TOWN OF MORAGA, CALIFORNIA

South Camino Pablo Annexation Project

INITIAL STUDY &
MITIGATED NEGATIVE DECLARATION

APPENDICES

JUNE 2020

Douglas Herring & Associates
Environmental, Policy, and Planning Services

Appendix A

CalEEMod Output Files for Air Quality Analysis

Moraga Camino Pablo
Air Quality
RCH Group
June 16, 2020

The original proposed project consisted of 13 single-family two-story detached homes with an average size of approximately 4,758 square feet for a total of 61,850 square feet. The project redesign includes six accessory dwelling units with a total of 6,409 square feet. Thus, the revised proposed project would include a total of 68,259 square feet (a ten percent increase from the original proposed project).

The air quality analysis associated with the original proposed project found construction emissions impacts would be less than significant with the implementation of Mitigation Measure AQ–1 and AQ–2. The revised proposed project would potentially increase the construction emissions compared to the original proposed project but the construction emissions impacts would continue to be less than significant with the implementation of Mitigation Measure AQ–1 and AQ–2. Notably, the construction emissions for the original proposed project would be less than 50 percent of the Bay Area Air Quality Management District (BAAQMD)'s significance thresholds and the project redesign would not substantially increase (resulting from a ten percent increase in project square footage) the construction emissions by comparison.

The air quality analysis associated with the original proposed project found operational emissions impacts would be well below the BAAQMD's significance thresholds. The revised proposed project would potentially increase the operational emissions compared to the original proposed project but the operational emissions impacts would continue to be less than significant. Notably, the operational emissions for the original proposed project would be less than four percent of the BAAQMD's significance thresholds and the project redesign would not substantially increase (resulting from a ten percent increase in project square footage) the operational emissions by comparison.

The greenhouse gas (GHG) construction and operational emissions associated with the original proposed project of 210 metric tons would be below the BAAQMD significance threshold of 1,100 metric tons. The revised proposed project would potentially increase the GHG emissions compared to the original proposed project but the GHG emissions impacts would continue to be less than significant.

Average SF		
4,758	61,850	Total SF
	6,409	Additional SF
2.57	68,259	Grand Total SF
	110%	SF Increase
	120%	Residence Increase

Table AQ–1 Estimated Unmitigated Average Daily Constructio

Emission Source	ROG	NO_x	PM_{10}
Daily Construction Emissions	4.27	23.9	1.14
Significance Thresholds	54	54	82
Significant Impact?	No	No	No

Table AQ–2 Estimated Mitigated Average Daily Construction E

Emission Source	ROG	NO_x	PM_{10}
Daily Construction Emissions	3.17	26.9	0.43
Significance Thresholds	54	54	82
Significant Impact?	No	No	No

Table AQ–3 Estimated Maximum Daily Operational Emissions

Emission Category	ROG	NO_x	PM_{10}
Area	1.55	0.26	0.03
Energy	0.02	0.13	0.01
Mobile	0.28	1.07	0.77
Total Daily Emissions	**1.85**	**1.46**	**0.80**
Significance Thresholds	54	54	82
Significant Impact?	No	No	No

Table AQ–4 Estimated Annual Operational Emissions (tons)

Emission Category	ROG	NO_x	PM_{10}
Area	0.28	<0.01	<0.01
Energy	<0.01	0.02	<0.01
Mobile	0.04	0.19	0.13
Total Annual Emissions	**0.32**	**0.22**	**0.14**
Significance Thresholds	10	10	15
Significant Impact?	No	No	No

n Emissions (pounds)

$PM_{2.5}$	CO
1.07	18.5
54	---
No	No

Emissions (pounds)

$PM_{2.5}$	CO
0.43	18.5
54	---
No	No

(pounds)

$PM_{2.5}$	CO
0.03	1.05
0.01	0.06
0.21	2.75
0.25	**3.86**
54	---
No	No

$PM_{2.5}$	CO
<0.01	0.09
<0.01	0.01
0.04	0.47
0.04	**0.57**
10	---
No	No

Table AQ–1 Estimated Unmitigated Average Daily Construction Emissions (pounds)

Emission Source	ROG	NO_x	PM_{10}	$PM_{2.5}$	CO
Daily Construction Emissions	4.71	26.4	1.26	1.18	20.4
Significance Thresholds	54	54	82	54	---
Significant Impact?	No	No	No	No	No

Table AQ–2 Estimated Mitigated Average Daily Construction Emissions (pounds)

Emission Source	ROG	NO_x	PM_{10}	$PM_{2.5}$	CO
Daily Construction Emissions	3.50	29.7	0.47	0.47	20.4
Significance Thresholds	54	54	82	54	---
Significant Impact?	No	No	No	No	No

Table AQ–3 Estimated Maximum Daily Operational Emissions (pounds)

Emission Category	ROG	NO_x	PM_{10}	$PM_{2.5}$	CO
Area	1.71	0.29	0.03	0.03	1.16
Energy	0.02	0.14	0.01	0.01	0.07
Mobile	0.33	1.28	0.92	0.25	3.29
Total Daily Emissions	**2.07**	**1.71**	**0.96**	**0.30**	**4.51**
Significance Thresholds	54	54	82	54	---
Significant Impact?	No	No	No	No	No

Table AQ–4 Estimated Annual Operational Emissions (tons)

Emission Category	ROG	NO_x	PM_{10}	$PM_{2.5}$	CO
Area	0.31	<0.01	<0.01	<0.01	0.10
Energy	<0.01	0.02	<0.01	<0.01	0.01
Mobile	0.05	0.23	0.16	0.05	0.56
Total Annual Emissions	**0.36**	**0.25**	**0.16**	**0.05**	**0.67**
Significance Thresholds	10	10	15	10	---
Significant Impact?	No	No	No	No	No

Table GHG–1 Estimated Greenhouse Gas Emissions (metric tons of CO2e)

Emission Source	Annual CO_2e
Construction (30-year amortized)	17.7
Operations: Area Sources	1.06
Operations: Energy	36.6
Operations: Mobile	143
Operations: Solid Waste	9.50
Operations: Water	1.31
Total GHG Emissions	**210**
BAAQMD Brightline Threshold	1,100
Potentially Significant?	No

Table GHG–1 Estimated Greenhouse Gas Emissions (metric tons of CO2e)

Emission Source	Annual CO_2e
Construction (30-year amortized)	19.5
Operations: Area Sources	1.17
Operations: Energy	40.4
Operations: Mobile	171
Operations: Solid Waste	10.48
Operations: Water	1.45
Total GHG Emissions	**244**
BAAQMD Brightline Threshold	1,100
Potentially Significant?	No

Appendix AQ

Construction and Operational Emissions

CalEEMod Output Files

- Annual
- Summer
- Winter

Moraga Camino Pablo

Contra Costa County, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Single Family Housing	13.00	Dwelling Unit	8.50	61,850.00	46

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	5			**Operational Year**	2021
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	290	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - GHG Emission factors: Guidance for PG&E Customers, November 2015

Land Use - A 13-unit single family homes on approximately 8.5 acres. Sizes of 3,685 to 6,080 sq ft; averaging 4,758 sq ft. Lots of 15,105 to 40,027 sq ft; averaging 22,367 sq ft.

Grading - 61,800 cubic yards of material movement due to contour grading.

Architectural Coating - BAAQMD Rule 8-03

Vehicle Trips - Fehr & Peers Traffic Study, dated November 17, 2015, estimated 160 daily trips or 12.31 trips per unit

Energy Use -

Construction Off-road Equipment Mitigation - BAAQMD Basic and Enhanced Construction Mitigation Measures

Area Mitigation -

Energy Mitigation -

Water Mitigation -

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Residential_Exterior	41,749.00	30,713.00
tblArchitecturalCoating	ConstArea_Residential_Interior	125,246.00	92,138.00
tblAreaCoating	Area_EF_Parking	150	0
tblAreaCoating	Area_Residential_Exterior	41749	30713
tblAreaCoating	Area_Residential_Interior	125246	92138
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2

tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2

tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblEnergyUse	NT24E	6,155.97	5,096.44
tblEnergyUse	NT24NG	2,615.00	6,192.92
tblEnergyUse	T24E	217.68	248.69
tblEnergyUse	T24NG	39,708.76	44,827.08
tblFireplaces	FireplaceDayYear	11.14	6.29
tblFireplaces	FireplaceWoodMass	228.80	215.60
tblFireplaces	NumberGas	3.25	7.15
tblFireplaces	NumberNoFireplace	1.04	0.00
tblFireplaces	NumberWood	5.59	5.85
tblGrading	MaterialExported	0.00	30,900.00
tblGrading	MaterialImported	0.00	30,900.00
tblLandUse	LandUseSquareFeet	23,400.00	61,850.00
tblLandUse	LotAcreage	4.22	8.50
tblLandUse	Population	37.00	46.00
tblOffRoadEquipment	HorsePower	231.00	226.00
tblOffRoadEquipment	HorsePower	158.00	162.00
tblOffRoadEquipment	HorsePower	158.00	162.00
tblOffRoadEquipment	HorsePower	187.00	174.00
tblOffRoadEquipment	HorsePower	130.00	125.00
tblOffRoadEquipment	HorsePower	132.00	130.00
tblOffRoadEquipment	HorsePower	247.00	255.00
tblOffRoadEquipment	HorsePower	247.00	255.00
tblOffRoadEquipment	HorsePower	247.00	255.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	290

tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblSolidWaste	SolidWasteGenerationRate	19.32	18.90
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblVehicleTrips	HO_TL	5.70	5.40
tblVehicleTrips	HO_TTP	54.00	44.80
tblVehicleTrips	HS_TL	4.80	4.30
tblVehicleTrips	HS_TTP	15.00	29.10
tblVehicleTrips	HW_TL	10.80	12.40
tblVehicleTrips	HW_TTP	31.00	26.10
tblVehicleTrips	ST_TR	9.91	12.31
tblVehicleTrips	SU_TR	8.62	12.31
tblVehicleTrips	WD_TR	9.52	12.31
tblWoodstoves	NumberCatalytic	0.52	0.46
tblWoodstoves	NumberNoncatalytic	0.52	0.46
tblWoodstoves	WoodstoveDayYear	21.06	26.24
tblWoodstoves	WoodstoveWoodMass	956.80	1,355.20

2.0 Emissions Summary

2.1 Overall Construction

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.1190	1.6070	0.9768	2.6800e-003	0.1960	0.0552	0.2512	0.0939	0.0513	0.1452	0.0000	250.3287	250.3287	0.0355	0.0000	251.2149
2020	0.5649	2.2103	1.9829	3.2100e-003	6.9600e-003	0.1277	0.1346	1.8700e-003	0.1200	0.1218	0.0000	277.0583	277.0583	0.0669	0.0000	278.7316
Maximum	**0.5649**	**2.2103**	**1.9829**	**3.2100e-003**	**0.1960**	**0.1277**	**0.2512**	**0.0939**	**0.1200**	**0.1452**	**0.0000**	**277.0583**	**277.0583**	**0.0669**	**0.0000**	**278.7316**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	tons/yr										MT/yr					
2019	0.0580	1.5607	0.8398	2.6800e-003	0.1084	0.0172	0.1256	0.0478	0.0171	0.0649	0.0000	250.3286	250.3286	0.0355	0.0000	251.2148
2020	0.4489	2.7445	2.1164	3.2100e-003	6.9600e-003	0.0521	0.0590	1.8700e-003	0.0521	0.0539	0.0000	277.0580	277.0580	0.0669	0.0000	278.7313
Maximum	**0.4489**	**2.7445**	**2.1164**	**3.2100e-003**	**0.1084**	**0.0521**	**0.1256**	**0.0478**	**0.0521**	**0.0649**	**0.0000**	**277.0580**	**277.0580**	**0.0669**	**0.0000**	**278.7313**

	ROG	**NOx**	**CO**	**SO2**	**Fugitive PM10**	**Exhaust PM10**	**PM10 Total**	**Fugitive PM2.5**	**Exhaust PM2.5**	**PM2.5 Total**	**Bio- CO2**	**NBio-CO2**	**Total CO2**	**CH4**	**N20**	**CO2e**
Percent Reduction	**25.89**	**-12.78**	**0.12**	**0.00**	**43.17**	**62.12**	**52.16**	**48.15**	**59.61**	**55.51**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Quarter	Start Date	End Date	Maximum Unmitigated ROG + NOX (tons/quarter)	Maximum Mitigated ROG + NOX (tons/quarter)
1	**10-1-2019**	**12-31-2019**	1.7256	1.6180
2	**1-1-2020**	**3-31-2020**	0.6937	0.8024
3	**4-1-2020**	**6-30-2020**	0.6935	0.8022
4	**7-1-2020**	**9-30-2020**	0.7012	0.8110
		Highest	1.7256	1.6180

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.3530	3.0000e-003	0.2148	2.6000e-004		0.0177	0.0177		0.0177	0.0177	1.8073	0.6617	2.4690	4.0600e-003	1.0000e-004	2.5989
Energy	3.5800e-003	0.0306	0.0130	2.0000e-004		2.4700e-003	2.4700e-003		2.4700e-003	2.4700e-003	0.0000	47.2857	47.2857	1.8700e-003	8.9000e-004	47.5990
Mobile	0.0424	0.1906	0.4745	1.5600e-003	0.1334	1.3700e-003	0.1348	0.0358	1.2800e-003	0.0371	0.0000	143.2251	143.2251	5.3900e-003	0.0000	143.3597
Waste						0.0000	0.0000		0.0000	0.0000	3.8365	0.0000	3.8365	0.2267	0.0000	9.5048
Water						0.0000	0.0000		0.0000	0.0000	0.2687	0.8487	1.1174	0.0277	6.7000e-004	2.0090
Total	**0.3989**	**0.2242**	**0.7023**	**2.0200e-003**	**0.1334**	**0.0216**	**0.1550**	**0.0358**	**0.0215**	**0.0573**	**5.9125**	**192.0212**	**197.9337**	**0.2657**	**1.6600e-003**	**205.0715**

2.2 Overall Operational

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Area	0.2759	1.7900e-003	0.0855	1.0000e-005		5.3000e-004	5.3000e-004		5.3000e-004	5.3000e-004	0.0000	1.0504	1.0504	1.3000e-004	2.0000e-005	1.0587
Energy	2.7900e-003	0.0239	0.0102	1.5000e-004		1.9300e-003	1.9300e-003		1.9300e-003	1.9300e-003	0.0000	36.3777	36.3777	1.4100e-003	6.9000e-004	36.6177
Mobile	0.0424	0.1906	0.4745	1.5600e-003	0.1334	1.3700e-003	0.1348	0.0358	1.2800e-003	0.0371	0.0000	143.2251	143.2251	5.3900e-003	0.0000	143.3597
Waste						0.0000	0.0000		0.0000	0.0000	3.8365	0.0000	3.8365	0.2267	0.0000	9.5048
Water						0.0000	0.0000		0.0000	0.0000	0.1720	0.5705	0.7425	0.0177	4.3000e-004	1.3133
Total	**0.3211**	**0.2163**	**0.5701**	**1.7200e-003**	**0.1334**	**3.8300e-003**	**0.1373**	**0.0358**	**3.7400e-003**	**0.0395**	**4.0085**	**181.2236**	**185.2321**	**0.2514**	**1.1400e-003**	**191.8543**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**19.52**	**3.53**	**18.82**	**14.85**	**0.00**	**82.23**	**11.43**	**0.00**	**82.57**	**30.95**	**32.20**	**5.62**	**6.42**	**5.40**	**31.33**	**6.45**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	10/1/2019	10/28/2019	5	20	
2	Site Preparation	Site Preparation	10/29/2019	11/11/2019	5	10	
3	Grading	Grading	11/12/2019	12/9/2019	5	20	
4	Building Construction	Building Construction	12/10/2019	10/26/2020	5	230	
5	Paving	Paving	10/27/2020	11/23/2020	5	20	
6	Architectural Coating	Architectural Coating	11/24/2020	12/21/2020	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 92,138; Residential Outdoor: 30,713; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	15.00	0.00	3,863.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	5.00	1.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	1.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Use DPF for Construction Equipment

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Demolition - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0332	0.3394	0.3081	4.0000e-004		0.0165	0.0165		0.0153	0.0153	0.0000	35.6454	35.6454	9.9600e-003	0.0000	35.8943
Total	**0.0332**	**0.3394**	**0.3081**	**4.0000e-004**		**0.0165**	**0.0165**		**0.0153**	**0.0153**	**0.0000**	**35.6454**	**35.6454**	**9.9600e-003**	**0.0000**	**35.8943**

3.2 Demolition - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.1000e-004	4.7000e-004	4.7100e-003	1.0000e-005	1.3700e-003	1.0000e-005	1.3700e-003	3.6000e-004	1.0000e-005	3.7000e-004	0.0000	1.2330	1.2330	3.0000e-005	0.0000	1.2338
Total	**6.1000e-004**	**4.7000e-004**	**4.7100e-003**	**1.0000e-005**	**1.3700e-003**	**1.0000e-005**	**1.3700e-003**	**3.6000e-004**	**1.0000e-005**	**3.7000e-004**	**0.0000**	**1.2330**	**1.2330**	**3.0000e-005**	**0.0000**	**1.2338**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0129	0.3347	0.2527	4.0000e-004		4.6700e-003	4.6700e-003		4.6700e-003	4.6700e-003	0.0000	35.6454	35.6454	9.9600e-003	0.0000	35.8942
Total	**0.0129**	**0.3347**	**0.2527**	**4.0000e-004**		**4.6700e-003**	**4.6700e-003**		**4.6700e-003**	**4.6700e-003**	**0.0000**	**35.6454**	**35.6454**	**9.9600e-003**	**0.0000**	**35.8942**

3.2 Demolition - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.1000e-004	4.7000e-004	4.7100e-003	1.0000e-005	1.3700e-003	1.0000e-005	1.3700e-003	3.6000e-004	1.0000e-005	3.7000e-004	0.0000	1.2330	1.2330	3.0000e-005	0.0000	1.2338
Total	**6.1000e-004**	**4.7000e-004**	**4.7100e-003**	**1.0000e-005**	**1.3700e-003**	**1.0000e-005**	**1.3700e-003**	**3.6000e-004**	**1.0000e-005**	**3.7000e-004**	**0.0000**	**1.2330**	**1.2330**	**3.0000e-005**	**0.0000**	**1.2338**

3.3 Site Preparation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0903	0.0000	0.0903	0.0497	0.0000	0.0497	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0201	0.2125	0.1740	2.0000e-004		0.0108	0.0108		9.8900e-003	9.8900e-003	0.0000	17.5845	17.5845	5.5600e-003	0.0000	17.7236
Total	**0.0201**	**0.2125**	**0.1740**	**2.0000e-004**	**0.0903**	**0.0108**	**0.1011**	**0.0497**	**9.8900e-003**	**0.0595**	**0.0000**	**17.5845**	**17.5845**	**5.5600e-003**	**0.0000**	**17.7236**

3.3 Site Preparation - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.7000e-004	2.8000e-004	2.8300e-003	1.0000e-005	8.2000e-004	1.0000e-005	8.2000e-004	2.2000e-004	1.0000e-005	2.2000e-004	0.0000	0.7398	0.7398	2.0000e-005	0.0000	0.7403
Total	**3.7000e-004**	**2.8000e-004**	**2.8300e-003**	**1.0000e-005**	**8.2000e-004**	**1.0000e-005**	**8.2000e-004**	**2.2000e-004**	**1.0000e-005**	**2.2000e-004**	**0.0000**	**0.7398**	**0.7398**	**2.0000e-005**	**0.0000**	**0.7403**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0407	0.0000	0.0407	0.0223	0.0000	0.0223	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	6.1500e-003	0.1721	0.1170	2.0000e-004		2.4000e-003	2.4000e-003		2.4000e-003	2.4000e-003	0.0000	17.5845	17.5845	5.5600e-003	0.0000	17.7236
Total	**6.1500e-003**	**0.1721**	**0.1170**	**2.0000e-004**	**0.0407**	**2.4000e-003**	**0.0431**	**0.0223**	**2.4000e-003**	**0.0247**	**0.0000**	**17.5845**	**17.5845**	**5.5600e-003**	**0.0000**	**17.7236**

3.3 Site Preparation - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	3.7000e-004	2.8000e-004	2.8300e-003	1.0000e-005	8.2000e-004	1.0000e-005	8.2000e-004	2.2000e-004	1.0000e-005	2.2000e-004	0.0000	0.7398	0.7398	2.0000e-005	0.0000	0.7403
Total	**3.7000e-004**	**2.8000e-004**	**2.8300e-003**	**1.0000e-005**	**8.2000e-004**	**1.0000e-005**	**8.2000e-004**	**2.2000e-004**	**1.0000e-005**	**2.2000e-004**	**0.0000**	**0.7398**	**0.7398**	**2.0000e-005**	**0.0000**	**0.7403**

3.4 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0690	0.0000	0.0690	0.0342	0.0000	0.0342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0276	0.2838	0.2339	3.0000e-004		0.0153	0.0153		0.0141	0.0141	0.0000	26.7093	26.7093	8.4500e-003	0.0000	26.9206
Total	**0.0276**	**0.2838**	**0.2339**	**3.0000e-004**	**0.0690**	**0.0153**	**0.0844**	**0.0342**	**0.0141**	**0.0483**	**0.0000**	**26.7093**	**26.7093**	**8.4500e-003**	**0.0000**	**26.9206**

