that were submitted to the CPUC on January 31, 2017.

[5] Soil map units that are no longer crossed by the revised alignment are highlighted in gray.

Soil Type	Soil Map Unit[3]	Slope (percent)	Permeability	Erosion Potential	Length of Soil Type Crossed by Proposed Project (miles)	Revised Length of Soil Type Crossed by Proposed Project (miles)[4]	MPs, Laydown Yards, and Permanent Patrol Roads Crossed by Soil Type
Cieneba very rocky coarse sandy loam	CmrG	30 to 75	Moderately Rapid	Severe	2.07	2.14	0.4 – 0.6 9.4 – 9.9 10.0 – 10.4 11.6 – 11.8 12.4 – 12.7 16.0, 17.4 Lake Hodges East Yard
Cieneba-Fallbrook rocky sandy loam	CnE2	9 to 30	Moderately Rapid	Severe	2.40	2.48	1.7 – 1.8 2.0, 2.2 13.3 – 13.9 16.1, 16.3 16.6 – 17.3 17.5 – 17.6
	CnG2	30 to 65					
Diablo-Olivenhain complex	DoE	9 to 30	Medium to Rapid	Severe	0.79	0.79	38.5 – 39.2
Escondido very fine sandy loam	EsC	5 to 9	Moderate	Moderate	0.87	0.87	5.6 – 5.7 21.3 – 21.4 21.5, 21.8 22.0 – 22.2 Montego Yard
	EsD2	9 to 15		Severe			
	EsE2	15 to 30					

Soil Type	Soil Map Unit[3]	Slope (percent)	Permeability	Erosion Potential	Length of Soil Type Crossed by Proposed Project (miles)	Revised Length of Soil Type Crossed by Proposed Project (miles)[4]	MPs, Laydown Yards, and Permanent Patrol Roads Crossed by Soil Type
Fallbrook sandy loam	FaB	2 to 5	Moderately Slow	Slight	3.51	3.71	8.6 10.5 10.7 – 10.8 11 – 11.1 11.4 – 11.5 14.5 – 14.8 15.1 15.4 – 15.6 18.0, 18.2 18.4 – 18.5 19.3 – 19.5 19.9 26.1 – 26.2 29.9 31.6 32.6 – 33.2 34.3 Montego Yard
	FaC	5 to 9		Moderate			
	FaC2	5 to 9					
	FaD2	9 to 15		Severe			
	FaE2	15 to 30					
	FaE3	9 to 30					
Fallbrook rocky sandy loam	FeC	5 to 9	Moderately Slow	Moderate	0.43	0.48	30.7 – 31.1
Fallbrook-Vista sandy loam	FvD	9 to 15	Moderately Slow	Moderate	0.82	0.93	10.9 11.2 – 11.3 20.0 – 20.4 26.5 – 26.6 Emmanuel Church Lot Yard
	FvE*	15 to 30		Severe	Not Previously Crossed		
Friant fine sandy loam	FwF	30 to 50	Moderately Rapid	Severe	0.14	0.13	13.2

Soil Type	Soil Map Unit[3]	Slope (percent)	Permeability	Erosion Potential	Length of Soil Type Crossed by Proposed Project (miles)	Revised Length of Soil Type Crossed by Proposed Project (miles)[4]	MPs, Laydown Yards, and Permanent Patrol Roads Crossed by Soil Type
Grangeville fine sandy loam	GoA	0 to 2	Moderate to Moderately Rapid	Slight	0.48	0.44	0.1 33.7 – 33.8 Rainbow Station Yard
Greenfield sandy loam	GrC	5 to 9	Moderately Rapid	Moderate	0.04	None	7.6
	GrD*	9 to 15	Moderately Rapid	Severe	Not previously crossed	0.03	
Huerhuero loam	HrC	2 to 9	Very Slow	Moderate	0.13	0.13	21.6 Montego Yard
Las Posas fine sandy loam	LpC	5 to 9	Slow	Moderate	0.94	0.91	2.3 – 3.0 18.3 Rainbow Hills Road Yard
	LpD2	9 to 15		Severe			
Las Posas stony fine sandy loam	LrG	30 to 65	Slow	Severe	0.47	0.46	3.4 – 3.7 Milepost 3.3 Patrol Road
Olivenhain cobbly loam	OhC	2 to 9	Very Slow	Slight	1.33	1.29	35.3 – 35.4 35.8 – 36.5 37.8 – 38.0 Arbolitos Field Yard
	OhE	9 to 30		Moderate			
Olivehain-Urban land complex	OkC	2 to 9	Very Slow	Slight	1.13	1.16	36.6 – 37.7

Soil Type	Soil Map Unit[3]	Slope (percent)	Permeability	Erosion Potential	Length of Soil Type Crossed by Proposed Project (miles)	Revised Length of Soil Type Crossed by Proposed Project (miles)[4]	MPs, Laydown Yards, and Permanent Patrol Roads Crossed by Soil Type
Placentia sandy loam	PeC	2 to 9	Very Slow	Moderate	3.26	3.42	5.9 18.7 – 19.2 20.7 – 20.7 22.7 – 23.0 23.6 – 23.7 24.1 24.6 – 26.0 28.7 – 28.8 Rainbow Station and Montiel Yards
	PeC2	5 to 9					
	PeD2	9 to 15		Severe			
Placentia sandy loam, thick surface	PfC	2 to 9	Very Slow	Moderate	1.26	1.18	19.6 – 19.8 28.9 – 29.1 33.6 35.5 – 35.7 38.1 – 38.2
Ramona gravelly sandy loam*	RcE*	15 to 30	Moderately Slow	Severe	Not previously crossed	25 feet	Between 6.9 and 7.0