3.4 Grading - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0175	0.6013	0.1101	1.5400e-003	0.0327	2.3700e-003	0.0351	8.9900e-003	2.2600e-003	0.0113	0.0000	147.9313	147.9313	6.8100e-003	0.0000	148.1017
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.1000e-004	4.7000e-004	4.7100e-003	1.0000e-005	1.3700e-003	1.0000e-005	1.3700e-003	3.6000e-004	1.0000e-005	3.7000e-004	0.0000	1.2330	1.2330	3.0000e-005	0.0000	1.2338
Total	**0.0181**	**0.6017**	**0.1148**	**1.5500e-003**	**0.0341**	**2.3800e-003**	**0.0365**	**9.3500e-003**	**2.2700e-003**	**0.0116**	**0.0000**	**149.1643**	**149.1643**	**6.8400e-003**	**0.0000**	**149.3355**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Fugitive Dust					0.0311	0.0000	0.0311	0.0154	0.0000	0.0154	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0110	0.2626	0.2038	3.0000e-004		4.1100e-003	4.1100e-003		4.1100e-003	4.1100e-003	0.0000	26.7093	26.7093	8.4500e-003	0.0000	26.9206
Total	**0.0110**	**0.2626**	**0.2038**	**3.0000e-004**	**0.0311**	**4.1100e-003**	**0.0352**	**0.0154**	**4.1100e-003**	**0.0195**	**0.0000**	**26.7093**	**26.7093**	**8.4500e-003**	**0.0000**	**26.9206**

3.4 Grading - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0175	0.6013	0.1101	1.5400e-003	0.0327	2.3700e-003	0.0351	8.9900e-003	2.2600e-003	0.0113	0.0000	147.9313	147.9313	6.8100e-003	0.0000	148.1017
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	6.1000e-004	4.7000e-004	4.7100e-003	1.0000e-005	1.3700e-003	1.0000e-005	1.3700e-003	3.6000e-004	1.0000e-005	3.7000e-004	0.0000	1.2330	1.2330	3.0000e-005	0.0000	1.2338
Total	**0.0181**	**0.6017**	**0.1148**	**1.5500e-003**	**0.0341**	**2.3800e-003**	**0.0365**	**9.3500e-003**	**2.2700e-003**	**0.0116**	**0.0000**	**149.1643**	**149.1643**	**6.8400e-003**	**0.0000**	**149.3355**

3.5 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0188	0.1677	0.1370	2.1000e-004		0.0103	0.0103		9.6700e-003	9.6700e-003	0.0000	18.7298	18.7298	4.5600e-003	0.0000	18.8438
Total	**0.0188**	**0.1677**	**0.1370**	**2.1000e-004**		**0.0103**	**0.0103**		**9.6700e-003**	**9.6700e-003**	**0.0000**	**18.7298**	**18.7298**	**4.5600e-003**	**0.0000**	**18.8438**

3.5 Building Construction - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	4.0000e-005	9.7000e-004	2.5000e-004	0.0000	5.0000e-005	1.0000e-005	5.0000e-005	1.0000e-005	1.0000e-005	2.0000e-005	0.0000	0.1937	0.1937	1.0000e-005	0.0000	0.1940
Worker	1.6000e-004	1.2000e-004	1.2600e-003	0.0000	3.6000e-004	0.0000	3.7000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.3288	0.3288	1.0000e-005	0.0000	0.3290
Total	**2.0000e-004**	**1.0900e-003**	**1.5100e-003**	**0.0000**	**4.1000e-004**	**1.0000e-005**	**4.2000e-004**	**1.1000e-004**	**1.0000e-005**	**1.2000e-004**	**0.0000**	**0.5225**	**0.5225**	**2.0000e-005**	**0.0000**	**0.5230**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	8.6300e-003	0.1877	0.1425	2.1000e-004		3.6100e-003	3.6100e-003		3.6100e-003	3.6100e-003	0.0000	18.7298	18.7298	4.5600e-003	0.0000	18.8437
Total	**8.6300e-003**	**0.1877**	**0.1425**	**2.1000e-004**		**3.6100e-003**	**3.6100e-003**		**3.6100e-003**	**3.6100e-003**	**0.0000**	**18.7298**	**18.7298**	**4.5600e-003**	**0.0000**	**18.8437**

3.5 Building Construction - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	4.0000e-005	9.7000e-004	2.5000e-004	0.0000	5.0000e-005	1.0000e-005	5.0000e-005	1.0000e-005	1.0000e-005	2.0000e-005	0.0000	0.1937	0.1937	1.0000e-005	0.0000	0.1940
Worker	1.6000e-004	1.2000e-004	1.2600e-003	0.0000	3.6000e-004	0.0000	3.7000e-004	1.0000e-004	0.0000	1.0000e-004	0.0000	0.3288	0.3288	1.0000e-005	0.0000	0.3290
Total	**2.0000e-004**	**1.0900e-003**	**1.5100e-003**	**0.0000**	**4.1000e-004**	**1.0000e-005**	**4.2000e-004**	**1.1000e-004**	**1.0000e-005**	**1.2000e-004**	**0.0000**	**0.5225**	**0.5225**	**2.0000e-005**	**0.0000**	**0.5230**

3.5 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.2259	2.0420	1.7985	2.8700e-003		0.1191	0.1191		0.1120	0.1120	0.0000	246.7954	246.7954	0.0601	0.0000	248.2986
Total	**0.2259**	**2.0420**	**1.7985**	**2.8700e-003**		**0.1191**	**0.1191**		**0.1120**	**0.1120**	**0.0000**	**246.7954**	**246.7954**	**0.0601**	**0.0000**	**248.2986**

3.5 Building Construction - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	4.0000e-004	0.0117	3.0200e-003	3.0000e-005	6.4000e-004	6.0000e-005	6.9000e-004	1.8000e-004	5.0000e-005	2.4000e-004	0.0000	2.5765	2.5765	1.3000e-004	0.0000	2.5798
Worker	1.9900e-003	1.4600e-003	0.0150	5.0000e-005	4.8700e-003	3.0000e-005	4.9000e-003	1.3000e-003	3.0000e-005	1.3200e-003	0.0000	4.2578	4.2578	1.0000e-004	0.0000	4.2604
Total	**2.3900e-003**	**0.0132**	**0.0181**	**8.0000e-005**	**5.5100e-003**	**9.0000e-005**	**5.5900e-003**	**1.4800e-003**	**8.0000e-005**	**1.5600e-003**	**0.0000**	**6.8343**	**6.8343**	**2.3000e-004**	**0.0000**	**6.8402**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.1154	2.5104	1.9063	2.8700e-003		0.0482	0.0482		0.0482	0.0482	0.0000	246.7951	246.7951	0.0601	0.0000	248.2983
Total	**0.1154**	**2.5104**	**1.9063**	**2.8700e-003**		**0.0482**	**0.0482**		**0.0482**	**0.0482**	**0.0000**	**246.7951**	**246.7951**	**0.0601**	**0.0000**	**248.2983**

3.5 Building Construction - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	4.0000e-004	0.0117	3.0200e-003	3.0000e-005	6.4000e-004	6.0000e-005	6.9000e-004	1.8000e-004	5.0000e-005	2.4000e-004	0.0000	2.5765	2.5765	1.3000e-004	0.0000	2.5798
Worker	1.9900e-003	1.4600e-003	0.0150	5.0000e-005	4.8700e-003	3.0000e-005	4.9000e-003	1.3000e-003	3.0000e-005	1.3200e-003	0.0000	4.2578	4.2578	1.0000e-004	0.0000	4.2604
Total	**2.3900e-003**	**0.0132**	**0.0181**	**8.0000e-005**	**5.5100e-003**	**9.0000e-005**	**5.5900e-003**	**1.4800e-003**	**8.0000e-005**	**1.5600e-003**	**0.0000**	**6.8343**	**6.8343**	**2.3000e-004**	**0.0000**	**6.8402**

3.6 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	0.0133	0.1378	0.1435	2.2000e-004		7.3900e-003	7.3900e-003		6.8000e-003	6.8000e-003	0.0000	19.6021	19.6021	6.3400e-003	0.0000	19.7606
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0133**	**0.1378**	**0.1435**	**2.2000e-004**		**7.3900e-003**	**7.3900e-003**		**6.8000e-003**	**6.8000e-003**	**0.0000**	**19.6021**	**19.6021**	**6.3400e-003**	**0.0000**	**19.7606**

3.6 Paving - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.6000e-004	4.1000e-004	4.2200e-003	1.0000e-005	1.3700e-003	1.0000e-005	1.3700e-003	3.6000e-004	1.0000e-005	3.7000e-004	0.0000	1.1938	1.1938	3.0000e-005	0.0000	1.1945
Total	**5.6000e-004**	**4.1000e-004**	**4.2200e-003**	**1.0000e-005**	**1.3700e-003**	**1.0000e-005**	**1.3700e-003**	**3.6000e-004**	**1.0000e-005**	**3.7000e-004**	**0.0000**	**1.1938**	**1.1938**	**3.0000e-005**	**0.0000**	**1.1945**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Off-Road	9.1200e-003	0.1970	0.1693	2.2000e-004		3.2700e-003	3.2700e-003		3.2700e-003	3.2700e-003	0.0000	19.6020	19.6020	6.3400e-003	0.0000	19.7605
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**9.1200e-003**	**0.1970**	**0.1693**	**2.2000e-004**		**3.2700e-003**	**3.2700e-003**		**3.2700e-003**	**3.2700e-003**	**0.0000**	**19.6020**	**19.6020**	**6.3400e-003**	**0.0000**	**19.7605**

3.6 Paving - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	5.6000e-004	4.1000e-004	4.2200e-003	1.0000e-005	1.3700e-003	1.0000e-005	1.3700e-003	3.6000e-004	1.0000e-005	3.7000e-004	0.0000	1.1938	1.1938	3.0000e-005	0.0000	1.1945
Total	**5.6000e-004**	**4.1000e-004**	**4.2200e-003**	**1.0000e-005**	**1.3700e-003**	**1.0000e-005**	**1.3700e-003**	**3.6000e-004**	**1.0000e-005**	**3.7000e-004**	**0.0000**	**1.1938**	**1.1938**	**3.0000e-005**	**0.0000**	**1.1945**

3.7 Architectural Coating - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.3203					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	2.4200e-003	0.0168	0.0183	3.0000e-005		1.1100e-003	1.1100e-003		1.1100e-003	1.1100e-003	0.0000	2.5533	2.5533	2.0000e-004	0.0000	2.5582
Total	**0.3227**	**0.0168**	**0.0183**	**3.0000e-005**		**1.1100e-003**	**1.1100e-003**		**1.1100e-003**	**1.1100e-003**	**0.0000**	**2.5533**	**2.5533**	**2.0000e-004**	**0.0000**	**2.5582**

3.7 Architectural Coating - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.0000e-005	3.0000e-005	2.8000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0796	0.0796	0.0000	0.0000	0.0796
Total	**4.0000e-005**	**3.0000e-005**	**2.8000e-004**	**0.0000**	**9.0000e-005**	**0.0000**	**9.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0796**	**0.0796**	**0.0000**	**0.0000**	**0.0796**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Archit. Coating	0.3203					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	1.1400e-003	0.0235	0.0183	3.0000e-005		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	2.5533	2.5533	2.0000e-004	0.0000	2.5582
Total	**0.3214**	**0.0235**	**0.0183**	**3.0000e-005**		**4.8000e-004**	**4.8000e-004**		**4.8000e-004**	**4.8000e-004**	**0.0000**	**2.5533**	**2.5533**	**2.0000e-004**	**0.0000**	**2.5582**

3.7 Architectural Coating - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Worker	4.0000e-005	3.0000e-005	2.8000e-004	0.0000	9.0000e-005	0.0000	9.0000e-005	2.0000e-005	0.0000	2.0000e-005	0.0000	0.0796	0.0796	0.0000	0.0000	0.0796
Total	**4.0000e-005**	**3.0000e-005**	**2.8000e-004**	**0.0000**	**9.0000e-005**	**0.0000**	**9.0000e-005**	**2.0000e-005**	**0.0000**	**2.0000e-005**	**0.0000**	**0.0796**	**0.0796**	**0.0000**	**0.0000**	**0.0796**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.0424	0.1906	0.4745	1.5600e-003	0.1334	1.3700e-003	0.1348	0.0358	1.2800e-003	0.0371	0.0000	143.2251	143.2251	5.3900e-003	0.0000	143.3597
Unmitigated	0.0424	0.1906	0.4745	1.5600e-003	0.1334	1.3700e-003	0.1348	0.0358	1.2800e-003	0.0371	0.0000	143.2251	143.2251	5.3900e-003	0.0000	143.3597

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Single Family Housing	160.03	160.03	160.03	357,246	357,246
Total	160.03	160.03	160.03	357,246	357,246

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Single Family Housing	12.40	4.30	5.40	26.10	29.10	44.80	86	11	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Single Family Housing	0.582298	0.039109	0.186022	0.123408	0.017184	0.005083	0.010615	0.023794	0.001605	0.001810	0.005454	0.002746	0.000871

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

Exceed Title 24

Install High Efficiency Lighting

Percent of Electricity Use Generated with Renewable Energy

Install Energy Efficient Appliances

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Electricity Mitigated						0.0000	0.0000		0.0000	0.0000	0.0000	8.7581	8.7581	8.8000e-004	1.8000e-004	8.8339
Electricity Unmitigated						0.0000	0.0000		0.0000	0.0000	0.0000	11.8916	11.8916	1.1900e-003	2.5000e-004	11.9946
NaturalGas Mitigated	2.7900e-003	0.0239	0.0102	1.5000e-004		1.9300e-003	1.9300e-003		1.9300e-003	1.9300e-003	0.0000	27.6196	27.6196	5.3000e-004	5.1000e-004	27.7837
NaturalGas Unmitigated	3.5800e-003	0.0306	0.0130	2.0000e-004		2.4700e-003	2.4700e-003		2.4700e-003	2.4700e-003	0.0000	35.3941	35.3941	6.8000e-004	6.5000e-004	35.6044

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Single Family Housing	663260	3.5800e-003	0.0306	0.0130	2.0000e-004		2.4700e-003	2.4700e-003		2.4700e-003	2.4700e-003	0.0000	35.3941	35.3941	6.8000e-004	6.5000e-004	35.6044
Total		**3.5800e-003**	**0.0306**	**0.0130**	**2.0000e-004**		**2.4700e-003**	**2.4700e-003**		**2.4700e-003**	**2.4700e-003**	**0.0000**	**35.3941**	**35.3941**	**6.8000e-004**	**6.5000e-004**	**35.6044**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	tons/yr										MT/yr					
Single Family Housing	517572	2.7900e-003	0.0239	0.0102	1.5000e-004		1.9300e-003	1.9300e-003		1.9300e-003	1.9300e-003	0.0000	27.6196	27.6196	5.3000e-004	5.1000e-004	27.7837
Total		**2.7900e-003**	**0.0239**	**0.0102**	**1.5000e-004**		**1.9300e-003**	**1.9300e-003**		**1.9300e-003**	**1.9300e-003**	**0.0000**	**27.6196**	**27.6196**	**5.3000e-004**	**5.1000e-004**	**27.7837**

5.3 Energy by Land Use - Electricity

Unmitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Single Family Housing	90401.6	11.8916	1.1900e-003	2.5000e-004	11.9946
Total		**11.8916**	**1.1900e-003**	**2.5000e-004**	**11.9946**

Mitigated

	Electricity Use	Total CO2	CH4	N2O	CO2e
Land Use	kWh/yr	MT/yr			
Single Family Housing	66580	8.7581	8.8000e-004	1.8000e-004	8.8339
Total		**8.7581**	**8.8000e-004**	**1.8000e-004**	**8.8339**

6.0 Area Detail

6.1 Mitigation Measures Area

Use Electric Lawnmower

Use Electric Leafblower

Use Electric Chainsaw

Use Low VOC Paint - Residential Interior

Use Low VOC Paint - Residential Exterior

Use Low VOC Paint - Non-Residential Interior

Use Low VOC Paint - Non-Residential Exterior

Use only Natural Gas Hearths

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	tons/yr										MT/yr					
Mitigated	0.2759	1.7900e-003	0.0855	1.0000e-005		5.3000e-004	5.3000e-004		5.3000e-004	5.3000e-004	0.0000	1.0504	1.0504	1.3000e-004	2.0000e-005	1.0587
Unmitigated	0.3530	3.0000e-003	0.2148	2.6000e-004		0.0177	0.0177		0.0177	0.0177	1.8073	0.6617	2.4690	4.0600e-003	1.0000e-004	2.5989

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0320					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.2416					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	0.0765	1.8800e-003	0.1181	2.5000e-004		0.0172	0.0172		0.0172	0.0172	1.8073	0.5040	2.3113	3.9100e-003	1.0000e-004	2.4374
Landscaping	2.9300e-003	1.1200e-003	0.0967	1.0000e-005		5.3000e-004	5.3000e-004		5.3000e-004	5.3000e-004	0.0000	0.1577	0.1577	1.5000e-004	0.0000	0.1615
Total	**0.3530**	**3.0000e-003**	**0.2148**	**2.6000e-004**		**0.0177**	**0.0177**		**0.0177**	**0.0177**	**1.8073**	**0.6617**	**2.4690**	**4.0600e-003**	**1.0000e-004**	**2.5989**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	tons/yr										MT/yr					
Architectural Coating	0.0320					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Consumer Products	0.2416					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Hearth	9.0000e-005	7.9000e-004	3.4000e-004	1.0000e-005		6.0000e-005	6.0000e-005		6.0000e-005	6.0000e-005	0.0000	0.9164	0.9164	2.0000e-005	2.0000e-005	0.9218
Landscaping	2.2400e-003	1.0000e-003	0.0851	0.0000		4.7000e-004	4.7000e-004		4.7000e-004	4.7000e-004	0.0000	0.1340	0.1340	1.2000e-004	0.0000	0.1369
Total	**0.2759**	**1.7900e-003**	**0.0855**	**1.0000e-005**		**5.3000e-004**	**5.3000e-004**		**5.3000e-004**	**5.3000e-004**	**0.0000**	**1.0504**	**1.0504**	**1.4000e-004**	**2.0000e-005**	**1.0587**

7.0 Water Detail

7.1 Mitigation Measures Water

Use Grey Water

Install Low Flow Bathroom Faucet

Install Low Flow Kitchen Faucet

Install Low Flow Toilet

Install Low Flow Shower

Use Water Efficient Irrigation System

	Total CO2	CH4	N2O	CO2e
Category	MT/yr			
Mitigated	0.7425	0.0177	4.3000e-004	1.3133
Unmitigated	1.1174	0.0277	6.7000e-004	2.0090

7.2 Water by Land Use

Unmitigated

	Indoor/ Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Single Family Housing	0.847002 / 0.53398	1.1174	0.0277	6.7000e-004	2.0090
Total		**1.1174**	**0.0277**	**6.7000e-004**	**2.0090**

7.2 Water by Land Use

Mitigated

	Indoor/ Outdoor Use	Total CO2	CH4	N2O	CO2e
Land Use	Mgal	MT/yr			
Single Family Housing	0.542081 / 0.401126	0.7425	0.0177	4.3000e-004	1.3133
Total		**0.7425**	**0.0177**	**4.3000e-004**	**1.3133**

8.0 Waste Detail

8.1 Mitigation Measures Waste

Category/Year

	Total CO2	CH4	N2O	CO2e
	MT/yr			
Mitigated	3.8365	0.2267	0.0000	9.5048
Unmitigated	3.8365	0.2267	0.0000	9.5048

8.2 Waste by Land Use

Unmitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Single Family Housing	18.9	3.8365	0.2267	0.0000	9.5048
Total		**3.8365**	**0.2267**	**0.0000**	**9.5048**

Mitigated

	Waste Disposed	Total CO2	CH4	N2O	CO2e
Land Use	tons	MT/yr			
Single Family Housing	18.9	3.8365	0.2267	0.0000	9.5048
Total		**3.8365**	**0.2267**	**0.0000**	**9.5048**

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Moraga Camino Pablo

Contra Costa County, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Single Family Housing	13.00	Dwelling Unit	8.50	61,850.00	46

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	5			**Operational Year**	2021
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	290	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Moraga Camino Pablo - Contra Costa County, Summer

Project Characteristics - GHG Emission factors: Guidance for PG&E Customers, November 2015

Land Use - A 13-unit single family homes on approximately 8.5 acres. Sizes of 3,685 to 6,080 sq ft; averaging 4,758 sq ft. Lots of 15,105 to 40,027 sq ft; averaging 22,367 sq ft.

Grading - 61,800 cubic yards of material movement due to contour grading.

Architectural Coating - BAAQMD Rule 8-03

Vehicle Trips - Fehr & Peers Traffic Study, dated November 17, 2015, estimated 160 daily trips or 12.31 trips per unit

Energy Use -

Construction Off-road Equipment Mitigation - BAAQMD Basic and Enhanced Construction Mitigation Measures

Area Mitigation -

Energy Mitigation -

Water Mitigation -

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Residential_Exterior	41,749.00	30,713.00
tblArchitecturalCoating	ConstArea_Residential_Interior	125,246.00	92,138.00
tblAreaCoating	Area_EF_Parking	150	0
tblAreaCoating	Area_Residential_Exterior	41749	30713
tblAreaCoating	Area_Residential_Interior	125246	92138
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2

tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2

tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblEnergyUse	NT24E	6,155.97	5,096.44
tblEnergyUse	NT24NG	2,615.00	6,192.92
tblEnergyUse	T24E	217.68	248.69
tblEnergyUse	T24NG	39,708.76	44,827.08
tblFireplaces	FireplaceDayYear	11.14	6.29
tblFireplaces	FireplaceWoodMass	228.80	215.60
tblFireplaces	NumberGas	3.25	7.15
tblFireplaces	NumberNoFireplace	1.04	0.00
tblFireplaces	NumberWood	5.59	5.85
tblGrading	MaterialExported	0.00	30,900.00
tblGrading	MaterialImported	0.00	30,900.00
tblLandUse	LandUseSquareFeet	23,400.00	61,850.00
tblLandUse	LotAcreage	4.22	8.50
tblLandUse	Population	37.00	46.00
tblOffRoadEquipment	HorsePower	231.00	226.00
tblOffRoadEquipment	HorsePower	158.00	162.00
tblOffRoadEquipment	HorsePower	158.00	162.00
tblOffRoadEquipment	HorsePower	187.00	174.00
tblOffRoadEquipment	HorsePower	130.00	125.00
tblOffRoadEquipment	HorsePower	132.00	130.00
tblOffRoadEquipment	HorsePower	247.00	255.00
tblOffRoadEquipment	HorsePower	247.00	255.00
tblOffRoadEquipment	HorsePower	247.00	255.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	290

tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblSolidWaste	SolidWasteGenerationRate	19.32	18.90
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblVehicleTrips	HO_TL	5.70	5.40
tblVehicleTrips	HO_TTP	54.00	44.80
tblVehicleTrips	HS_TL	4.80	4.30
tblVehicleTrips	HS_TTP	15.00	29.10
tblVehicleTrips	HW_TL	10.80	12.40
tblVehicleTrips	HW_TTP	31.00	26.10
tblVehicleTrips	ST_TR	9.91	12.31
tblVehicleTrips	SU_TR	8.62	12.31
tblVehicleTrips	WD_TR	9.52	12.31
tblWoodstoves	NumberCatalytic	0.52	0.46
tblWoodstoves	NumberNoncatalytic	0.52	0.46
tblWoodstoves	WoodstoveDayYear	21.06	26.24
tblWoodstoves	WoodstoveWoodMass	956.80	1,355.20

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	4.5569	87.3447	35.4444	0.1858	18.2360	2.1516	20.3876	9.9757	1.9794	11.9551	0.0000	19,514.3304	19,514.3304	1.6658	0.0000	19,555.9759
2020	32.2758	19.2045	16.9932	0.0275	0.1415	1.1137	1.1669	0.0375	1.0472	1.0615	0.0000	2,617.1609	2,617.1609	0.7023	0.0000	2,632.7085
Maximum	**32.2758**	**87.3447**	**35.4444**	**0.1858**	**18.2360**	**2.1516**	**20.3876**	**9.9757**	**1.9794**	**11.9551**	**0.0000**	**19,514.3304**	**19,514.3304**	**1.6658**	**0.0000**	**19,555.9759**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	2.8939	85.2249	31.5217	0.1858	8.2996	0.6470	8.7812	4.5138	0.6368	4.9954	0.0000	19,514.3304	19,514.3304	1.6658	0.0000	19,555.9759
2020	32.1475	23.5821	18.0004	0.0275	0.1415	0.4516	0.5049	0.0375	0.4516	0.4658	0.0000	2,617.1609	2,617.1609	0.7023	0.0000	2,632.7085
Maximum	**32.1475**	**85.2249**	**31.5217**	**0.1858**	**8.2996**	**0.6470**	**8.7812**	**4.5138**	**0.6368**	**4.9954**	**0.0000**	**19,514.3304**	**19,514.3304**	**1.6658**	**0.0000**	**19,555.9759**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**4.86**	**-2.12**	**5.56**	**0.00**	**54.07**	**66.35**	**56.92**	**54.55**	**64.04**	**58.04**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	24.8279	0.4590	29.3718	0.0506		3.9612	3.9612		3.9612	3.9612	411.0127	178.5782	589.5909	0.3331	0.0333	607.8469
Energy	0.0196	0.1675	0.0713	1.0700e-003		0.0135	0.0135		0.0135	0.0135		213.7824	213.7824	4.1000e-003	3.9200e-003	215.0528
Mobile	0.2774	1.0154	2.7525	9.2200e-003	0.7589	7.4900e-003	0.7663	0.2030	7.0000e-003	0.2100		929.1867	929.1867	0.0330		930.0121
Total	**25.1250**	**1.6418**	**32.1956**	**0.0608**	**0.7589**	**3.9823**	**4.7411**	**0.2030**	**3.9818**	**4.1848**	**411.0127**	**1,321.5474**	**1,732.5600**	**0.3702**	**0.0372**	**1,752.9118**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	1.5534	0.2627	1.0528	1.6500e-003		0.0255	0.0255		0.0255	0.0255	0.0000	322.8177	322.8177	7.5800e-003	5.8900e-003	324.7619
Energy	0.0153	0.1307	0.0556	8.3000e-004		0.0106	0.0106		0.0106	0.0106		166.8242	166.8242	3.2000e-003	3.0600e-003	167.8155
Mobile	0.2774	1.0154	2.7525	9.2200e-003	0.7589	7.4900e-003	0.7663	0.2030	7.0000e-003	0.2100		929.1867	929.1867	0.0330		930.0121
Total	**1.8462**	**1.4088**	**3.8609**	**0.0117**	**0.7589**	**0.0436**	**0.8024**	**0.2030**	**0.0431**	**0.2461**	**0.0000**	**1,418.8286**	**1,418.8286**	**0.0438**	**8.9500e-003**	**1,422.5895**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**92.65**	**14.20**	**88.01**	**80.77**	**0.00**	**98.91**	**83.08**	**0.00**	**98.92**	**94.12**	**100.00**	**-7.36**	**18.11**	**88.17**	**75.97**	**18.84**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	10/1/2019	10/28/2019	5	20	
2	Site Preparation	Site Preparation	10/29/2019	11/11/2019	5	10	
3	Grading	Grading	11/12/2019	12/9/2019	5	20	
4	Building Construction	Building Construction	12/10/2019	10/26/2020	5	230	
5	Paving	Paving	10/27/2020	11/23/2020	5	20	
6	Architectural Coating	Architectural Coating	11/24/2020	12/21/2020	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 92,138; Residential Outdoor: 30,713; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Moraga Camino Pablo - Contra Costa County, Summer

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	15.00	0.00	3,863.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	5.00	1.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	1.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Use DPF for Construction Equipment

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Demolition - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.3224	33.9413	30.8050	0.0399		1.6448	1.6448		1.5316	1.5316		3,929.2327	3,929.2327	1.0974		3,956.6669
Total	**3.3224**	**33.9413**	**30.8050**	**0.0399**		**1.6448**	**1.6448**		**1.5316**	**1.5316**		**3,929.2327**	**3,929.2327**	**1.0974**		**3,956.6669**

3.2 Demolition - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0656	0.0416	0.5297	1.4900e-003	0.1415	9.2000e-004	0.1424	0.0375	8.5000e-004	0.0384		148.1861	148.1861	3.9800e-003		148.2855
Total	**0.0656**	**0.0416**	**0.5297**	**1.4900e-003**	**0.1415**	**9.2000e-004**	**0.1424**	**0.0375**	**8.5000e-004**	**0.0384**		**148.1861**	**148.1861**	**3.9800e-003**		**148.2855**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2905	33.4676	25.2649	0.0399		0.4669	0.4669		0.4669	0.4669	0.0000	3,929.2327	3,929.2327	1.0974		3,956.6669
Total	**1.2905**	**33.4676**	**25.2649**	**0.0399**		**0.4669**	**0.4669**		**0.4669**	**0.4669**	**0.0000**	**3,929.2327**	**3,929.2327**	**1.0974**		**3,956.6669**

3.2 Demolition - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0656	0.0416	0.5297	1.4900e-003	0.1415	9.2000e-004	0.1424	0.0375	8.5000e-004	0.0384		148.1861	148.1861	3.9800e-003		148.2855
Total	**0.0656**	**0.0416**	**0.5297**	**1.4900e-003**	**0.1415**	**9.2000e-004**	**0.1424**	**0.0375**	**8.5000e-004**	**0.0384**		**148.1861**	**148.1861**	**3.9800e-003**		**148.2855**

3.3 Site Preparation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.0188	42.5046	34.8088	0.0391		2.1505	2.1505		1.9784	1.9784		3,876.7233	3,876.7233	1.2266		3,907.3872
Total	**4.0188**	**42.5046**	**34.8088**	**0.0391**	**18.0663**	**2.1505**	**20.2167**	**9.9307**	**1.9784**	**11.9091**		**3,876.7233**	**3,876.7233**	**1.2266**		**3,907.3872**

3.3 Site Preparation - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0787	0.0500	0.6357	1.7900e-003	0.1698	1.1000e-003	0.1709	0.0450	1.0200e-003	0.0460		177.8233	177.8233	4.7700e-003		177.9426
Total	**0.0787**	**0.0500**	**0.6357**	**1.7900e-003**	**0.1698**	**1.1000e-003**	**0.1709**	**0.0450**	**1.0200e-003**	**0.0460**		**177.8233**	**177.8233**	**4.7700e-003**		**177.9426**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	1.2300	34.4240	23.4003	0.0391		0.4805	0.4805		0.4805	0.4805	0.0000	3,876.7233	3,876.7233	1.2266		3,907.3872
Total	**1.2300**	**34.4240**	**23.4003**	**0.0391**	**8.1298**	**0.4805**	**8.6104**	**4.4688**	**0.4805**	**4.9493**	**0.0000**	**3,876.7233**	**3,876.7233**	**1.2266**		**3,907.3872**

3.3 Site Preparation - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0787	0.0500	0.6357	1.7900e-003	0.1698	1.1000e-003	0.1709	0.0450	1.0200e-003	0.0460		177.8233	177.8233	4.7700e-003		177.9426
Total	**0.0787**	**0.0500**	**0.6357**	**1.7900e-003**	**0.1698**	**1.1000e-003**	**0.1709**	**0.0450**	**1.0200e-003**	**0.0460**		**177.8233**	**177.8233**	**4.7700e-003**		**177.9426**

3.4 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.9018	0.0000	6.9018	3.4204	0.0000	3.4204			0.0000			0.0000
Off-Road	2.7610	28.3800	23.3864	0.0297		1.5329	1.5329		1.4103	1.4103		2,944.1998	2,944.1998	0.9315		2,967.4876
Total	**2.7610**	**28.3800**	**23.3864**	**0.0297**	**6.9018**	**1.5329**	**8.4347**	**3.4204**	**1.4103**	**4.8307**		**2,944.1998**	**2,944.1998**	**0.9315**		**2,967.4876**

3.4 Grading - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.7304	58.9231	10.6158	0.1546	3.3735	0.2346	3.6081	0.9244	0.2244	1.1488		16,421.9446	16,421.9446	0.7303		16,440.2028
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0656	0.0416	0.5297	1.4900e-003	0.1415	9.2000e-004	0.1424	0.0375	8.5000e-004	0.0384		148.1861	148.1861	3.9800e-003		148.2855
Total	**1.7959**	**58.9647**	**11.1456**	**0.1561**	**3.5149**	**0.2355**	**3.7504**	**0.9619**	**0.2253**	**1.1872**		**16,570.1307**	**16,570.1307**	**0.7343**		**16,588.4883**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.1058	0.0000	3.1058	1.5392	0.0000	1.5392			0.0000			0.0000
Off-Road	1.0980	26.2602	20.3762	0.0297		0.4115	0.4115		0.4115	0.4115	0.0000	2,944.1998	2,944.1998	0.9315		2,967.4876
Total	**1.0980**	**26.2602**	**20.3762**	**0.0297**	**3.1058**	**0.4115**	**3.5173**	**1.5392**	**0.4115**	**1.9507**	**0.0000**	**2,944.1998**	**2,944.1998**	**0.9315**		**2,967.4876**

3.4 Grading - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.7304	58.9231	10.6158	0.1546	3.3735	0.2346	3.6081	0.9244	0.2244	1.1488		16,421.9446	16,421.9446	0.7303		16,440.2028
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0656	0.0416	0.5297	1.4900e-003	0.1415	9.2000e-004	0.1424	0.0375	8.5000e-004	0.0384		148.1861	148.1861	3.9800e-003		148.2855
Total	**1.7959**	**58.9647**	**11.1456**	**0.1561**	**3.5149**	**0.2355**	**3.7504**	**0.9619**	**0.2253**	**1.1872**		**16,570.1307**	**16,570.1307**	**0.7343**		**16,588.4883**

3.5 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3516	20.9650	17.1204	0.0268		1.2850	1.2850		1.2083	1.2083		2,580.7618	2,580.7618	0.6279		2,596.4595
Total	**2.3516**	**20.9650**	**17.1204**	**0.0268**		**1.2850**	**1.2850**		**1.2083**	**1.2083**		**2,580.7618**	**2,580.7618**	**0.6279**		**2,596.4595**

3.5 Building Construction - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	4.5700e-003	0.1195	0.0296	2.6000e-004	6.1200e-003	8.5000e-004	6.9700e-003	1.7600e-003	8.1000e-004	2.5700e-003		26.9971	26.9971	1.4300e-003		27.0329
Worker	0.0219	0.0139	0.1766	5.0000e-004	0.0472	3.1000e-004	0.0475	0.0125	2.8000e-004	0.0128		49.3954	49.3954	1.3300e-003		49.4285
Total	**0.0264**	**0.1333**	**0.2062**	**7.6000e-004**	**0.0533**	**1.1600e-003**	**0.0544**	**0.0143**	**1.0900e-003**	**0.0154**		**76.3924**	**76.3924**	**2.7600e-003**		**76.4614**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0782	23.4615	17.8156	0.0268		0.4508	0.4508		0.4508	0.4508	0.0000	2,580.7618	2,580.7618	0.6279		2,596.4595
Total	**1.0782**	**23.4615**	**17.8156**	**0.0268**		**0.4508**	**0.4508**		**0.4508**	**0.4508**	**0.0000**	**2,580.7618**	**2,580.7618**	**0.6279**		**2,596.4595**

3.5 Building Construction - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	4.5700e-003	0.1195	0.0296	2.6000e-004	6.1200e-003	8.5000e-004	6.9700e-003	1.7600e-003	8.1000e-004	2.5700e-003		26.9971	26.9971	1.4300e-003		27.0329
Worker	0.0219	0.0139	0.1766	5.0000e-004	0.0472	3.1000e-004	0.0475	0.0125	2.8000e-004	0.0128		49.3954	49.3954	1.3300e-003		49.4285
Total	**0.0264**	**0.1333**	**0.2062**	**7.6000e-004**	**0.0533**	**1.1600e-003**	**0.0544**	**0.0143**	**1.0900e-003**	**0.0154**		**76.3924**	**76.3924**	**2.7600e-003**		**76.4614**

3.5 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1113	19.0839	16.8084	0.0268		1.1128	1.1128		1.0465	1.0465		2,542.4799	2,542.4799	0.6194		2,557.9658
Total	**2.1113**	**19.0839**	**16.8084**	**0.0268**		**1.1128**	**1.1128**		**1.0465**	**1.0465**		**2,542.4799**	**2,542.4799**	**0.6194**		**2,557.9658**

3.5 Building Construction - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	3.7000e-003	0.1083	0.0263	2.5000e-004	6.1200e-003	5.3000e-004	6.6500e-003	1.7600e-003	5.1000e-004	2.2700e-003		26.8546	26.8546	1.3100e-003		26.8874
Worker	0.0199	0.0123	0.1585	4.8000e-004	0.0472	3.0000e-004	0.0475	0.0125	2.8000e-004	0.0128		47.8263	47.8263	1.1600e-003		47.8553
Total	**0.0236**	**0.1206**	**0.1848**	**7.3000e-004**	**0.0533**	**8.3000e-004**	**0.0541**	**0.0143**	**7.9000e-004**	**0.0151**		**74.6810**	**74.6810**	**2.4700e-003**		**74.7427**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0782	23.4615	17.8156	0.0268		0.4508	0.4508		0.4508	0.4508	0.0000	2,542.4799	2,542.4799	0.6194		2,557.9658
Total	**1.0782**	**23.4615**	**17.8156**	**0.0268**		**0.4508**	**0.4508**		**0.4508**	**0.4508**	**0.0000**	**2,542.4799**	**2,542.4799**	**0.6194**		**2,557.9658**

3.5 Building Construction - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	3.7000e-003	0.1083	0.0263	2.5000e-004	6.1200e-003	5.3000e-004	6.6500e-003	1.7600e-003	5.1000e-004	2.2700e-003		26.8546	26.8546	1.3100e-003		26.8874
Worker	0.0199	0.0123	0.1585	4.8000e-004	0.0472	3.0000e-004	0.0475	0.0125	2.8000e-004	0.0128		47.8263	47.8263	1.1600e-003		47.8553
Total	**0.0236**	**0.1206**	**0.1848**	**7.3000e-004**	**0.0533**	**8.3000e-004**	**0.0541**	**0.0143**	**7.9000e-004**	**0.0151**		**74.6810**	**74.6810**	**2.4700e-003**		**74.7427**

3.6 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3301	13.7845	14.3523	0.0223		0.7390	0.7390		0.6799	0.6799		2,160.7571	2,160.7571	0.6988		2,178.2279
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**1.3301**	**13.7845**	**14.3523**	**0.0223**		**0.7390**	**0.7390**		**0.6799**	**0.6799**		**2,160.7571**	**2,160.7571**	**0.6988**		**2,178.2279**

3.6 Paving - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0598	0.0368	0.4754	1.4400e-003	0.1415	9.0000e-004	0.1424	0.0375	8.3000e-004	0.0384		143.4790	143.4790	3.4800e-003		143.5660
Total	**0.0598**	**0.0368**	**0.4754**	**1.4400e-003**	**0.1415**	**9.0000e-004**	**0.1424**	**0.0375**	**8.3000e-004**	**0.0384**		**143.4790**	**143.4790**	**3.4800e-003**		**143.5660**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.9122	19.6998	16.9276	0.0223		0.3271	0.3271		0.3271	0.3271	0.0000	2,160.7571	2,160.7571	0.6988		2,178.2279
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.9122**	**19.6998**	**16.9276**	**0.0223**		**0.3271**	**0.3271**		**0.3271**	**0.3271**	**0.0000**	**2,160.7571**	**2,160.7571**	**0.6988**		**2,178.2279**

3.6 Paving - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0598	0.0368	0.4754	1.4400e-003	0.1415	9.0000e-004	0.1424	0.0375	8.3000e-004	0.0384		143.4790	143.4790	3.4800e-003		143.5660
Total	**0.0598**	**0.0368**	**0.4754**	**1.4400e-003**	**0.1415**	**9.0000e-004**	**0.1424**	**0.0375**	**8.3000e-004**	**0.0384**		**143.4790**	**143.4790**	**3.4800e-003**		**143.5660**

3.7 Architectural Coating - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	32.0296					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	**32.2718**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9928**

3.7 Architectural Coating - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	3.9800e-003	2.4500e-003	0.0317	1.0000e-004	9.4300e-003	6.0000e-005	9.4900e-003	2.5000e-003	6.0000e-005	2.5600e-003		9.5653	9.5653	2.3000e-004		9.5711
Total	**3.9800e-003**	**2.4500e-003**	**0.0317**	**1.0000e-004**	**9.4300e-003**	**6.0000e-005**	**9.4900e-003**	**2.5000e-003**	**6.0000e-005**	**2.5600e-003**		**9.5653**	**9.5653**	**2.3000e-004**		**9.5711**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	32.0296					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1139	2.3524	1.8324	2.9700e-003		0.0475	0.0475		0.0475	0.0475	0.0000	281.4481	281.4481	0.0218		281.9928
Total	**32.1435**	**2.3524**	**1.8324**	**2.9700e-003**		**0.0475**	**0.0475**		**0.0475**	**0.0475**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9928**

3.7 Architectural Coating - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	3.9800e-003	2.4500e-003	0.0317	1.0000e-004	9.4300e-003	6.0000e-005	9.4900e-003	2.5000e-003	6.0000e-005	2.5600e-003		9.5653	9.5653	2.3000e-004		9.5711
Total	**3.9800e-003**	**2.4500e-003**	**0.0317**	**1.0000e-004**	**9.4300e-003**	**6.0000e-005**	**9.4900e-003**	**2.5000e-003**	**6.0000e-005**	**2.5600e-003**		**9.5653**	**9.5653**	**2.3000e-004**		**9.5711**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.2774	1.0154	2.7525	9.2200e-003	0.7589	7.4900e-003	0.7663	0.2030	7.0000e-003	0.2100		929.1867	929.1867	0.0330		930.0121
Unmitigated	0.2774	1.0154	2.7525	9.2200e-003	0.7589	7.4900e-003	0.7663	0.2030	7.0000e-003	0.2100		929.1867	929.1867	0.0330		930.0121

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Single Family Housing	160.03	160.03	160.03	357,246	357,246
Total	160.03	160.03	160.03	357,246	357,246

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Single Family Housing	12.40	4.30	5.40	26.10	29.10	44.80	86	11	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Single Family Housing	0.582298	0.039109	0.186022	0.123408	0.017184	0.005083	0.010615	0.023794	0.001605	0.001810	0.005454	0.002746	0.000871

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

Exceed Title 24

Install High Efficiency Lighting

Percent of Electricity Use Generated with Renewable Energy

Install Energy Efficient Appliances

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0153	0.1307	0.0556	8.3000e-004		0.0106	0.0106		0.0106	0.0106		166.8242	166.8242	3.2000e-003	3.0600e-003	167.8155
NaturalGas Unmitigated	0.0196	0.1675	0.0713	1.0700e-003		0.0135	0.0135		0.0135	0.0135		213.7824	213.7824	4.1000e-003	3.9200e-003	215.0528

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	1817.15	0.0196	0.1675	0.0713	1.0700e-003		0.0135	0.0135		0.0135	0.0135		213.7824	213.7824	4.1000e-003	3.9200e-003	215.0528
Total		**0.0196**	**0.1675**	**0.0713**	**1.0700e-003**		**0.0135**	**0.0135**		**0.0135**	**0.0135**		**213.7824**	**213.7824**	**4.1000e-003**	**3.9200e-003**	**215.0528**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	1.41801	0.0153	0.1307	0.0556	8.3000e-004		0.0106	0.0106		0.0106	0.0106		166.8242	166.8242	3.2000e-003	3.0600e-003	167.8155
Total		**0.0153**	**0.1307**	**0.0556**	**8.3000e-004**		**0.0106**	**0.0106**		**0.0106**	**0.0106**		**166.8242**	**166.8242**	**3.2000e-003**	**3.0600e-003**	**167.8155**

6.0 Area Detail

6.1 Mitigation Measures Area

Use Electric Lawnmower

Use Electric Leafblower

Use Electric Chainsaw

Use Low VOC Paint - Residential Interior

Use Low VOC Paint - Residential Exterior

Use Low VOC Paint - Non-Residential Interior

Use Low VOC Paint - Non-Residential Exterior

Use only Natural Gas Hearths

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	1.5534	0.2627	1.0528	1.6500e-003		0.0255	0.0255		0.0255	0.0255	0.0000	322.8177	322.8177	7.5800e-003	5.8900e-003	324.7619
Unmitigated	24.8279	0.4590	29.3718	0.0506		3.9612	3.9612		3.9612	3.9612	411.0127	178.5782	589.5909	0.3331	0.0333	607.8469

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.1755					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	1.3236					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	23.2963	0.4466	28.2970	0.0505		3.9553	3.9553		3.9553	3.9553	411.0127	176.6471	587.6597	0.3312	0.0333	605.8689
Landscaping	0.0326	0.0124	1.0749	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003		1.9312	1.9312	1.8700e-003		1.9780
Total	**24.8279**	**0.4590**	**29.3718**	**0.0506**		**3.9612**	**3.9612**		**3.9612**	**3.9612**	**411.0127**	**178.5782**	**589.5909**	**0.3331**	**0.0333**	**607.8469**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.1755					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	1.3236					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0294	0.2516	0.1071	1.6100e-003		0.0203	0.0203		0.0203	0.0203	0.0000	321.1765	321.1765	6.1600e-003	5.8900e-003	323.0851
Landscaping	0.0249	0.0111	0.9457	5.0000e-005		5.1700e-003	5.1700e-003		5.1700e-003	5.1700e-003		1.6413	1.6413	1.4200e-003		1.6769
Total	**1.5534**	**0.2627**	**1.0528**	**1.6600e-003**		**0.0255**	**0.0255**		**0.0255**	**0.0255**	**0.0000**	**322.8177**	**322.8177**	**7.5800e-003**	**5.8900e-003**	**324.7619**

7.0 Water Detail

7.1 Mitigation Measures Water

Use Grey Water

Install Low Flow Bathroom Faucet

Install Low Flow Kitchen Faucet

Install Low Flow Toilet

Install Low Flow Shower

Use Water Efficient Irrigation System

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Moraga Camino Pablo

Contra Costa County, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Single Family Housing	13.00	Dwelling Unit	8.50	61,850.00	46

1.2 Other Project Characteristics

Urbanization	Rural	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	58
Climate Zone	5			**Operational Year**	2021
Utility Company	Pacific Gas & Electric Company				
CO2 Intensity (lb/MWhr)	290	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics - GHG Emission factors: Guidance for PG&E Customers, November 2015

Land Use - A 13-unit single family homes on approximately 8.5 acres. Sizes of 3,685 to 6,080 sq ft; averaging 4,758 sq ft. Lots of 15,105 to 40,027 sq ft; averaging 22,367 sq ft.