Soil Type	Soil Map Unit[3]	Slope (percent)	Permeability	Erosion Potential	Length of Soil Type Crossed by Proposed Project (miles)	Revised Length of Soil Type Crossed by Proposed Project (miles)[4]	MPs, Laydown Yards, and Permanent Patrol Roads Crossed by Soil Type
Ramona sandy loam	RaB	2 to 5	Moderately Slow	Moderate	6.43	6.42	6.9 – 7.5 7.7 – 8.5 15.2 – 15.3 17.9 20.8 – 21.0 23.1 – 23.5 23.8 – 24.0 24.2 – 24.3 26.3 – 26.4 26.7 – 27.7 27.8 – 28.2 29.2 – 29.7 30.0 30.5 – 30.6 31.2 – 31.5 31.7 – 31.8 Nutmeg Street and Lake Hodges West Yards
	RaC	5 to 9					
	RaC2	5 to 9					
	RaD2	9 to 15		Severe			
Redding gravelly loam	RdC	2 to 9	Slow to Very Slow	Moderate	3.27	3.21	40.9 – 41.2 42.5 – 43.1 43.7 – 43.8 44.4 – 45.0 45.2 – 45.3 45.8 – 46.1 46.3 – 46.6 Alliant Yard Milepost 43.5 Patrol Road

Soil Type	Soil Map Unit[3]	Slope (percent)	Permeability	Erosion Potential	Length of Soil Type Crossed by Proposed Project (miles)	Revised Length of Soil Type Crossed by Proposed Project (miles)[4]	MPs, Laydown Yards, and Permanent Patrol Roads Crossed by Soil Type
Redding cobbly loam	ReE	9 to 30	Slow to Very Slow	Severe	2.29	2.46	39.4 – 39.5 40.6 – 40.8 41.3 – 41.8 43.2, 43.6 43.9 – 44.3 45.1 45.1 – 45.7 Milepost 43.5 Patrol Road
Redding cobbly loam, dissected	RfF	15 to 50	Slow to Very Slow	Severe	1.03	1.05	39.6 – 40.5
Riverwash	Rm	15 to 50	Moderately Rapid to Very Rapid	Slight	1.6	1.46	8.8 – 8.9 14.2 39.3 41.9 – 42.4 43.3 – 43.5 45.4, 46.2 Milepost 43.5 Patrol Road
San Miguel rocky silt loam	SmE	9 to 30	Very Slow	Severe	0.11	0.08	21.9
Steep gullied land	StG	INA	INA	Severe	0.29	0.09	3.1, 10.6
Terrace escarpments	TeF	INA	INA	Severe	0.03	0.03	Between 46.2 and 46.3

Soil Type	Soil Map Unit[3]	Slope (percent)	Permeability	Erosion Potential	Length of Soil Type Crossed by Proposed Project (miles)	Revised Length of Soil Type Crossed by Proposed Project (miles)[4]	MPs, Laydown Yards, and Permanent Patrol Roads Crossed by Soil Type
Tujunga sand	TuB	0 to 5	Rapid	Slight	0.48	0.46	8.7 9.0 – 9.1 12.9 – 13.1
Visalia sandy loam	VaA	0 to 2	Rapid	Slight	3.8	3.68	1.9 0 6.2 – 6.8 12.8 14.0 – 14.1 14.3 – 14.4 14.9 – 15.0 15.7 – 15.8 16.2 16.4 – 16.5 18.1, 18.6 22.4 – 22.6 24.4 – 24.5 29.8 38.3 – 38.4 Rainbow Station, 395 Stewart Canyon, and Boulder Knolls Road Yards
	VaB	2 to 5					
	VaC	5 to 9		Moderate			
Vista coarse sandy loam	VsD	9 to 15	Moderately Rapid	Severe	2.32	2.39	3.8 – 5.5 5.8 9.2 – 9.3 15.9, 22.3, 32.5 Nutmeg Street and Montiel Yards
	VsE	15 to 30					
	VsE2	15 to 30					
	VsG	30 to 65					

Soil Type	Soil Map Unit[3]	Slope (percent)	Permeability	Erosion Potential	Length of Soil Type Crossed by Proposed Project (miles)	Revised Length of Soil Type Crossed by Proposed Project (miles)[4]	MPs, Laydown Yards, and Permanent Patrol Roads Crossed by Soil Type
Vista rocky coarse sandy loam	VvD	5 to 15	Moderately Rapid	Severe	0.84	0.88	0.2 – 0.3 20.5 33.9 – 34.2 34.4 – 34.6
	VvG	30 to 65					
Water	W	NA	NA	Not Rated	0.32	0.32	30.1 – 30.4
Wyman loam	WmC	5 to 9	Moderately Slow	Moderate	0.23	0.23	3.2 -3.3 Rainbow Hills Road Yard Milepost 3.3 Patrol Road
	WmD	9 to 15		Severe			

Sources: U.S. Department of Agriculture (USDA) 2017a and 2017b
* = New soil map unit and/or soil type

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