Grading - 61,800 cubic yards of material movement due to contour grading.

Architectural Coating - BAAQMD Rule 8-03

Vehicle Trips - Fehr & Peers Traffic Study, dated November 17, 2015, estimated 160 daily trips or 12.31 trips per unit

Energy Use -

Construction Off-road Equipment Mitigation - BAAQMD Basic and Enhanced Construction Mitigation Measures

Area Mitigation -

Energy Mitigation -

Water Mitigation -

Table Name	Column Name	Default Value	New Value
tblArchitecturalCoating	ConstArea_Residential_Exterior	41,749.00	30,713.00
tblArchitecturalCoating	ConstArea_Residential_Interior	125,246.00	92,138.00
tblAreaCoating	Area_EF_Parking	150	0
tblAreaCoating	Area_Residential_Exterior	41749	30713
tblAreaCoating	Area_Residential_Interior	125246	92138
tblConstDustMitigation	WaterUnpavedRoadVehicleSpeed	0	15
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2

tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	DPF	No Change	Level 2
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	3.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	6.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	10.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2

tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblConstEquipMitigation	Tier	No Change	Tier 2
tblEnergyUse	NT24E	6,155.97	5,096.44
tblEnergyUse	NT24NG	2,615.00	6,192.92
tblEnergyUse	T24E	217.68	248.69
tblEnergyUse	T24NG	39,708.76	44,827.08
tblFireplaces	FireplaceDayYear	11.14	6.29
tblFireplaces	FireplaceWoodMass	228.80	215.60
tblFireplaces	NumberGas	3.25	7.15
tblFireplaces	NumberNoFireplace	1.04	0.00
tblFireplaces	NumberWood	5.59	5.85
tblGrading	MaterialExported	0.00	30,900.00
tblGrading	MaterialImported	0.00	30,900.00
tblLandUse	LandUseSquareFeet	23,400.00	61,850.00
tblLandUse	LotAcreage	4.22	8.50
tblLandUse	Population	37.00	46.00
tblOffRoadEquipment	HorsePower	231.00	226.00
tblOffRoadEquipment	HorsePower	158.00	162.00
tblOffRoadEquipment	HorsePower	158.00	162.00
tblOffRoadEquipment	HorsePower	187.00	174.00
tblOffRoadEquipment	HorsePower	130.00	125.00
tblOffRoadEquipment	HorsePower	132.00	130.00
tblOffRoadEquipment	HorsePower	247.00	255.00
tblOffRoadEquipment	HorsePower	247.00	255.00
tblOffRoadEquipment	HorsePower	247.00	255.00
tblProjectCharacteristics	CO2IntensityFactor	641.35	290

tblProjectCharacteristics	UrbanizationLevel	Urban	Rural
tblSolidWaste	SolidWasteGenerationRate	19.32	18.90
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblTripsAndVMT	WorkerTripLength	10.80	12.40
tblVehicleTrips	HO_TL	5.70	5.40
tblVehicleTrips	HO_TTP	54.00	44.80
tblVehicleTrips	HS_TL	4.80	4.30
tblVehicleTrips	HS_TTP	15.00	29.10
tblVehicleTrips	HW_TL	10.80	12.40
tblVehicleTrips	HW_TTP	31.00	26.10
tblVehicleTrips	ST_TR	9.91	12.31
tblVehicleTrips	SU_TR	8.62	12.31
tblVehicleTrips	WD_TR	9.52	12.31
tblWoodstoves	NumberCatalytic	0.52	0.46
tblWoodstoves	NumberNoncatalytic	0.52	0.46
tblWoodstoves	WoodstoveDayYear	21.06	26.24
tblWoodstoves	WoodstoveWoodMass	956.80	1,355.20

2.0 Emissions Summary

2.1 Overall Construction (Maximum Daily Emission)

Unmitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	4.6097	88.7855	35.4447	0.1831	18.2360	2.1516	20.3876	9.9757	1.9794	11.9551	0.0000	19,225.8389	19,225.8389	1.7136	0.0000	19,268.6787
2020	32.2759	19.2083	16.9824	0.0275	0.1415	1.1137	1.1670	0.0375	1.0473	1.0615	0.0000	2,611.9131	2,611.9131	0.7020	0.0000	2,627.4613
Maximum	**32.2759**	**88.7855**	**35.4447**	**0.1831**	**18.2360**	**2.1516**	**20.3876**	**9.9757**	**1.9794**	**11.9551**	**0.0000**	**19,225.8389**	**19,225.8389**	**1.7136**	**0.0000**	**19,268.6787**

Mitigated Construction

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Year	lb/day										lb/day					
2019	2.9467	86.6657	32.4344	0.1831	8.2996	0.6518	8.7812	4.5138	0.6413	4.9954	0.0000	19,225.8389	19,225.8389	1.7136	0.0000	19,268.6787
2020	32.1476	23.5859	17.9895	0.0275	0.1415	0.4516	0.5049	0.0375	0.4516	0.4659	0.0000	2,611.9131	2,611.9131	0.7020	0.0000	2,627.4613
Maximum	**32.1476**	**86.6657**	**32.4344**	**0.1831**	**8.2996**	**0.6518**	**8.7812**	**4.5138**	**0.6413**	**4.9954**	**0.0000**	**19,225.8389**	**19,225.8389**	**1.7136**	**0.0000**	**19,268.6787**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**4.86**	**-2.09**	**3.82**	**0.00**	**54.07**	**66.21**	**56.92**	**54.55**	**63.89**	**58.04**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

2.2 Overall Operational

Unmitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	24.8279	0.4590	29.3718	0.0506		3.9612	3.9612		3.9612	3.9612	411.0127	178.5782	589.5909	0.3331	0.0333	607.8469
Energy	0.0196	0.1675	0.0713	1.0700e-003		0.0135	0.0135		0.0135	0.0135		213.7824	213.7824	4.1000e-003	3.9200e-003	215.0528
Mobile	0.2280	1.0696	2.7453	8.5000e-003	0.7589	7.5500e-003	0.7664	0.2030	7.0700e-003	0.2101		857.1917	857.1917	0.0336		858.0310
Total	**25.0755**	**1.6961**	**32.1884**	**0.0601**	**0.7589**	**3.9823**	**4.7412**	**0.2030**	**3.9818**	**4.1849**	**411.0127**	**1,249.5524**	**1,660.5651**	**0.3708**	**0.0372**	**1,680.9307**

Mitigated Operational

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Area	1.5534	0.2627	1.0528	1.6500e-003		0.0255	0.0255		0.0255	0.0255	0.0000	322.8177	322.8177	7.5800e-003	5.8900e-003	324.7619
Energy	0.0153	0.1307	0.0556	8.3000e-004		0.0106	0.0106		0.0106	0.0106		166.8242	166.8242	3.2000e-003	3.0600e-003	167.8155
Mobile	0.2280	1.0696	2.7453	8.5000e-003	0.7589	7.5500e-003	0.7664	0.2030	7.0700e-003	0.2101		857.1917	857.1917	0.0336		858.0310
Total	**1.7967**	**1.4630**	**3.8537**	**0.0110**	**0.7589**	**0.0436**	**0.8025**	**0.2030**	**0.0432**	**0.2462**	**0.0000**	**1,346.8336**	**1,346.8336**	**0.0444**	**8.9500e-003**	**1,350.6085**

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio-CO2	Total CO2	CH4	N20	CO2e
Percent Reduction	**92.83**	**13.74**	**88.03**	**81.74**	**0.00**	**98.90**	**83.07**	**0.00**	**98.92**	**94.12**	**100.00**	**-7.79**	**18.89**	**88.04**	**75.97**	**19.65**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Demolition	Demolition	10/1/2019	10/28/2019	5	20	
2	Site Preparation	Site Preparation	10/29/2019	11/11/2019	5	10	
3	Grading	Grading	11/12/2019	12/9/2019	5	20	
4	Building Construction	Building Construction	12/10/2019	10/26/2020	5	230	
5	Paving	Paving	10/27/2020	11/23/2020	5	20	
6	Architectural Coating	Architectural Coating	11/24/2020	12/21/2020	5	20	

Acres of Grading (Site Preparation Phase): 0

Acres of Grading (Grading Phase): 10

Acres of Paving: 0

Residential Indoor: 92,138; Residential Outdoor: 30,713; Non-Residential Indoor: 0; Non-Residential Outdoor: 0; Striped Parking Area: 0 (Architectural Coating – sqft)

OffRoad Equipment

Moraga Camino Pablo - Contra Costa County, Winter

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Demolition	Concrete/Industrial Saws	1	8.00	81	0.73
Demolition	Excavators	3	8.00	162	0.38
Demolition	Rubber Tired Dozers	2	8.00	255	0.40
Site Preparation	Rubber Tired Dozers	3	8.00	255	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	162	0.38
Grading	Graders	1	8.00	174	0.41
Grading	Rubber Tired Dozers	1	8.00	255	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Building Construction	Cranes	1	7.00	226	0.29
Building Construction	Forklifts	3	8.00	89	0.20
Building Construction	Generator Sets	1	8.00	84	0.74
Building Construction	Tractors/Loaders/Backhoes	3	7.00	97	0.37
Building Construction	Welders	1	8.00	46	0.45
Paving	Pavers	2	8.00	125	0.42
Paving	Paving Equipment	2	8.00	130	0.36
Paving	Rollers	2	8.00	80	0.38
Architectural Coating	Air Compressors	1	6.00	78	0.48

Trips and VMT

Phase Name	Offroad Equipment Count	Worker Trip Number	Vendor Trip Number	Hauling Trip Number	Worker Trip Length	Vendor Trip Length	Hauling Trip Length	Worker Vehicle Class	Vendor Vehicle Class	Hauling Vehicle Class
Demolition	6	15.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Site Preparation	7	18.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	15.00	0.00	3,863.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Building Construction	9	5.00	1.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Paving	6	15.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT
Architectural Coating	1	1.00	0.00	0.00	12.40	6.60	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Use DPF for Construction Equipment

Water Exposed Area

Reduce Vehicle Speed on Unpaved Roads

3.2 Demolition - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	3.3224	33.9413	30.8050	0.0399		1.6448	1.6448		1.5316	1.5316		3,929.2327	3,929.2327	1.0974		3,956.6669
Total	**3.3224**	**33.9413**	**30.8050**	**0.0399**		**1.6448**	**1.6448**		**1.5316**	**1.5316**		**3,929.2327**	**3,929.2327**	**1.0974**		**3,956.6669**

3.2 Demolition - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0675	0.0514	0.4826	1.3500e-003	0.1415	9.2000e-004	0.1424	0.0375	8.5000e-004	0.0384		134.2335	134.2335	3.6600e-003		134.3250
Total	**0.0675**	**0.0514**	**0.4826**	**1.3500e-003**	**0.1415**	**9.2000e-004**	**0.1424**	**0.0375**	**8.5000e-004**	**0.0384**		**134.2335**	**134.2335**	**3.6600e-003**		**134.3250**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.2905	33.4676	25.2649	0.0399		0.4669	0.4669		0.4669	0.4669	0.0000	3,929.2327	3,929.2327	1.0974		3,956.6669
Total	**1.2905**	**33.4676**	**25.2649**	**0.0399**		**0.4669**	**0.4669**		**0.4669**	**0.4669**	**0.0000**	**3,929.2327**	**3,929.2327**	**1.0974**		**3,956.6669**

3.2 Demolition - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0675	0.0514	0.4826	1.3500e-003	0.1415	9.2000e-004	0.1424	0.0375	8.5000e-004	0.0384		134.2335	134.2335	3.6600e-003		134.3250
Total	**0.0675**	**0.0514**	**0.4826**	**1.3500e-003**	**0.1415**	**9.2000e-004**	**0.1424**	**0.0375**	**8.5000e-004**	**0.0384**		**134.2335**	**134.2335**	**3.6600e-003**		**134.3250**

3.3 Site Preparation - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					18.0663	0.0000	18.0663	9.9307	0.0000	9.9307			0.0000			0.0000
Off-Road	4.0188	42.5046	34.8088	0.0391		2.1505	2.1505		1.9784	1.9784		3,876.7233	3,876.7233	1.2266		3,907.3872
Total	**4.0188**	**42.5046**	**34.8088**	**0.0391**	**18.0663**	**2.1505**	**20.2167**	**9.9307**	**1.9784**	**11.9091**		**3,876.7233**	**3,876.7233**	**1.2266**		**3,907.3872**

3.3 Site Preparation - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0810	0.0617	0.5791	1.6200e-003	0.1698	1.1000e-003	0.1709	0.0450	1.0200e-003	0.0460		161.0802	161.0802	4.3900e-003		161.1900
Total	**0.0810**	**0.0617**	**0.5791**	**1.6200e-003**	**0.1698**	**1.1000e-003**	**0.1709**	**0.0450**	**1.0200e-003**	**0.0460**		**161.0802**	**161.0802**	**4.3900e-003**		**161.1900**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					8.1298	0.0000	8.1298	4.4688	0.0000	4.4688			0.0000			0.0000
Off-Road	1.2300	34.4240	23.4003	0.0391		0.4805	0.4805		0.4805	0.4805	0.0000	3,876.7233	3,876.7233	1.2266		3,907.3872
Total	**1.2300**	**34.4240**	**23.4003**	**0.0391**	**8.1298**	**0.4805**	**8.6104**	**4.4688**	**0.4805**	**4.9493**	**0.0000**	**3,876.7233**	**3,876.7233**	**1.2266**		**3,907.3872**

3.3 Site Preparation - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0810	0.0617	0.5791	1.6200e-003	0.1698	1.1000e-003	0.1709	0.0450	1.0200e-003	0.0460		161.0802	161.0802	4.3900e-003		161.1900
Total	**0.0810**	**0.0617**	**0.5791**	**1.6200e-003**	**0.1698**	**1.1000e-003**	**0.1709**	**0.0450**	**1.0200e-003**	**0.0460**		**161.0802**	**161.0802**	**4.3900e-003**		**161.1900**

3.4 Grading - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					6.9018	0.0000	6.9018	3.4204	0.0000	3.4204			0.0000			0.0000
Off-Road	2.7610	28.3800	23.3864	0.0297		1.5329	1.5329		1.4103	1.4103		2,944.1998	2,944.1998	0.9315		2,967.4876
Total	**2.7610**	**28.3800**	**23.3864**	**0.0297**	**6.9018**	**1.5329**	**8.4347**	**3.4204**	**1.4103**	**4.8307**		**2,944.1998**	**2,944.1998**	**0.9315**		**2,967.4876**

3.4 Grading - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.7812	60.3542	11.5757	0.1520	3.3735	0.2394	3.6129	0.9244	0.2290	1.1534		16,147.4056	16,147.4056	0.7784		16,166.8662
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0675	0.0514	0.4826	1.3500e-003	0.1415	9.2000e-004	0.1424	0.0375	8.5000e-004	0.0384		134.2335	134.2335	3.6600e-003		134.3250
Total	**1.8487**	**60.4056**	**12.0582**	**0.1534**	**3.5149**	**0.2403**	**3.7552**	**0.9619**	**0.2299**	**1.1917**		**16,281.6392**	**16,281.6392**	**0.7821**		**16,301.1911**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Fugitive Dust					3.1058	0.0000	3.1058	1.5392	0.0000	1.5392			0.0000			0.0000
Off-Road	1.0980	26.2602	20.3762	0.0297		0.4115	0.4115		0.4115	0.4115	0.0000	2,944.1998	2,944.1998	0.9315		2,967.4876
Total	**1.0980**	**26.2602**	**20.3762**	**0.0297**	**3.1058**	**0.4115**	**3.5173**	**1.5392**	**0.4115**	**1.9507**	**0.0000**	**2,944.1998**	**2,944.1998**	**0.9315**		**2,967.4876**

3.4 Grading - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	1.7812	60.3542	11.5757	0.1520	3.3735	0.2394	3.6129	0.9244	0.2290	1.1534		16,147.4056	16,147.4056	0.7784		16,166.8662
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0675	0.0514	0.4826	1.3500e-003	0.1415	9.2000e-004	0.1424	0.0375	8.5000e-004	0.0384		134.2335	134.2335	3.6600e-003		134.3250
Total	**1.8487**	**60.4056**	**12.0582**	**0.1534**	**3.5149**	**0.2403**	**3.7552**	**0.9619**	**0.2299**	**1.1917**		**16,281.6392**	**16,281.6392**	**0.7821**		**16,301.1911**

3.5 Building Construction - 2019

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.3516	20.9650	17.1204	0.0268		1.2850	1.2850		1.2083	1.2083		2,580.7618	2,580.7618	0.6279		2,596.4595
Total	**2.3516**	**20.9650**	**17.1204**	**0.0268**		**1.2850**	**1.2850**		**1.2083**	**1.2083**		**2,580.7618**	**2,580.7618**	**0.6279**		**2,596.4595**

3.5 Building Construction - 2019

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	4.8000e-003	0.1209	0.0342	2.5000e-004	6.1200e-003	8.6000e-004	6.9800e-003	1.7600e-003	8.2000e-004	2.5900e-003		26.2640	26.2640	1.5700e-003		26.3032
Worker	0.0225	0.0171	0.1609	4.5000e-004	0.0472	3.1000e-004	0.0475	0.0125	2.8000e-004	0.0128		44.7445	44.7445	1.2200e-003		44.7750
Total	**0.0273**	**0.1380**	**0.1950**	**7.0000e-004**	**0.0533**	**1.1700e-003**	**0.0544**	**0.0143**	**1.1000e-003**	**0.0154**		**71.0085**	**71.0085**	**2.7900e-003**		**71.0782**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0782	23.4615	17.8156	0.0268		0.4508	0.4508		0.4508	0.4508	0.0000	2,580.7618	2,580.7618	0.6279		2,596.4595
Total	**1.0782**	**23.4615**	**17.8156**	**0.0268**		**0.4508**	**0.4508**		**0.4508**	**0.4508**	**0.0000**	**2,580.7618**	**2,580.7618**	**0.6279**		**2,596.4595**

3.5 Building Construction - 2019

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	4.8000e-003	0.1209	0.0342	2.5000e-004	6.1200e-003	8.6000e-004	6.9800e-003	1.7600e-003	8.2000e-004	2.5900e-003		26.2640	26.2640	1.5700e-003		26.3032
Worker	0.0225	0.0171	0.1609	4.5000e-004	0.0472	3.1000e-004	0.0475	0.0125	2.8000e-004	0.0128		44.7445	44.7445	1.2200e-003		44.7750
Total	**0.0273**	**0.1380**	**0.1950**	**7.0000e-004**	**0.0533**	**1.1700e-003**	**0.0544**	**0.0143**	**1.1000e-003**	**0.0154**		**71.0085**	**71.0085**	**2.7900e-003**		**71.0782**

3.5 Building Construction - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	2.1113	19.0839	16.8084	0.0268		1.1128	1.1128		1.0465	1.0465		2,542.4799	2,542.4799	0.6194		2,557.9658
Total	**2.1113**	**19.0839**	**16.8084**	**0.0268**		**1.1128**	**1.1128**		**1.0465**	**1.0465**		**2,542.4799**	**2,542.4799**	**0.6194**		**2,557.9658**

3.5 Building Construction - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	3.9000e-003	0.1093	0.0304	2.5000e-004	6.1200e-003	5.4000e-004	6.6600e-003	1.7600e-003	5.2000e-004	2.2800e-003		26.1125	26.1125	1.4400e-003		26.1484
Worker	0.0205	0.0151	0.1435	4.3000e-004	0.0472	3.0000e-004	0.0475	0.0125	2.8000e-004	0.0128		43.3206	43.3206	1.0600e-003		43.3471
Total	**0.0244**	**0.1244**	**0.1739**	**6.8000e-004**	**0.0533**	**8.4000e-004**	**0.0541**	**0.0143**	**8.0000e-004**	**0.0151**		**69.4332**	**69.4332**	**2.5000e-003**		**69.4955**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.0782	23.4615	17.8156	0.0268		0.4508	0.4508		0.4508	0.4508	0.0000	2,542.4799	2,542.4799	0.6194		2,557.9658
Total	**1.0782**	**23.4615**	**17.8156**	**0.0268**		**0.4508**	**0.4508**		**0.4508**	**0.4508**	**0.0000**	**2,542.4799**	**2,542.4799**	**0.6194**		**2,557.9658**

3.5 Building Construction - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	3.9000e-003	0.1093	0.0304	2.5000e-004	6.1200e-003	5.4000e-004	6.6600e-003	1.7600e-003	5.2000e-004	2.2800e-003		26.1125	26.1125	1.4400e-003		26.1484
Worker	0.0205	0.0151	0.1435	4.3000e-004	0.0472	3.0000e-004	0.0475	0.0125	2.8000e-004	0.0128		43.3206	43.3206	1.0600e-003		43.3471
Total	**0.0244**	**0.1244**	**0.1739**	**6.8000e-004**	**0.0533**	**8.4000e-004**	**0.0541**	**0.0143**	**8.0000e-004**	**0.0151**		**69.4332**	**69.4332**	**2.5000e-003**		**69.4955**

3.6 Paving - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	1.3301	13.7845	14.3523	0.0223		0.7390	0.7390		0.6799	0.6799		2,160.7571	2,160.7571	0.6988		2,178.2279
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**1.3301**	**13.7845**	**14.3523**	**0.0223**		**0.7390**	**0.7390**		**0.6799**	**0.6799**		**2,160.7571**	**2,160.7571**	**0.6988**		**2,178.2279**

3.6 Paving - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0616	0.0453	0.4305	1.3000e-003	0.1415	9.0000e-004	0.1424	0.0375	8.3000e-004	0.0384		129.9619	129.9619	3.1800e-003		130.0413
Total	**0.0616**	**0.0453**	**0.4305**	**1.3000e-003**	**0.1415**	**9.0000e-004**	**0.1424**	**0.0375**	**8.3000e-004**	**0.0384**		**129.9619**	**129.9619**	**3.1800e-003**		**130.0413**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Off-Road	0.9122	19.6998	16.9276	0.0223		0.3271	0.3271		0.3271	0.3271	0.0000	2,160.7571	2,160.7571	0.6988		2,178.2279
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.9122**	**19.6998**	**16.9276**	**0.0223**		**0.3271**	**0.3271**		**0.3271**	**0.3271**	**0.0000**	**2,160.7571**	**2,160.7571**	**0.6988**		**2,178.2279**

3.6 Paving - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	0.0616	0.0453	0.4305	1.3000e-003	0.1415	9.0000e-004	0.1424	0.0375	8.3000e-004	0.0384		129.9619	129.9619	3.1800e-003		130.0413
Total	**0.0616**	**0.0453**	**0.4305**	**1.3000e-003**	**0.1415**	**9.0000e-004**	**0.1424**	**0.0375**	**8.3000e-004**	**0.0384**		**129.9619**	**129.9619**	**3.1800e-003**		**130.0413**

3.7 Architectural Coating - 2020

Unmitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	32.0296					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.2422	1.6838	1.8314	2.9700e-003		0.1109	0.1109		0.1109	0.1109		281.4481	281.4481	0.0218		281.9928
Total	**32.2718**	**1.6838**	**1.8314**	**2.9700e-003**		**0.1109**	**0.1109**		**0.1109**	**0.1109**		**281.4481**	**281.4481**	**0.0218**		**281.9928**

3.7 Architectural Coating - 2020

Unmitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.1000e-003	3.0200e-003	0.0287	9.0000e-005	9.4300e-003	6.0000e-005	9.4900e-003	2.5000e-003	6.0000e-005	2.5600e-003		8.6641	8.6641	2.1000e-004		8.6694
Total	**4.1000e-003**	**3.0200e-003**	**0.0287**	**9.0000e-005**	**9.4300e-003**	**6.0000e-005**	**9.4900e-003**	**2.5000e-003**	**6.0000e-005**	**2.5600e-003**		**8.6641**	**8.6641**	**2.1000e-004**		**8.6694**

Mitigated Construction On-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Archit. Coating	32.0296					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Off-Road	0.1139	2.3524	1.8324	2.9700e-003		0.0475	0.0475		0.0475	0.0475	0.0000	281.4481	281.4481	0.0218		281.9928
Total	**32.1435**	**2.3524**	**1.8324**	**2.9700e-003**		**0.0475**	**0.0475**		**0.0475**	**0.0475**	**0.0000**	**281.4481**	**281.4481**	**0.0218**		**281.9928**

3.7 Architectural Coating - 2020

Mitigated Construction Off-Site

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Hauling	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Vendor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		0.0000	0.0000	0.0000		0.0000
Worker	4.1000e-003	3.0200e-003	0.0287	9.0000e-005	9.4300e-003	6.0000e-005	9.4900e-003	2.5000e-003	6.0000e-005	2.5600e-003		8.6641	8.6641	2.1000e-004		8.6694
Total	**4.1000e-003**	**3.0200e-003**	**0.0287**	**9.0000e-005**	**9.4300e-003**	**6.0000e-005**	**9.4900e-003**	**2.5000e-003**	**6.0000e-005**	**2.5600e-003**		**8.6641**	**8.6641**	**2.1000e-004**		**8.6694**

4.0 Operational Detail - Mobile

4.1 Mitigation Measures Mobile

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	0.2280	1.0696	2.7453	8.5000e-003	0.7589	7.5500e-003	0.7664	0.2030	7.0700e-003	0.2101		857.1917	857.1917	0.0336		858.0310
Unmitigated	0.2280	1.0696	2.7453	8.5000e-003	0.7589	7.5500e-003	0.7664	0.2030	7.0700e-003	0.2101		857.1917	857.1917	0.0336		858.0310

4.2 Trip Summary Information

	Average Daily Trip Rate			Unmitigated	Mitigated
Land Use	Weekday	Saturday	Sunday	Annual VMT	Annual VMT
Single Family Housing	160.03	160.03	160.03	357,246	357,246
Total	160.03	160.03	160.03	357,246	357,246

4.3 Trip Type Information

	Miles			Trip %			Trip Purpose %		
Land Use	H-W or C-W	H-S or C-C	H-O or C-NW	H-W or C-W	H-S or C-C	H-O or C-NW	Primary	Diverted	Pass-by
Single Family Housing	12.40	4.30	5.40	26.10	29.10	44.80	86	11	3

4.4 Fleet Mix

Land Use	LDA	LDT1	LDT2	MDV	LHD1	LHD2	MHD	HHD	OBUS	UBUS	MCY	SBUS	MH
Single Family Housing	0.582298	0.039109	0.186022	0.123408	0.017184	0.005083	0.010615	0.023794	0.001605	0.001810	0.005454	0.002746	0.000871

5.0 Energy Detail

Historical Energy Use: N

5.1 Mitigation Measures Energy

Exceed Title 24

Install High Efficiency Lighting

Percent of Electricity Use Generated with Renewable Energy

Install Energy Efficient Appliances

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
NaturalGas Mitigated	0.0153	0.1307	0.0556	8.3000e-004		0.0106	0.0106		0.0106	0.0106		166.8242	166.8242	3.2000e-003	3.0600e-003	167.8155
NaturalGas Unmitigated	0.0196	0.1675	0.0713	1.0700e-003		0.0135	0.0135		0.0135	0.0135		213.7824	213.7824	4.1000e-003	3.9200e-003	215.0528

5.2 Energy by Land Use - NaturalGas

Unmitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	1817.15	0.0196	0.1675	0.0713	1.0700e-003		0.0135	0.0135		0.0135	0.0135		213.7824	213.7824	4.1000e-003	3.9200e-003	215.0528
Total		**0.0196**	**0.1675**	**0.0713**	**1.0700e-003**		**0.0135**	**0.0135**		**0.0135**	**0.0135**		**213.7824**	**213.7824**	**4.1000e-003**	**3.9200e-003**	**215.0528**

Mitigated

	NaturalGas Use	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Land Use	kBTU/yr	lb/day										lb/day					
Single Family Housing	1.41801	0.0153	0.1307	0.0556	8.3000e-004		0.0106	0.0106		0.0106	0.0106		166.8242	166.8242	3.2000e-003	3.0600e-003	167.8155
Total		**0.0153**	**0.1307**	**0.0556**	**8.3000e-004**		**0.0106**	**0.0106**		**0.0106**	**0.0106**		**166.8242**	**166.8242**	**3.2000e-003**	**3.0600e-003**	**167.8155**

6.0 Area Detail

6.1 Mitigation Measures Area

Use Electric Lawnmower

Use Electric Leafblower

Use Electric Chainsaw

Use Low VOC Paint - Residential Interior

Use Low VOC Paint - Residential Exterior

Use Low VOC Paint - Non-Residential Interior

Use Low VOC Paint - Non-Residential Exterior

Use only Natural Gas Hearths

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
Category	lb/day										lb/day					
Mitigated	1.5534	0.2627	1.0528	1.6500e-003		0.0255	0.0255		0.0255	0.0255	0.0000	322.8177	322.8177	7.5800e-003	5.8900e-003	324.7619
Unmitigated	24.8279	0.4590	29.3718	0.0506		3.9612	3.9612		3.9612	3.9612	411.0127	178.5782	589.5909	0.3331	0.0333	607.8469

6.2 Area by SubCategory

Unmitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.1755					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	1.3236					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	23.2963	0.4466	28.2970	0.0505		3.9553	3.9553		3.9553	3.9553	411.0127	176.6471	587.6597	0.3312	0.0333	605.8689
Landscaping	0.0326	0.0124	1.0749	6.0000e-005		5.9200e-003	5.9200e-003		5.9200e-003	5.9200e-003		1.9312	1.9312	1.8700e-003		1.9780
Total	**24.8279**	**0.4590**	**29.3718**	**0.0506**		**3.9612**	**3.9612**		**3.9612**	**3.9612**	**411.0127**	**178.5782**	**589.5909**	**0.3331**	**0.0333**	**607.8469**

6.2 Area by SubCategory

Mitigated

	ROG	NOx	CO	SO2	Fugitive PM10	Exhaust PM10	PM10 Total	Fugitive PM2.5	Exhaust PM2.5	PM2.5 Total	Bio- CO2	NBio- CO2	Total CO2	CH4	N2O	CO2e
SubCategory	lb/day										lb/day					
Architectural Coating	0.1755					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Consumer Products	1.3236					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Hearth	0.0294	0.2516	0.1071	1.6100e-003		0.0203	0.0203		0.0203	0.0203	0.0000	321.1765	321.1765	6.1600e-003	5.8900e-003	323.0851
Landscaping	0.0249	0.0111	0.9457	5.0000e-005		5.1700e-003	5.1700e-003		5.1700e-003	5.1700e-003		1.6413	1.6413	1.4200e-003		1.6769
Total	**1.5534**	**0.2627**	**1.0528**	**1.6600e-003**		**0.0255**	**0.0255**		**0.0255**	**0.0255**	**0.0000**	**322.8177**	**322.8177**	**7.5800e-003**	**5.8900e-003**	**324.7619**

7.0 Water Detail

7.1 Mitigation Measures Water

Use Grey Water

Install Low Flow Bathroom Faucet

Install Low Flow Kitchen Faucet

Install Low Flow Toilet

Install Low Flow Shower

Use Water Efficient Irrigation System

8.0 Waste Detail

8.1 Mitigation Measures Waste

9.0 Operational Offroad

Equipment Type	Number	Hours/Day	Days/Year	Horse Power	Load Factor	Fuel Type

10.0 Stationary Equipment

Fire Pumps and Emergency Generators

Equipment Type	Number	Hours/Day	Hours/Year	Horse Power	Load Factor	Fuel Type

Boilers

Equipment Type	Number	Heat Input/Day	Heat Input/Year	Boiler Rating	Fuel Type

User Defined Equipment

Equipment Type	Number

11.0 Vegetation

Appendix B

Biological Reports

ZENTNER and ZENTNER
Land Planning and Restoration

Camino Pablo

Special Status Habitat and Species Analysis

Project
1004 DPL

Zentner and Zentner

Prepared for:
Dobbins Properties, LLC.

Date Issued:
October 2015

95 Linden Street Suite 3 Oakland California 94607 510.622.8110

Camino Pablo

Special Status Habitat and Species Analysis

I. Introduction

This analysis identifies special status habitats and species and other important biological resources within the Camino Pablo property (also known as the project site), potential project impacts on biological resources, and the applicant's mitigation measures that are included in the project for potential impacts.

Zentner and Zentner completed several studies for this site in preparation for this analysis. Zentner and Zentner conducted site analyses including preliminary species assessments and a jurisdictional delineation over the period from December 20 through 31, 2013. Further delineation work and site analyses were completed on February 10, 2015. Zentner and Zentner also conducted plant surveys on January 2 and April 14, 2014, and a plant report was produced in May 2014.

The analysis draws on that earlier work and the reports produced from that work, as it also draws on the preliminary species report titled "Camino Pablo Property Biotic Resources Assessment" by Zentner and Zentner of March 2014.

In addition to this work, the most recent versions of the California Department of Fish and Wildlife (CDFW; formerly California Department of Fish and Game; CDFG) California Natural Diversity Database (CNDDB), United States Fish and Wildlife Service (USFWS) special status species list, and the California Native Plant Society's (CNPS) Online Inventory of Rare and Endangered Plants were reviewed during the preparation of this analysis to determine special-status plant and animal species potentially occurring in the project vicinity. The databases were searched for the project site and greater project area (*i.e.,* the surrounding 9 surrounding USGS 7.5-minute quadrangles).

This report assesses the biological and associated regulatory issues relevant to the development of the Camino Pablo Property (the site), an undeveloped property on Camino Pablo in the Town of Moraga (**Figure 1**), that is to be carved out of the larger Carr Ranch, which lies east of the site. The site is approximately 24 acres and is the westernmost portion of the Carr Ranch. The Camino Pablo site lies in south-central Contra Costa on the southern edge of the Moraga adjacent to the Sanders Ranch, Tharpe and Sky view subdivisions. Camino Pablo and Sanders Ranch form the site's western and northern border. The southern border abuts the Moraga Highlands (Sky View) subdivision, while the eastern border is undeveloped open space; parts of which are owned by East Bay Municipal Utility District

ZENTNER and ZENTNER
Land Planning and Restoration
95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 Fax: 510.622.8116

FIGURE 1
Location Map

CAMINO PABLO
Moraga, California

BY: **Chris J Long**

DATE: **9/29/15**

N
W E
S

MAP NOT TO SCALE.

SOURCE:
CNDDB Database

FILE: **D:\..\PROJECTS\..\1018 Pickering\Adobe\1018 CNDDB 15-1-27**

(EBMUD) and by the Carr Ranch. The Site's APN is 258-290-023 and the street address is 1211 Camino Pablo.

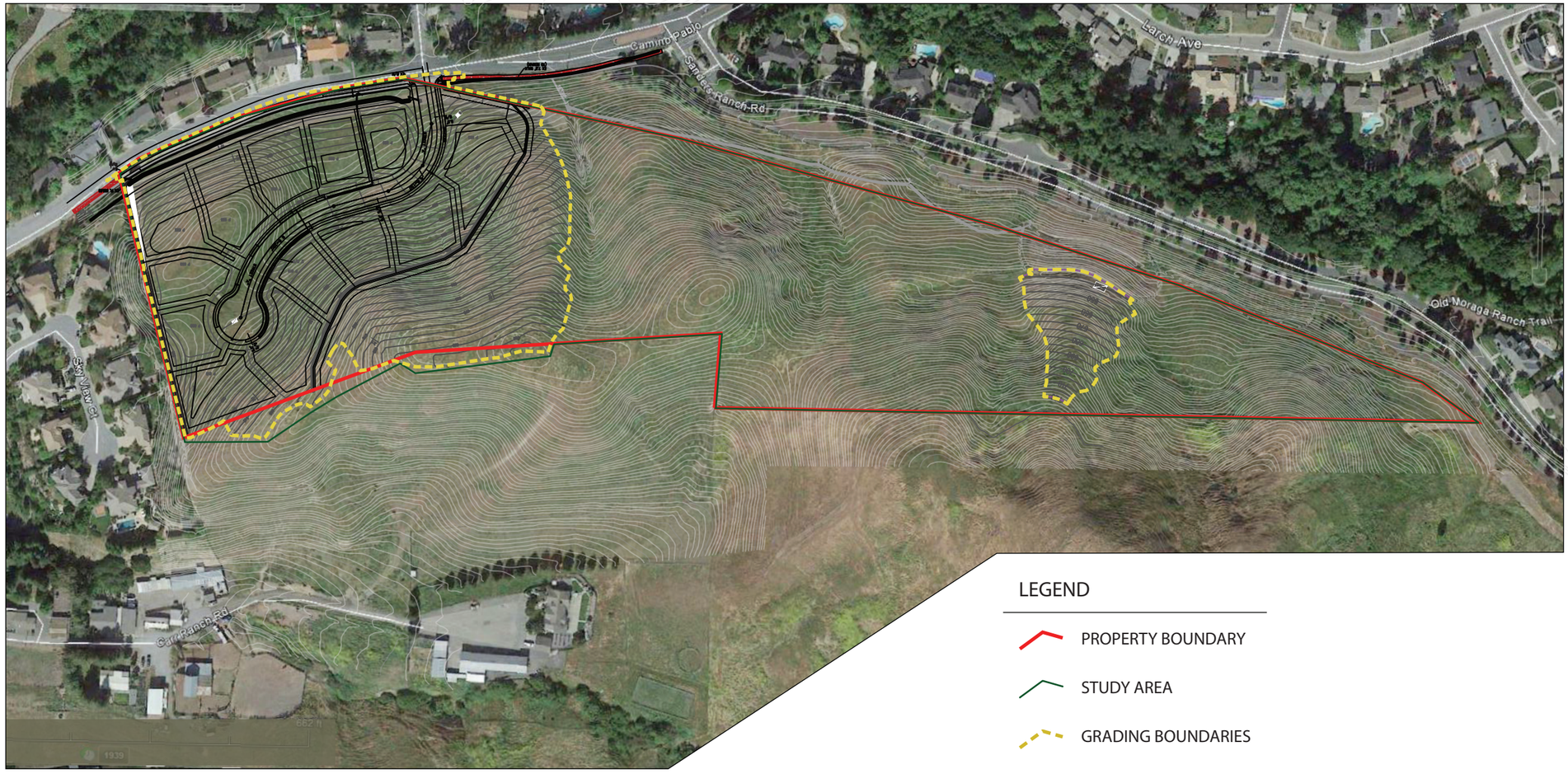
Regionally, the site is on the southern edge of the Lamorinda development area, a generally suburban residential complex situated between Oakland and Walnut Creek. The great majority of the developed lands are to the north, however. South of the site, lands are generally public open space and include EBMUD reservoirs and East Bay Regional Park District (EBRPD) open space and parks.

Photo 1: View of the annual grassland (the dominant habitat) facing west and Camino Pablo Blvd and Tharp Dr. in the background. April 14, 2014.

A. Project Description

The Camino Pablo project proposes to construct 13 residential units on approximately 7.75 acres of the property, including roads, lots, and landscaping (**Figure 2**). These lots would be built in the far southern corner of the site adjacent to the Sky View residential community and Camino Pablo Blvd. Grading for the project would be conducted on approximately 10.6 acres of the site in order to repair erosional features such as slumps above the lots. Therefore a total of approximately 2.85 acres would be temporarily impacted by grading and would be repaired and hydroseeded to return it to approximately its existing condition. A small portion of this grading will be completed near the ridge top in the adjacent parcel of land, which will be retained by the Carr family. The remainder of the site, approximately 16.25 acres, will be permanent open space. A potential soil borrow site may be temporarily impacted in the open space if there is a need for more soils during grading. The barrow site is located in the approximate center of the open space and totals about 0.86 acres. This area will also be temporarily impacted and then hydroseeded to return it to a similar condition as existing if borrow soils are required. If the barrow site is used, a haul road will run between the development and the barrow site during grading. The haul route will be placed, in consultation with a qualified biologist, to stay out of wetland areas and instead through non-native grassland as much as practicable.

A small strip of native creeping wildrye (*Elymus triticoides*), which is a native grass, is located adjacent to Camino Pablo Blvd. Specifically, the grass lies between the sidewalk that lies adjacent to and east of Camino Pablo Blvd and an existing fence-line that runs parallel to the road approximately 15 feet east of the sidewalk. This patch of grassland is about 12 feet wide and 120 feet long. As part of the project, the applicant has agreed to move this grassland to an appropriate area of the open space. As the grass grows from rhizomes, it can be moved and watered in to ensure that it is transplanted successfully.



ZENTNER and ZENTNER
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FIGURE 2
DEVELOPMENT MAP

BY: **Chris J Long**

DATE: **10/12/2015**

CAMINO PABLO
Moraga, California

0 125' 250'

BASE MAP:
GOOGLE MAPS 2015

FILE: **D:\PROJECTS\1042\adobe \1004 development map**

II. ENVIRONMENTAL SETTING

A. Site Description

The Camino Pablo property is located in central, far western Contra Costa County, very close to the northwestern tip of Alameda County. The roughly triangular site is bordered on the south by the Sky View residential development on the south, Camino Pablo Blvd. and the Tharpe Drive residential development on the west, Sanders Ranch residential development on the north and East Bay Municipal Utility District (EBMUD) and Carr Ranch land on the east. The property itself is the western piece of the greater Carr Ranch land that includes homes, barns and other ranch outbuildings, stock pens, and grazing land. The Carrs have lived and run cattle on the property since 1916.

The watershed of the site consists of primarily of ephemeral waterways in the drainages of the slopes. Water on the west side of the property is intercepted at roadside drainages along Camino Pablo Blvd. Existent concrete v-ditches run northeast to southwest along Sanders Ranch Rd. There are approximately 2,180 linear feet of v-ditch adjacent to the property, with 483 linear feet actually within the property. From the site, the drains connect with Moraga Creek and become part of the greater San Leandro watershed. Moraga Creek flows into the Upper San Leandro Reservoir, and then into San Leandro Creek, which exits to the bay at Arrowhead Marsh, between the Oakland Airport and Alameda.

The project site contains approximately 24 acres of grazed grassland on primarily the western-facing slope of a relatively steep, north-south trending ridge. The grasslands now appear to be relatively moderately grazed, however, they are dominated by non-native, annual grasses, which is often indicative of past heavy grazing. Two gullies run down the steep ridge toward Camino Pablo Blvd. and are picked up by one of the v-ditches. The site contains a good number of slides and slumps and a number of cement v-ditches run along the northern portion of the site to catch and drain water.

Erosion, which is prevalent across the site due to the presence of annual vegetation and the history of grazing, is apparent by the minor slumps and slides that make up the jurisdictional waterways onsite. Small seasonal wetlands occur in only a couple of locations on the property; at the base of the largest jurisdictional waterway, at the base of a wide slump at a higher elevation, and along a seep adjacent to one of the gullies.

B. PLANT COMMUNITIES AND ASSOCIATED WILDLIFE HABITAT

As noted above, the project site is dominated by grassland and non-native annual grassland vegetation (**Figure 3**). The site also contains a few small pockets of ruderal vegetation. A few very small seasonal wetlands are also associated with seeps or gullies on the northern portion of the property.

Nomenclature used for plant names follows *The Jepson Manual*, Second Edition (Baldwin et. al. 2012) and changes made to this manual as published on the Jepson Interchange Project website (http://ucjeps.berkeley.edu/interchange/index.html). Nomenclature for wildlife follows the CDFW's *Complete list of Amphibian, Reptile, Bird, and Mammal Species in California* (2008) and any changes made to species nomenclature as published in scientific journals since the publication of CDFW's list.

1. Annual Grassland Vegetation

Grassland characterized by non-native annual grasses and forbs dominate the site. These non-native grasslands are primarily composed of wild oats (*Avena fatua*), ryegrass (*Festuca perennis*), soft chess brome (*Bromus hordeaceus*), ripgut brome (*Bromus diandrus*), with areas of bindweed (*Convolvulus arvensis*), red-stem filaree (*Erodium cicutarium*), and rose clover (*Trifolium hirtum*).

This grassland composition is characteristic of most of the grasslands in the region, the majority of which have been subjected to relatively heavy grazing since the Spanish first brought cattle into the area in the 1700's and have had a wide variety of grazing regimes since that period. Once established, these non-native grasses are very difficult to remove and their establishment has some broad ramifications to the habitat in general. One of the primary effects of annual grassland is on soil structure. Annual grasslands have dense, shallow roots that dry the upper soil zones, whereas the native perennial grasses have long, deep roots. While these deep roots helped hold the soils on California's steep slopes, the shallow-rooted annual grasses leave the soils, especially the upper layers vulnerable. This often leads to erosion, particularly slumps and gully erosion as is found on the site, especially on the very steep west-facing slopes of the property.

However, a couple of slumps on the northern portion of the site contain small pockets of relatively steep north or northwest facing slopes. These older slump areas contain a scattering of native vegetation including primarily purple needlegrass (*Stipa pulchra*), creeping wildrye (*Elymus triticoides*), buttercup (*Ranunculus californicus*), common fiddleneck (*Amsinckia intermedia*), soap plant (*Chlorogalum pomeridianum*), and sun cup (*Taraxia ovate*).

In addition, a strip of creeping wildrye is present on the property between the sidewalk that lies adjacent to Camino Pablo Blvd and an existing fence-line that runs parallel to the road. This strip is approximately 20 feet wide and runs about 75 feet long.

2. Ruderal Vegetation

A few small pockets of ruderal vegetation are found on the project site. These primarily include areas that have been relatively heavily disturbed by more recent slump or slide activity and areas where cattle tend to congregate, such as ridge tops. The ruderal vegetation

LEGEND

- PROPERTY BOUNDARIES
- STUDY AREA

VEGETATION TYPES

- GRASSLAND
- RUDERAL VEGETATION
- SEASONAL WETLAND
- OTHER WATERS

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FIGURE 3
VEGETATION MAP

BY: **Chris J Long**
DATE: **10/12/2015**

CAMINO PABLO
Moraga, California

0 125' 250'

BASE MAP:
GOOGLE MAPS 2015

FILE: **D:\PROJECTS\1042\adobe \1004 vegetation map**

found in the slide and slump areas tends to be found in the uppermost portion of these areas, especially near adjacent property where the land use management is different than the project site.

The ruderal vegetation is dominated by black mustard (*Brassica nigra*). Other vegetation includes ryegrass, ripgut, wild oats, bristly ox-tongue (*Helminthotheca echioides*), Italian thistle (*Carduus pycnochephalus*), spring vetch (*Vicia sativa*), and summer mustard (*Hirschfeldia incana*). This assemblage also includes invasive exotics--those non-native species that can invade and dominate habitats containing native species.

3. Seasonal Wetland

Seasonal wetland vegetation is found in four small areas on the project site including a seep near the northeastern border of the site, a seep adjacent to the northern gully, and within two portions of the gullies along the western edge of the site adjacent of Camino Pablo Blvd. These areas remain saturated for a prolonged period of time, but don't really pond water.

The vegetation in the seasonal wetlands is characterized by mildly hydrophytic vegetation reflecting the saturated conditions that drain and dry relatively quickly. The majority of the vegetation is facultative (FAC) meaning that these are plants that occur between 33% to 67% of the time in wetlands, rather than obligate (OBL) vegetation which is nearly always (greater the 99%) associated with ponded conditions. The only obligate vegetation in the wetlands is relatively sparse, iris-leaved rush (*Juncus xiphioides*). Other vegetation observed in these areas includes ryegrass (FAC), soft chess brome (*Bromus hordeaceus*; FACU), Mediterranean barley (*Hordeum marinum*; FAC), and white sweet clover (*Trifolium repens*, FACU). FACU plants occur less than 33% of the time in wetlands.

C. Wildlife

Wildlife at the Site appears limited to common suburban/rural species. Mammals would include coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and lagomorphs (rabbits) such as black-tailed jackrabbit (*Lepus californicus*). The coyotes and other predators, such as red-tailed hawk (*Buteo jamaicensis*) and red-shouldered hawk (*Buteo lineatus*), prey on the small mammals that appear to be common on-site, including California vole (*Microtus californicus*) and deer mouse (*Peromyscus maniculatus*). Other birds commonly found in this type of grassland habitat include mourning dove (*Zenaida macroura*), western meadowlark (*Sturnella neglecta*), turkey vulture (*Cathartes aura*), killdeer (*Charadrius vociferous*), and American kestrel (*Falco sparverius*). While there is no nesting habitat for most birds, including raptors, the grasslands do provide good foraging habitat for raptors such as white-tailed kite (*Elanus leucurus*), American Kestrel and, especially, red-tailed hawk.Common reptiles likely present include western fence lizard (*Sceloperus occidentalis*), southern alligator lizard (*Gerrhonotus*

multicarinatus), gopher snake (*Pituophis melanoleucus*), and western rattle snake (*Crotalus viridis*).

III. SPECIAL-STATUS SPECIES

A. Definitions

Special-status species are plants and animals that are legally protected under the California and Federal Endangered Species Acts (CESA and FESA, respectively) or other regulations, and species that are considered rare by the scientific community (for example, the California Native Plant Society [CNPS]). Special-status species are defined as:

- Plants and animals that are listed or proposed for listing as threatened or endangered under the CESA (Fish and Game Code §2050 et seq.; 14 CCR §670.1 et seq.) or the FESA (50 CFR 17.12 for plants; 50 CFR 17.11 for animals; various notices in the Federal Register [FR] for proposed species);
- Plants and animals that are candidates for possible future listing as threatened or endangered under the FESA (50 CFR 17; FR Vol. 64, No. 205, pages 57533-57547, October 25, 1999); and under the CESA (California Fish and Game Code §2068);
- Plants and animals that meet the definition of endangered, rare, or threatened under the California Environmental Quality Act (CEQA) (14 CCR §15380) that may include species not found on either State or Federal Endangered Species lists;
- Plants occurring on Lists 1A, 1B, 2, 3, and 4 of CNPS' Electronic Inventory (CNPS 2015). The California Department of Fish and Wildlife (CDFW) recognizes that Lists 1A, 1B, and 2 of the CNPS inventory contain plants that, in the majority of cases, would qualify for State listing, and CDFW requests their inclusion in EIRs. Plants occurring on CNPS Lists 3 and 4 are "plants about which more information is necessary," and "plants of limited distribution," respectively (CNPS 2015). Such plants may be included as special-status species on a case by case basis due to local significance or recent biological information;
- Migratory non-game birds of management concern listed by U.S. Fish and Wildlife Service (Migratory Non-game Birds of Management Concern in the United States: The list 1995; Office of Migratory Bird Management; Washington D.C.; Sept. 1995);
- Animals that are designated as "species of special concern" by CDFW (2010);
- Animal species that are "fully protected" in California (Fish and Game Codes 3511, 4700, 5050, and 5515).

B. Special Status Species Potentially Occurring Within the Project Site

Figures 4 and 5 (Special Status Animal and Plant Species Occurrences within Five Miles of the Project Site) provide a graphical illustration of the closest known records for special-status animal and plant species within five miles of the project. No special-status animals or plants have been recorded on the project site. However, according to the CNPS Inventory, USFWS database, and CDFG's California Natural Diversity Database (CNDDB), a total of 58 special status animal and 61 special status plant species are known to occur in the general region of the project, that is, within the nine USGS 7.5 minute Quadrangles surrounding the project site. However, a much smaller number of species including 12 wildlife species and 19 plants are

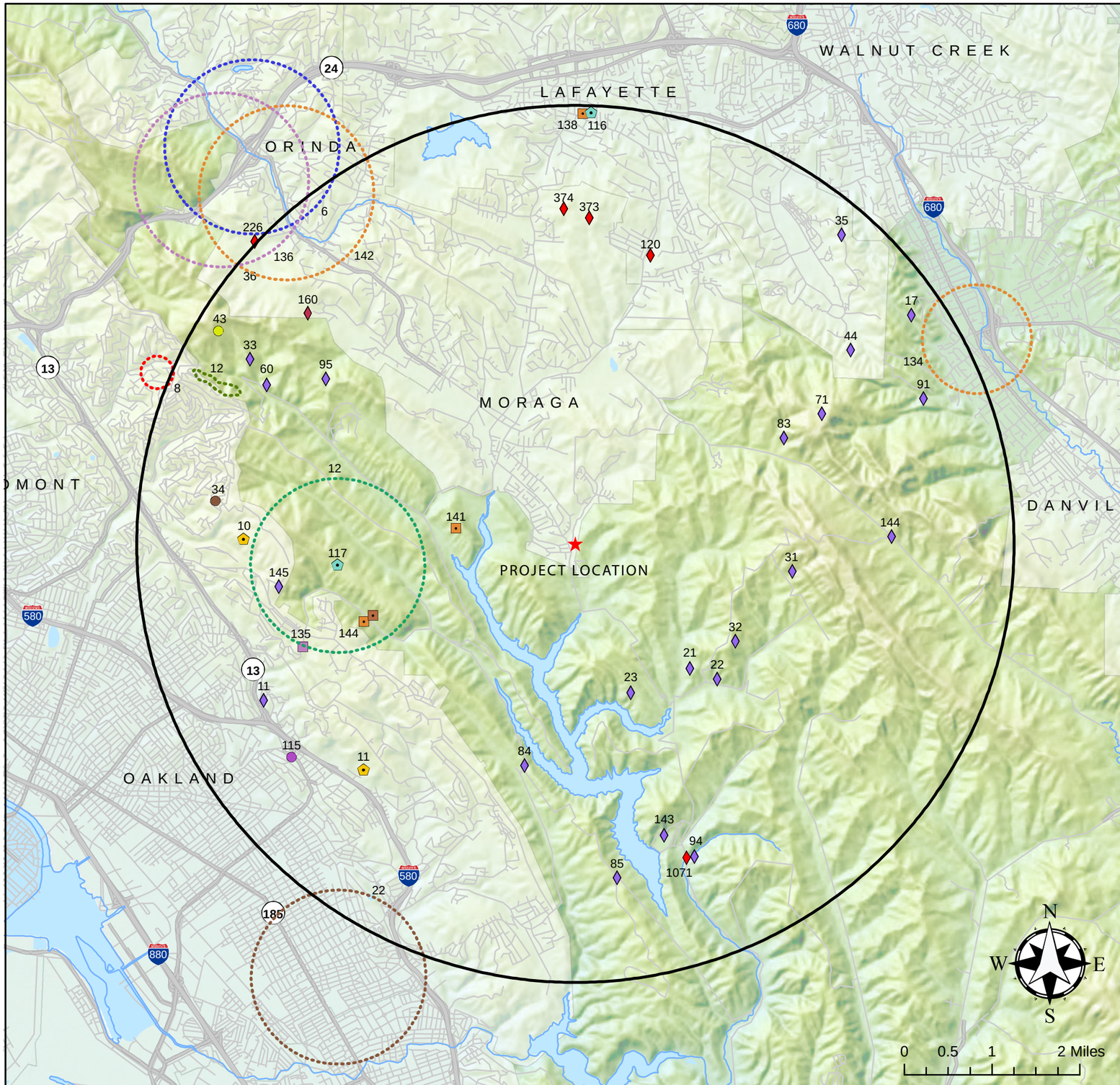


FIGURE 4
Special Status Wildlife & Habitat Occurrences within 5 miles of project

ZENTNER and ZENTNER
Land Planning and Restoration
95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 Fax: 510.622.8116

CAMINO PABLO
Moraga, California

BY: Chris J Long DATE: 10/12/15

LEGEND

★ PROJECT LOCATION

5-mile buffer

REPTILES

- Alameda whipsnake, *Masticophis lateralis euryxanthus,* 11, 17, 21, 22, 23, 31, 32, 33, 35, 44, 60, 71, 83, 84, 85, 91, 94, 95, 143, 144, 145
- California red-legged frog, *Rana draytonii,* 120, 226, 373, 374, 1071
- foothill yellow-legged frog, *Rana boylii,* 160

BIRDS

- Cooper's hawk, *Accipiter cooperii*, 115
- golden eagle, *Aquila chrysaetos*, 43
- Alameda song sparrow, *Melospiza melodia pusillula*, 22, 34

MAMMALS

- hoary bat, *Lasiurus cinereus,* 17
- pallid bat, *Antrozous pallidus,* 134, 138, 141, 142, 144
- American badger, *Taxidea taxus*, 135, 136
- Berkeley kangaroo rat, *Dipodomys heermanni berkeleyensis,* 6

INSECTS

- obscure bumblebee, *Bombus caliginosus*, 116, 117
- bay checkerspot butterfly, *Euphydryas editha bayensis,* 10, 11

HABITATS

- Northern Maritime Chaparral, 12
- Serpentine Bunchgrass, 12

PROJECT: 1004 Camino Pablo

FILE: D:\..\PROJECTS\1004\adobe\1004 CNDDB wildlife

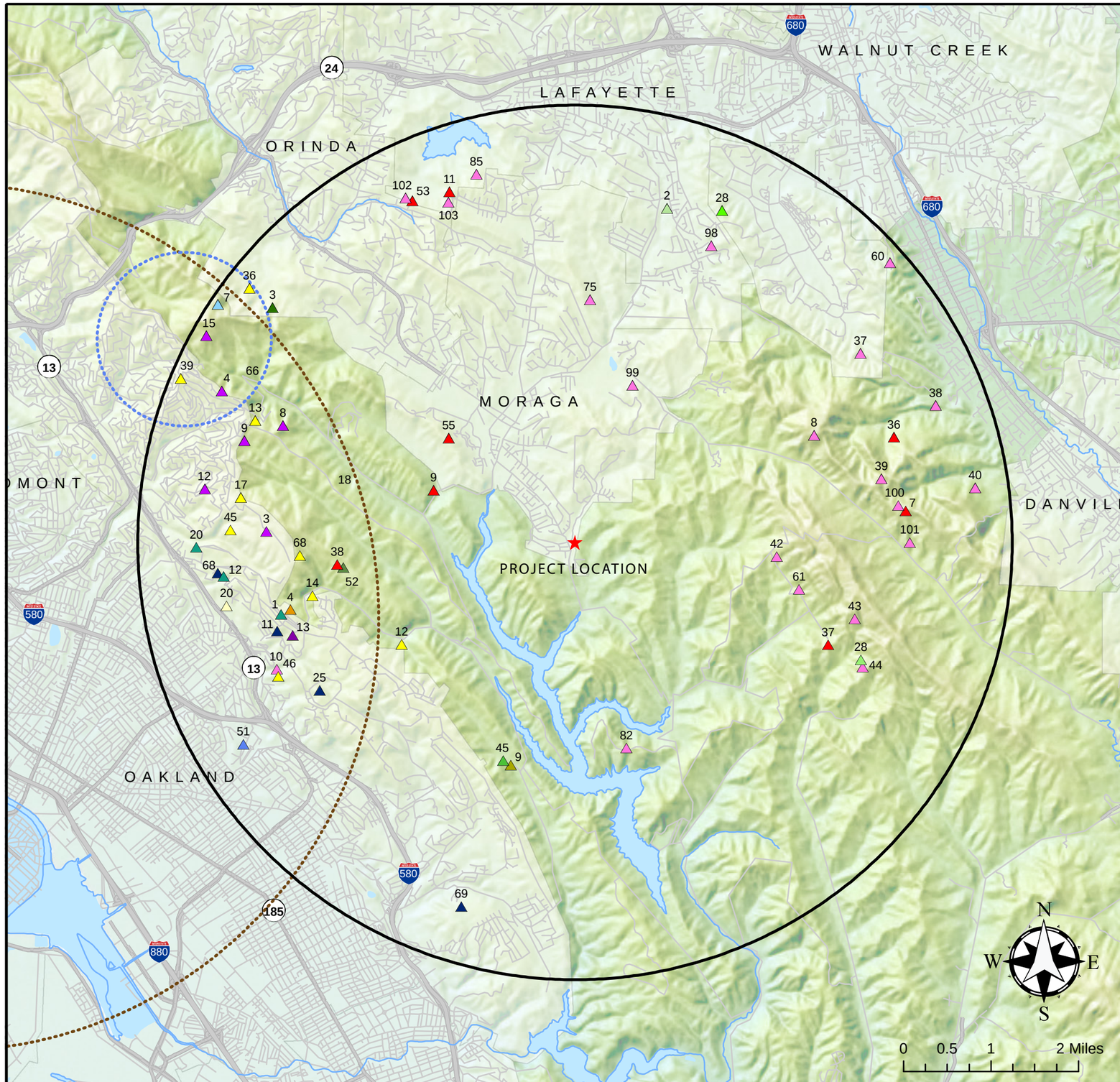
SOURCE: CNDDB shapefiles September 2015

FIGURE 5
Special Status Plant Occurrences within 5 miles of project

ZENTNER and ZENTNER
Land Planning and Restoration
95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 Fax: 510.622.8116

CAMINO PABLO
Moraga, California

BY: Chris J Long DATE: 10/12/15



LEGEND

- PROJECT LOCATION
- 5-mile buffer
- Diablo helianthella, *Helianthella castanea,* 8, 10, 37, 38, 39, 40, 42, 43, 44, 60, 61, 75, 82, 85, 98, 99, 100, 101, 102, 103
- woodland woolythread, *Monolopia gracilens,* 45
- bent-flowered fiddleneck, *Amsinckia lunaris,* 7, 9, 11, 36, 37, 38, 53, 55
- San Francisco popcornflower, *Plagiobothrys diffusus,* 13
- most beautiful jewelflower, *Streptanthus alpidus ssp. peramoenus,* 11, 25, 68, 69
- oval-leaved viburnum, *Viburnum ellipticum,* 28
- pallid manzanita, *Arctostaphylos pallida,* 3, 4, 8, 9, 12, 15
- Loma Prieta hoita, *Hoita strobilina,* 9
- round-leaved filaree, *California macrophylla,* 52
- northern California black walnut, *Juglans hindsii,* 2
- Santa Clara red ribbons, *Clarkia concinna ssp. automixa,* 20
- Presidio clarkia, *Clarkia franciscana,* 4
- Oregon meconella, *Meconella oregana,* 3
- Tiburon buckwheat, *Eriogonoum luteolum var. caninum,* 1, 12, 20
- western leatherwood, *Dirca occidentalis,* 12, 13, 14, 17, 36, 39, 45, 46, 68
- Mt. Diablo fairy-lantern, *Calochorus pulchellus,* 28
- fragrant fritilary, *Fritillaria liliacea,* 51, 66
- slender-leafed pondweed, *Stuckenia filiformis ssp. alpina,* 7
- Marin knotweed, *Polygonum marinese,* 18

PROJECT: 1004 Camino Pablo
FILE: D:\..\PROJECTS\1004\adobe\1004 CNDDB vegetation
SOURCE: CNDDB shapefiles September 2015

known to occur within 5 miles of the site, which are shown on Figures 4 and 5. The CNDDB and USFWS species lists are provided in Appendix A. The definitions for the special status species designations are provided in Appendix B.

1. Wildlife

The 58 special status wildlife species that occur in the project region are described in Table 1, along with their regulatory status, habitat requirements, and an evaluation of their potential to occur on the site. Figures 4 and 5 show the Known Occurrences of Special Status Wildlife Species within Five Miles of the project site from the CNDDB and all other sources previously identified. The wildlife species that have potential to occur on the project site are described in more detail below. The majority of the species are highly unlikely to occur onsite because they are out of the range of the species or due to the lack of suitable habitat onsite or the lack of local occurrences.

Of the remaining special status wildlife species occurring in the project region, none have been observed within the project site boundaries. The following species have not been seen but have at least some potential to nest on-site at some time, move through the site, or otherwise depend on the site for some function given the presence of potentially suitable habitat and known occurrences in the surrounding area.

Mammals

American Badger *(Taxidea taxus*), California Species of Special Concern (CSC), Special Animal (IUCN:LC)

The American badger is a carnivorous mammal found throughout the state of California, except in the North Coast area (Grinnell et al. 1937). They have stocky, low-slung bodies with short powerful legs and long foreclaws (up to 5 cm in length). They are 23.6 to 29.5 inches in length and way approximately 15 to 20 pounds. Male individuals are slightly larger than females. Their bodies are covered in silvery coat of coarse fur and heads with distinctive white and black markings.

Badgers occur throughout California except in humid coastal forests and areas of dense forest and they do not survive on cultivated land (CDFG 1986). Typically, they are most abundant in drier open stages of most shrub, forest and herbaceous habitats with friable soils.

American badgers predate on small mammal populations, particularly ground squirrels and pocket gophers (Zeiner et al 1990). They dig burrows in friable soils and frequently reuse old burrows. Badger populations have declined in the past century, although still little is known about their current population size and extent. They mate in the summer and early fall and give birth to a little of 2 to 3 in March and April (Long 1973). They are nocturnal and diurnal and active yearlong with potential for periods of torpor (Long 1973).

Scientific name	Common name	Status	Habitat	Potential habitat on-site	Range	Known range/ Critical habitat	Potential for occurrence on-site
AMPHIBIANS							
Ambystoma californiense	California tiger salamander	FT, ST, CSC, SA	Cismontane woodland, Meadow & seep, Riparian woodland, Valley & foothill grassland, Vernal pool, Wetland	No breeding habitat	Patchy distribution in CA; coast ranges between Sonoma and Santa Barbara counties, Central Valley and east and west foothills,	Yes	None: No breeding habitat No obs within 5 miles
Rana boylii	foothill yellow-legged frog	SA	Aquatic, Chaparral, Cismontane woodland, Coastal scrub, Klamath/North coast flowing waters, Lower montane coniferous forest, Meadow & seep, Riparian forest, Riparian woodland, Sacramento/San Joaquin flowing waters; PARTLY-SHADED, SHALLOW STREAMS & RIFFLES WITH A ROCKY SUBSTRATE IN A VARIETY OF HABITATS.	No breeding habitat	Northern Oregon to southern California, in coastal ranges and Sierra foothills below 2,130 meters.	Yes	Unlikely: No breeding habitat
Rana draytonii	California red-legged frog	FT, CSC, SA	Aquatic, Artificial flowing waters, Artificial standing waters, Freshwater marsh, Marsh & swamp, Riparian forest, Riparian scrub, Riparian woodland, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland	No breeding habitat	Mendocino County to Baja California, primarily west of the Cascade-Sierra crest.	Yes	Unlikley: No breeding habitat
BIRDS							
Accipiter cooperii	Cooper's hawk	SA	Cismontane woodland, Riparian forest, Riparian woodland, Upper montane coniferous forest	No breeding habitat	Widely distributed throughout California. In the Bay Area, known to be present in Contra Costa, Alameda, Santa Clara, Santa Cruz counties.	Yes	None: No breeding habitat; foraging potential only
Accipiter striatus	sharp-shinned hawk	SA	Cismontane woodland, Lower montane coniferous forest, Riparian forest, Riparian woodland	No	Throughout California; permanent populations in northern CA and the Sierra Nevadas, non-breeding resident in southern CA.	Yes	None
Agelaius tricolor	tricolored blackbird	CSC, SA	Freshwater marsh, Marsh & swamp, Swamp, Wetland	No	Oregon to southern California; primarily along the central California coast and the Central Valley.	Yes	None
Aquila chrysaetos	golden eagle	CFP, SA	Broadleaved upland forest, Cismontane woodland, Coastal prairie, Great Basin grassland, Great Basin scrub, Lower montane coniferous forest, Pinon & juniper woodlands, Upper montane coniferous forest, Valley & foothill grassland	No breeding habitat	Permanent resident in mountainous areas throughout California.	Yes	None: No breeding habitat; foraging potential only

Ardea herodias	great blue heron	SA	Brackish marsh, Estuary, Freshwater marsh, Marsh & swamp, Riparian forest, Wetland	No	Permanent resident in most of California except the southeastern desert regions.	Yes	None
Athene cunicularia	burrowing owl	CSC, SA	Coastal prairie, Coastal scrub, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Sonoran desert scrub, Valley & foothill grassland	Yes	Permanent resident of southern California valleys, from the Bay Area to Los Vegas, Nevada. Breeding range extends through the northern Central Valley.	Yes	Unlikely: Not observed and no obs within 5 miles
Branta hutchinsii leucopareia	cackling (=Aleutian Canada) goose	NONE	Artificial standing waters, Sacramento/San Joaquin standing waters, Valley & foothill grassland	No breeding habitat	Breeds in Alaska. Winters along the north coast of California, in Contra Costa County, and the Central Valley.	Yes	None: No breeding habitat
Buteo regalis	ferruginous hawk	SA	Great Basin grassland, Great Basin scrub, Pinon & juniper woodlands, Valley & foothill grassland	No breeding habitat	Nonbreeding resident throughout most of California except the northernmost counties.	Yes	None: No breeding habitat
Buteo swainsoni	Swainson's hawk	ST, SA	Great Basin grassland, Riparian forest, Riparian woodland, Valley & foothill grassland	No breeding habitat	Breeding range extends throughout California's interior counties inluding Contra Costa and Alameda.	Yes	None: Out of range; habitat east of Mt. Diablo
Charadrius alexandrinus nivosus	western snowy plover	FT, CSC, SA	Great Basin standing waters, Sand shore, Wetland	No	Along the Pacific coast of the U.S., but more numerous in valleys and deserts in southern California.	Yes	None
Circus cyaneus	northern harrier	CSC, SA	Coastal scrub, Great Basin grassland, Marsh & swamp, Riparian scrub, Valley & foothill grassland, Wetland	No breeding habitat	Nonnbreeding resident trhoughout California, and a permanent resident of northern California down through Monterey County.	Yes	None: No breeding habitat
Elanus leucurus	white-tailed kite	CFP, SA	Cismontane woodland, Marsh & swamp, Riparian woodland, Valley & foothill grassland, Wetland	No breeding habitat	Mendocino County to Baja California, west of the Sierra Nevadas.	Yes	None: No breeding habitat
Eremophila alpestris actia	California horned lark	SA	SHORT-GRASS PRAIRIE, "BALD" HILLS, MOUNTAIN MEADOWS, OPEN COASTAL PLAINS, FALLOW GRAIN FIELDS, ALKALI FLATS.	Marginal	Coast range from Humboldt County to Baja California and northern San Joaquin Valley	Yes	Unlikely: Marginal habitat, not observed
Falco mexicanus	prairie falcon	SA	Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Sonoran desert scrub, Valley & foothill grassland	No breeding habitat	Permanent resident of southern California and coastal mountain ranges up to Oregon.	Yes	None: No breeding habitat

Falco peregrinus anatum	American peregrine falcon	CFP, SA	NEAR WETLANDS, LAKES, RIVERS, OR OTHER WATER; ON CLIFFS, BANKS, DUNES, MOUNDS; ALSO, HUMAN-MADE STRUCTURES.	No breeding habitat	Breeds along the Pacific coast from Alaska to Mexico and through California. Permanent resident in parts of California.	Yes	None: No breeding habitat
Geothlypis trichas sinuosa	saltmarsh common yellowthroat	CSC, SA	Marsh & swamp	No	Breeds in the San Francisco Bay area from the Tomales Bay to Carquinez Strait and San Jose. Non-breeding range extends down to San Diego.	Yes	None
Haliaeetus leucocephalus	bald eagle	SE, CFP, SA	Lower montane coniferous forest, Oldgrowth	No	Non-breeding resident throughout mountainous areas of California. Permanent resident of Trinity mountains in northern CA.	Yes	None: No habitat
Laterallus jamaicensis coturniculus	California black rail	ST, CFP, SA	Brackish marsh, Freshwater marsh, Marsh & swamp, Salt marsh, Wetland	No	Fragmented populations in San Francisco Bay area, including San Pablo Bay, Tomales Bay and Bolinas Lagoon.	No	None: No habitat
Melospiza melodia maxillaris	Suisun song sparrow	CSC, SA	Marsh & swamp, Wetland	No	Suisun Bay and surrounding counties in the San Francisco Bay estuary. Also observed in Santa Clara county.	Yes	None: No habitat
Melospiza melodia pusillula	Alameda song sparrow	CSC, SA	Salt marsh	No	The San Francisco Bay area, including Alameda, Contra Costa, San Mateo and Santa Clara counties.	Yes	None: No habitat
Rallus longirostris obsoletus	California clapper rail	FE, SE, CFP, SA	Brackish marsh, Marsh & swamp, Salt marsh, Wetland	No	The San Francisco Bay area, including all 9 counties that border the bay.	Yes	None: No habitat
Rynchops niger	black skimmer	CSC, SA	Alkali playa, Sand shore	No	The only California populations are along the southern coast, although the species has been observed in Alameda County.	No	None: No habitat
Setophaga petechia	yellow warbler	CSC, SA	Riparian forest, Riparian scrub, Riparian woodland	No	Breeding resident of most of California except the southern Sierras and desert regions.	Yes	None: No habitat
Sternula antillarum browni	California least tern	FE, SE, CFP, SA	Alkali playa, Wetland	No	Breeds along the California coast from the San Francisco Bay to Baja California. Winters in Baja or Mexico.	Yes	None: No habitat

FISH

Archoplites interruptus	Sacramento perch	CSC, SA	Aquatic, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters	No	Persists in a few watersheds in Alameda, Sacramento, and Lake Counties, including gravel pit ponds adjacent to Alameda Creek.	No	None: No habitat

Eucyclogobius newberryi	tidewater goby	FE, CSC, SA	Aquatic, Klamath/North coast flowing waters, Sacramento/San Joaquin flowing waters, South coast flowing waters	No	Coastal streams from Oregon to San Diego, although it is possibly extirpated from the San Francisco Bay.	Yes	None: No habitat
Spirinchus thaleichthys	longfin smelt	FC, ST, CSC	Aquatic, Estuary	No	California coastal streams from the San Francisco Bay northward. However populations in the San Francisco Bay Estuary and Delta may be extirpated.	Yes	None: No habitat

INVERTEBRATES

Microcina leei	Lee's micro-blind harvestman	NONE	Valley & foothill grassland	Yes	Range is largely unknown, only sitings have been in Alameda County.	No	None: Out of Range
Microcina lumi	Lum's micro-blind harvestman	NONE	Ultramafic, Valley & foothill grassland; usually associated with serpentine rocks	No	Range is largely unknown, only sitings have been in Alameda County.	No	None: No habitat
Linderiella occidentalis	California linderiella	SA	Vernal pool	No	Throughout the Central Valley and north-central coastal mountain regions of California.	Yes	None: No habitat
Bombus caliginosus	obscure bumble bee	SA	Grassy coastal prairies and coast range meadows.	Marginal	Pacific coastal ranges from Washington to southern California	Yes	Unlikely: Marginal habitat, not observed during surveys
Callophrys mossii bayensis	San Bruno elfin butterfly	FE, SA	Valley & foothill grassland;Only occurs on north-facing slopes within fogbelt with hostplant, stonecrop (Sedum spathulifolium).	No	Primarily open ridges in San Mateo County and Contra Costa County.	Yes	None: No habitat
Danaus plexippus pop. 1	monarch - California overwintering population	SA	Closed-cone coniferous forest	No breeding habitat	Along the Pacific coast from Mendocino county to Baja California.	Yes	None: No habitat
Efferia antiochi	Antioch efferian robberfly	NONE	Interior dunes	No	Only known to exist in Contra Costa, Madera, and Fresno counties, and may be extirpated in the latter 2.	Yes	None: No habitat
Euphydryas editha bayensis	Bay checkerspot butterfly	FT, SA	Coastal dunes, Ultramafic (serpentine), Valley & foothill grassland; All habitat are on shallow serpentine-derived or similar soil. Primary host plant is dwarf plantain (Plantago erecta) or secondary hosts Indian paintbrush/purple owls clover (Castilleja exserta spp. exerta).	No-Needs serpentine outcrops	Restricted to serpentine outcrops near San Francisco Bay, including Alameda and Contra Costa counties.	Yes	None: requires serpentine outcrops and specific host plants

Helminthoglypta nickliniana bridgesi	Bridges' coast range shoulderband	SA	Valley & foothill grassland; typically found in moist or riparian areas; usually under rocks or woody debris or in accumulations of leaf mold.	No	Only known to exist in Alameda and Contra Costa counties.	Yes	None: requires rocks, leaf litter or other debris for habitat; no observations within 5 miles
Tryonia imitator	mimic tryonia (=California brackishwater snail)	SA	Aquatic, Brackish marsh, Estuary, Lagoon, Marsh & swamp, Salt marsh, Wetland	No	Southern California coast from San Francisco to Ensenada, Mexico.	Yes	None: No habitat

MAMMALS

Antrozous pallidus	pallid bat	CSC, SA	Chaparral, Coastal scrub, Desert wash, Great Basin grassland, Great Basin scrub, Mojavean desert scrub, Riparian woodland, Sonoran desert scrub, Upper montane coniferous forest, Valley & foothill grassland	No	Permanent resident throughout California and western U.S. from Washington to Colorado to Mexico	Yes	None: No roosting or breeding habitat
Corynorhinus townsendii	Townsend's big-eared bat	ST, CSC, SA	Broadleaved upland forest, Chaparral, Chenopod scrub, Great Basin grassland, Great Basin scrub, Joshua tree woodland, Lower montane coniferous forest, Meadow & seep, Mojavean desert scrub, Riparian forest, Riparian woodland, Sonoran desert scrub, Sonoran thorn woodland, Upper montane coniferous forest, Valley & foothill grassland	No	Permanent resident throughout California and western U.S. from British Columbia to Colorado to central Mexico	Yes	None: No roosting or breeding habitat
Dipodomys heermanni berkeleyensis	Berkeley kangaroo rat	NONE	Chaparral, Cismontane woodland	No	West-central California; from Contra Costa county to Sacramento, throughout the San Joaquin Valley to coastal Santa Barbara county.	Yes	None: No roosting or breeding habitat
Eumops perotis californicus	western mastiff bat	CSC, SA	Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland	No	from Alameda County south and eastward throughout interior California.	No	None: No roosting or breeding habitat
Lasionycteris noctivagans	silver-haired bat	SA	Lower montane coniferous forest, Oldgrowth, Riparian forest	No	Permanent resident throughout northern California to the San Francisco Bay area and the southeastern Sierra Nevadas.	Yes	None: No roosting or breeding habitat
Lasiurus cinereus	hoary bat	SA	Broadleaved upland forest, Cismontane woodland, Lower montane coniferous forest, North coast coniferous forest	No	Found throughout California. Breeding resident of northern 2/3 of state, non-breeding resident from Kern County southward.	Yes	None: No roosting or breeding habitat
Myotis yumanensis	Yuma myotis	SA	Lower montane coniferous forest, Riparian forest, Riparian woodland, Upper montane coniferous forest	No	Permanent resident throughout California.	Yes	None: No roosting or breeding habitat

Neotoma fuscipes annectens	San Francisco dusky-footed woodrat	CSC	Chaparral, Redwood; Prefers forest habitats with moderate canopy, year-round greenery, a brushy understory, and suitable nestbuilding materials. Well-developed understory at base of a single evergreen may be suitable for a single individual.	No	Only found in several counties in San Francisco Bay area; Alameda, Contra Costa, San Mateo, Santa Clara and Santa Cruz.	Yes	None: No habitat
Nyctinomops macrotis	big free-tailed bat	CSC	Rocky areas, evergreen forest, desert areas, scrub; nests in crevices in the tops of cliffs, occasionaly buildings or tree cavities.	No	Permanent resident of southern-most counties in California; Orange, Riverside, San Diego, and Imperial. Range may extend up to Alameda and Contra Costa, however, likely extirpated in these areas.	Marginal	None: No roosting or breeding habitat
Perognathus inornatus	San Joaquin Pocket Mouse	SA	Cismontane woodland, Mojavean desert scrub, Valley & foothill grassland	Yes	Found throughout the Central Valley and Salinas Valley and extending into the Mohave Desert in western San Bernardino County.	No	None: out of range
Reithrodontomys raviventris	salt-marsh harvest mouse	FE, SE, CFP, SA	Marsh & swamp, Wetland	No	Primarily in salt marshes in south San Francisco Bay including San Mateo, Santa Clara, Contra Costa Alameda, Marin, Napa, Solano and Sonoma counties.	Yes	None: No habitat
Scapanus latimanus parvus	Alameda Island mole	CSC	Valley & foothill grassland	Yes	Only found on Alameda Island in the City of Alameda, California.	No	None: out of range
Sorex vagrans halicoetes	salt-marsh wandering shrew	CSC	Marsh & swamp, Wetland	No	Only found in several counties in San Francisco Bay area; Alameda, Contra Costa, San Mateo and Santa Clara.	Yes	None: No habitat
Taxidea taxus	American badger	CSC, SA	Alkali marsh, Alkali playa, Alpine, Alpine dwarf scrub, Bog & fen, Brackish marsh, Broadleaved upland forest, Chaparral, Chenopod scrub, Cismontane woodland, Closed-cone coniferous forest, Coastal bluff scrub, Coastal dunes, Coastal prairie, Coastal scrub, Desert dunes, Desert wash, Freshwater marsh, Great Basin grassland, Great Basin scrub, Interior dunes, Ione formation, Joshua tree woodland, Limestone, Lower montane coniferous forest, Marsh & swamp, Meadow & seep, Mojavean desert scrub, Montane dwarf scrub, North coast coniferous forest, Oldgrowth, Pavement plain, Redwood, Riparian forest, Riparian scrub, Riparian woodland, Salt marsh, Sonoran desert scrub, Sonoran thorn woodland, Ultramafic, Upper montane coniferous forest, Upper Sonoran scrub, Valley & foothill grassland.	Yes	Throughout California and North American; from British Columbia to the Great Lake Region and south to Central Mexico.	Yes	Unlikely: Not observed during surveys; no signs of potential burrows observed
Vulpes macrotis mutica	San Joaquin kit fox	FE, ST	Chenopod scrub, Valley & foothill grassland	Yes	San Joaquin Valley in central California; from San Joaquin to Kern counties, including the eastern edge of Contra Costa and Alameda counties.	No	None: out of range

REPTILES

Emys marmorata	western pond turtle	CSC, SA	Aquatic, Artificial flowing waters, Klamath/North coast flowing waters, Klamath/North coast standing waters, Marsh & swamp, Sacramento/San Joaquin flowing waters, Sacramento/San Joaquin standing waters, South coast flowing waters, South coast standing waters, Wetland	No	Isolated populations exist in the western half of California from the Sierra Nevada foothills to the Pacific coast, throughout the length of the state.	Yes	None: No habitat
Masticophis lateralis euryxanthus	Alameda whipsnake	FT, ST	Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland	Yes	Throughout the Central Valley and surrounding foothills from Shasta County to Kern County, and along the coastal ranges from Mendocino to San Diego counties.	Yes/ Critical Habitat	Unlikely: No Core habitat, edge of CH; adjacent to development, no movement corridor
Phrynosoma blainvillii	coast horned lizard	CSC, SA	Chaparral, Cismontane woodland, Coastal bluff scrub, Coastal scrub, Desert wash, Pinon & juniper woodlands, Riparian scrub, Riparian woodland, Valley & foothill grassland; Inhabits open sandy areas, washes flood-plains and wind-blown deposits; usually found between shrubs often near ant nests	Marginal	Western California from Shasta County to Baja California under 2438 m elevation and excluding southeastern desert areas.	Yes	Unlikely; Marginal habitat, not observed during surveys, no obs within 5 miles

An American badger was observed near the site about four miles to the west the site from a 1930 collection near Mills College. Another observation is from just over 5 miles northwest of the site from a 1925 collection near Orinda.

Badgers are not likely to occur on the site. The soils are relatively heavy clays and not amenable to large burrows. Additionally, no burrows large enough to host badgers were observed during the site reviews or special status species assessments. Finally, the site is adjacent to existing development and generally badgers do not favor proximity to homes; as well, if they occurred on-site, they would likely have been reported or observed.

Dusky-footed woodrat (*Neotoma fuscipes annectens*), California Species of Special Concern (CSC

Dusky-footed woodrats are medium-sized rodents ranging from about 7 to 9 inches and approximately 7 to 14 oz (Brylski 2008). The body coloring is brown/grey with white/grey underside and white/dusky coloring on feet (Brylski 2008).

These species are relatively common to abundant in forested habitats with a moderate canopy and a moderate to dense understory and can also be found in chaparral habitats (Brylski 2008). They prefer year-round greenery, a brushy understory with suitable nestbuilding materials (Brylski 2008). They feed mainly on woody plants. Nest-houses are built of sticks and leaves at the base of or within a tree or shrub.

According to the CNDDB, there are no observations of this species within 5 miles of the site. However, this species is relatively common in relatively dense riparian understories in the Orinda, Lafayette, and Moraga areas. The property, however, does not contain suitable habitat for this species as the site is dominated by open grasslands without the necessary tree and shrub cover and dense understory that this species requires. In addition, the woodrat nests would be very easy to see within the open grasslands and no nests have been observed on the property during site surveys. Therefore, this species is highly unlikely to occur on the property.

Birds (nesting birds unless noted otherwise)

Western Burrowing Owl *(Athene cunicularia),* California Species of Special Concern (CSC); Special Animal (IUCN:LC)

The western burrowing owl (*Athene cunicularia hypugaea*) is a small ground-dwelling owl that lives in open, dry grasslands, agricultural and range lands, and desert habitats associated with burrowing mammals (Zeiner et. al. 1990). The owl typically nests in old ground squirrel (*Spermophilus beecheyi*) or similar burrows for breeding, wintering, foraging, and migration stopovers. They have been known to occupy artificially constructed burrows. Burrowing owls

are commonly seen perching on fences or on mounds outside their burrows. The owl is a mostly opportunistic feeder and forages on level areas with short grass or bare ground. Grasshoppers, beetles, mice, ground squirrels, rats, and gophers comprise the majority of their diet, however, they may also feed on reptiles, young cottontails, amphibians, scorpions, bats, and birds. The owl tends to inhabit areas where food sources are stable and available year-round. They are migratory (leaving the breeding grounds in fall) but often return to the same nest sites in spring to lay eggs from late March to May.

The burrowing owl was once common throughout California but is now found mainly in the Central and Imperial Valleys (DeSante et al. 1997). Over 60% of the breeding pairs known to exist in the 1980's disappeared by the early 1990's. The population decline is due to predation by non-native species, small mammal controls in farmlands, and habitat loss. This species also has very low fledgling success rates (Trulio 1997).

There are no observations of burrowing owls within five miles of the project site. In addition, burrowing owls have not been observed on the project site during site surveys and relatively few burrowing mammal burrows, including ground squirrel burrows that are favored by burrowing owls, were observed on the site. Therefore, it is unlikely that this species occurs on the project site.

California Horned Lark (*Eremophila alpestris actia*), CDFW: WL, Special Animal

California horned larks are medium-sized (7.5" long) open-ground nesting birds with distinctive facial characteristics. California horned larks have black and yellow banded heads and males have 2 black feathers that stick up on the sides of their heads and have the appearance of horns.

This species inhabits open grasslands with short grass and sparse, low shrubs. It feeds mainly on insects during breading season with forb seeds and other plant materials during other seasons (Green 1983). Horned larks have a weak high-pitched warble with buzzy notes (Sibley 2001).

The horned lark breeds from March through July, with peak activity in May (Green 1983) and nests in hollows on the bare ground often near a tuft of grass or a clod of earth (Hammerson, 1995); nests are cup-shaped and grass-lined (Green 1983). The bird's incubation period is approximately 2 weeks and young leave the nest about 10 days after birth. Young are tended to by both parents.

Horned larks are found throughout North America from Mexico through Canada. The California horned lark inhabits the coastal range from Baja California to Humboldt County and the San Joaquin Valley except for the extreme southern end.

There are no observations of this species within 5 miles of the project site and this species was not observed during surveys and assessments of the project site. However, this species and

other ground nesting birds (outside of burrowing owls) have some potential to use the site and could move in prior to construction. Therefore, a preconstruction survey for the horned lark and other ground nesting birds should be completed.

Nesting raptors (various species), generally protected under the CDFW Code and the Migratory Bird Treaty Act (MBTA).

While the site does support foraging habitat for some raptor species, the site does not provide suitable nesting habitat for nesting raptors as there are no trees or even large shrubs that would support raptor nests.

Other Migratory Nesting Birds; protected by the MBTA

The site does provide very limited suitable habitat for nesting birds protected by the MBTA. Though there are no trees or shrubs on the project site that support the majority of these species, there are a relatively small number of bird species that nest in grasslands. In addition, there are trees and shrubs located adjacent to the site that could support nesting migratory birds. Accordingly, there is some limited potential for this guild to nest on or adjacent to the site and a preconstruction nesting bird survey should be completed

Reptiles

Coast horned lizard (*Phrynosoma cornatum*); California Species of Special Concern (CSC); Special Animal

The coast horned lizard has a wide, flattened body with a short tail. Numerous pointed scales stick out along the sides of the body and back, though only the horns around the head are rigid.

The coast horned lizard is found on open ground, especially sandy areas, washes, flood plains and wind-blown deposits; usually between shrubs and often near ant nests (Morey 2000). It relies on camouflage for protection and often freezes when predators approach. It avoids heat by burrowing into loose soils (Morey 2000).

The horned lizard needs bare soil; they cannot tolerate weeds such as yellow star thistle or relatively dense non-native grasses such as Bromes (*Bromus sp.)* as it makes it very difficult for them to move around, likely due to their width (Wilson 2013). They prefer clean chaparral without non-native vegetation with areas of loose soil to hide and lay eggs in (Wilson 2013). In addition, Argentine ants, which are common in urban and suburban areas, displace native ants and thereby displace horned lizards, which can't persist on a diet of only Argentine ants (Wong 2002).

There are no observations of horned lizards within five miles of the project site. In addition, this species has not been observed on the project site during site surveys. The site is dominated by non-native grasses and there are no significant bare areas with loose soil on the property, which makes use of the site by this species unlikely. Therefore, it is unlikely that this species occurs on the project site.

Alameda whipsnake *(Masticophis lateralis euryxanthus),* Federal Threatened (FT); California Threatened (ST); Critical Habitat

The Alameda whipsnake (Masticophis lateralis euryxanthus) is a medium-sized whipsnake that can be up to 60 inches (152 centimeters) in length and are slender with a narrow neck, broad head, and large eyes. They are dark brown to black with a wide yellow-orange stripe on each side extending down the length of the body. The underside is cream tapering to orange or pinkish toward the tail.

They mate from March through mid-June and hatchlings usually appear in August through November; females have an average clutch size of approximately seven. These snakes are fast moving and hunt generally with their head held up. Western fence lizard (*Sceloporus occidentalis*) is an important prey item, as well as frogs, snakes and birds.

The historical distribution is difficult to determine, but it likely inhabited suitable habitat in Alameda and Contra Costa County, as well as western San Joaquin and northern Santa Clara Counties (USFWS, 2002). Currently, the whipsnake is known generally from five populations in Alameda and Contra Costa Counties. The five populations are located as follows: Sobrante Ridge, Tilden/Wildcat Regional Parks to the Briones Hills, in Contra Costa County (Tilden-Briones population); Oakland Hills, Anthony Chabot area to Las Trampas Ridge, in Contra Costa County (Oakland-Las Trampas population); Hayward Hills, Palomares area to Pleasanton Ridge, in Alameda County (Hayward-Pleasanton Ridge population); Mount Diablo vicinity and the Black Hills, in Contra Costa County (Mount Diablo-Black Hills population); Wauhab Ridge, Del Valle area to the Cedar Mountain Ridge, in (Sunol-Cedar Mountain population). They are found in chaparral and northern and coastal sage scrub as well as approximately 500 feet into adjacent grassland, oak savanna and oak-bay woodland. They seek shelter in rock outcrops or piles or in small mammal burrows.

Core habitat for AWS is generally found in open-canopied shrub communities, including coastal scrub and chaparral, often with rock outcroppings on south-, southeast-, east-, and southwest-facing slopes (Swaim 1994). Rock outcrops are an important element of its habitat, as AWS provide protection from predators and habitat for western fence lizards and other prey species (Swaim 1994). Rock outcrops are typically found within approximately 0.5 miles (Swaim 1994). AWS may also be found less frequently in oak woodland/savanna and grassland areas adjoining core habitats, especially where these areas are used as movement corridors between core habitats. Typical plant species within occupied habitats of scrub and chaparral communities include California sage, coyote brush, poison oak - and sticky monkey

flower. Canopy cover within these habitats is typically open (<75% cover of total area) with little to no herbaceous understory (Swaim 1994). Therefore, habitat associations for AWS should include those that co-occur in the general chaparral/scrub habitat mosaic (Alvarez 2005).

This site lies just within the north-central edge of the Unit 2 section of Critical Habitat for this species in Contra Costa County; the Critical Habitat border in the area is Camino Pablo Blvd.

Core habitat is not present within or near the site and it is not likely that the site is movement habitat for the species due to the impediments created by adjacent developments. Nearby developments where the snake was also not found have contained much more suitable matrix of habitats. LSA (2008) completed an assessment for the adjacent Sanders ranch and determined that even the scrub habitat here was unsuitable for Alameda whipsnake. The site itself contains no rock outcrops, no chaparral, scrub or even individual shrubs. As noted above, telemetry data indicate that Alameda whipsnakes venture up to 500 feet into adjacent habitats from their home ranges, which are centered on chaparral/scrub communities (USFWS 2005). The closest Core habitat of this type is located approximately 1 mile to the east of the project site within Critical Habitat or about 0.5 miles southwest of the site across Camino Pablo Road outside of Critical Habitat. Because the site does not contain any elements of core habitat and is on the very edge of critical habitat located adjacent to residential developments on three sides that block whipsnake movement, the site is not likely movement habitat for this species. Accordingly, Alameda whipsnake are not likely to occur on this site despite its inclusion in Critical Habitat. However, avoidance measures should be undertaken to further ensure that no Alameda whipsnakes are impacted as a result of the project.

Amphibians

California red-legged frog (*Rana aurora draytonii; CRLF*); FT, California Species of Special Concern (CSC); Special Animal (IUCN:VU)

The California Red-legged frog (CRLF) historically ranged from Redding and Marin County, south to northern Baja California (Jennings and Hayes 1994). Due to the loss and modification of habitat, predation by the non-native bullfrog, and impacted water quality, its range has been reduced to isolated drainages within coastal ranges and near-coastal foothills. The United States Fish and Wildlife Service (USFWS) notes that the CRLF once occupied 46 counties, but is now found in only 22 with the greatest concentrations in Monterey, San Luis Obispo and Santa Barbara Counties (USFWS 2002).

The CRLF is a relatively large, spade-shaped species at 1.7 to 5.1 inches in length. They vary in color, and may be brown, grey, olive, or reddish in color with black spots and irregular blotches. The lower abdomen and undersides of the legs are often, but not always, red. They have a dark mask above the upper jaw. The species is characterized by its prominent dorsolateral fold which extends on the body from eye to hip. The tadpoles are brown and

marked with small, dark spots. The lower body is creamy white and also flecked with small spots.

From late-November to late-April, adult CRLF are typically found in or near breeding habitat, which consists of perennial or near-perennial, deep (greater than 2 foot) ponds, pools or similar habitats associated with dense riparian or marsh vegetation (Hayes and Jennings 1989, 1994, Jennings 1988). Breeding takes place in streams, deep pools, backwaters within streams and creeks, ponds, marshes, and stock ponds. CRLF can occur in ephemeral ponds or permanent streams and ponds; however, populations probably cannot persist in ephemeral streams (Jennings and Hayes 1985). Habitats with the highest densities of CRLF are deep-water ponds with dense stands of overhanging willows and a fringe of cattails (Jennings 1988; Rathbun et al. 1993).

During rainy nights during this time, however, they may also be found 200 to 300 feet away from the aquatic habitat (Zeiner et al 1988). From late-spring through fall, CRLF will stay near aquatic habitat, but during the end of this period they may move away from the breeding locale into nearby moist locations.

CRLF breeds during the winter and early spring, from as early as late November through April and May. Larvae (tadpoles) remain in breeding ponds until metamorphosis in the summer months. Mortality rates are high, with less than 1 percent of eggs laid reaching metamorphosis (Jennings et al. 1992). Males reach sexual maturity about 2 years after metamorphosis, while females require 3 years to attain sexual maturity (Jennings and Hayes 1985). Individuals of this species may live up to 10 years (Jennings et al. 1992). Young CRLF (eggs, larvae, and tadpoles) are found almost exclusively in ponds (such as stockponds) or slow moving water in creeks, ditches, or similar habitat. Typically, these ponds or creeks are well-vegetated (Zeiner et al 1988) but habitat may also consist of well-grazed stockponds with little marsh vegetation (USFWS 2002). Young CRLF generally do not occur in aquatic habitats which also contain bullfrogs (Jennings and Hayes 1989).

Determining the location of CRLF habitat is complicated by CRLF movement away from relatively easily identified riparian and wetland habitats. Much of the movement ecology of CRLF is still poorly understood (Jennings and Hayes 1994), but they appear to move significant distances at two times during a year. First, adults move between winter oviposition sites and spring and summer foraging habitat (Jennings and Hayes 1989). Frogs observed in upland habitat at night during winter rains may represent such movement, but new aquatic habitat may also be found and colonized during such periods of reduced water stress. Movement into upland riparian habitat at such time may also protect frogs from catastrophic injury and transport by floodwaters (Jennings and Hayes 1994). Second, CRLF move into the shelter of riparian thickets during fall, when stream habitat is often much reduced (Rathbun et al. 1993). Such behavior appears to resemble estivation of amphibians like California tiger salamanders and spadefoots (Jameson 1981), however, the CRLF, especially the coastal populations, does not experience seasonal dormancy.

According to the CNDDB, there have been five observations of CRLF within five miles of the Site with four to the north and one from the south, all from local creeks or stockponds, *e.g.* Brookside Creek in Orinda. LSA completed surveys for CRF at the adjacent Sanders Ranch and concluded that CRF did not occur there and that breeding habitat was lacking at the Ranch (LSA 2008). Critical Habitat for this species has been identified; the closest is Unit CCS 2B, whose closest border is about three miles to the west.

CRLF are not likely to occur on the site as there is no breeding habitat on or near the site and CRLF are not likely to move through or towards the site seeking summer habitat as there is no nearby breeding habitat. Further, movement corridors to the north, west, and south are blocked by adjacent residential development and therefore, there is no draw for CRLF to move in the direction of the site.

Foothill yellow-legged frog (*Rana boylii*) California Species of Special Concern (CSC); Special Animal (IUCN:NT; USFS:S; BLM:S

The foothill yellow-legged frog is a small species at 1.46 to 3.2 inches. They are gray, brownish, or olive, and tend to match the background of its habitat. It can be plain or mottled with dark spotting with no mask through the eyes, but a light-colored band across top of its head. The lower abdomen and rear legs are yellowish. Juveniles do not have the distinctive yellow coloring right away, but acquire it as they grow older.

The foothill yellow-legged frog occurs in the Coast Ranges from southern Oregon to the Transverse Mountains in Los Angeles County, east to the Sierras (Stebbins 2003). The species frequents shallow, slow, gravelly streams and rivers with sunny banks, in forests, chaparral and woodland habitats, from sea level to 6,700 ft. (2,040 m.) in elevation. It is rarely found far from permanent water and mostly active during daylight. They stay still along the river bottom along rock cover and litter, where they are camouflaged by their coloring. Mating and egg-laying occurs in water from mid-March until early June when streams have slowed from winter runoff. Clusters of eggs are attached to the downstream side of submerged rocks. Tadpoles transform in about 15 weeks, from July to September.

According to the CNDDB, there is one observation of foothill yellow-legged frog within five miles of the Site, which is located approximately four miles northwest of the property. Foothill yellow-legged frogs are not likely to occur on the site as there is no breeding habitat on or near the site and CRLF are not likely to move through or towards the site seeking summer habitat as there is no nearby breeding habitat, which is even less common than CRLF habitat.

California tiger salamander (*Ambystoma californiense*), Federally Threatened (FT), California Species of Special Concern (CSC)

The California tiger salamander (CTS) is a relatively large, mostly terrestrial salamander. CTS are restricted to relatively deep vernal pools, stockponds or similar habitats as, compared to other amphibians, its larvae take a significant amount of time to transform into juvenile adults and require relatively lengthy hydroperiods. CTS are relatively secretive and difficult to find outside of the breeding ponds or their nocturnal breeding migrations, which begin with the first rains of the season in November or December. Sexually mature adults move at night from underground refugia, *e.g.* squirrel burrows, to breeding ponds from late November to early March and they may move significant distances, as much as 1.24 miles from a breeding pool (USFWS 2003). Breeding occurs from late winter into early spring. The species also breeds in reservoirs and small lakes but there they are often subject to predation by fish.

After breeding, the adults return to their underground burrows or other refugia. The eggs then hatch and the resulting gilled aquatic larvae metamorphose into juveniles that also move at night into terrestrial habitats (Zeiner et al 1988). Beginning in late spring and early summer, juveniles migrate from the ponds into refugia where they estivate (similar to hibernation) until the dry season ends. Juveniles can travel up to one mile from their breeding site to upland refugia (Austin and Shaffer 1992). This distance is normally less when there are large numbers of refugial sites in close proximity to breeding sites. Barriers including road berms, buildings, or walls can impede migration and roads with high levels of traffic are both a major barrier to the species and a major source of mortality. At the end of the dry season, juveniles and adults return to the breeding pond.

There are no occurrences of CTS in the project region, and no habitat on or nearby the project site. Accordingly, this site is not likely to support CTS.

Invertebrates

Bridge's coast shoulderband snail (*Helminthoglypta nickliniana bridgesi); IUCN: DD*

Bridge's coast shoulderband snail is a subspecies of *H. nickliniana*. This snail is not too different in appearance from the common garden snail, but has a golden-brown shell encirecled by a single, neat dark brown band (Arnold 2003). This species is distinguished from other subspecies by having a relatively large, depressed-globose shell (Arnold 2003).

This shoulderband snail ranges widely over Contra Costa and northern Alameda Counties and is most often found under rocks or woody debris or in accumulations of leaf mold.

There are no observations of this species within 5 miles of the project site. In addition, this species is most often associated with woody debris or accumulations of leaf mold and under

rocks (EDAW 2008), which are not found on this project site. Therefore, this site is unlikely to support this species.

Obscure bumble bee (*Bombus caliginosus*) Special Animal

The obscure bumble bee is also known, probably more properly, as the fog belt bumble bee and is uncommon throughout its range. It is mainly restricted to cooler or fog belt climates, especially near the southern end of its range and is not found at drier, interior sites. Nesting occurs underground as well as above ground in abandoned bird nests (Hatfield 2015). There is evidence suggesting that *B. caliginosus* does not do well in urban areas and that it is out competed by the common bumble bee (*B. vosnesenskii)* which can be very abundant in urban habitats.

According to the CNDDB, there are two occurrences of this species within 5 miles of the project site. One occurrence (#116) is located directly north of the project just under 5 miles from the site. However, it is a historic occurrence from a 1956 collection that was mapped in the general vicinity of Lafayette. The other observation (#117) is located approximately two miles west of the site and was from historic collections that were made between 1940 and 1952 and were mapped in the general vicinity of Redwood Regional Park.

Though there are two observations of this species within 5 miles, both are from historic collections and there are no recent collections or observations of this species within the region. In addition, the species is generally coastally restricted and the property does not provide a great diversity of flowering plants for food given that it is dominated by non-native grassland vegetation. Therefore, due to the lack of recent observations and the marginal nature of the habitat, the site is unlikely to support this species.

2. Plants

A total 61 special status plant species occur in the nine USGS quadrangles that surround the project site. These species are described in Table 2 along with their regulatory status, habitat requirements, and an evaluation of their potential to occur on the site. The majority of the species are highly unlikely to occur onsite because they are out of the range of the species or due to the lack of suitable habitat onsite or the lack of local occurrences.

Of the remaining special status species now occurring in the project region, none have been observed within the project site boundaries. The following species have not been seen but have at least some likelihood to occur on-site given the presence of potentially suitable habitat and known occurrences in the surrounding area.

Scientific name	Common name	Status	Habitat	Potential habitat on-site	Range	Known Range	Elevation	Life Form	Potential for Occurrence On-site	Flowering/ Survey Period
Amsinckia lunaris	bent-flowered fiddleneck	CRPR 1B.2	Cismontane woodland, Valley & foothill grassland	Yes	Alameda, Contra Costa, Colusa, Lake, Marin, Napa, San Benito, Santa Clara, Santa Cruz, San Mateo, Sonoma, Yolo	Yes	3-500 meters	annual herb	Unlikely: not observed during surveys	March - June
Anomobryum julaceum	slender silver moss	CRPR 4.2	Broadleaved upland forest, Lower montane coniferous forest, North coast coniferous forest	No	Butte, Contra Costa, Humboldt, Los Angeles, Mariposa, Santa Barbara, Santa Cruz, Shasta, Sonoma	Yes	100-1000 meters	moss	None: no habitat	N/A
Arctostaphylos auriculata	Mt. Diablo manzanita	CRPR 1B.3	Chaparral, Cismontane woodland	No	Contra Costa	Yes	135-650 meters	perennial evergreen shrub	None: no habitat	January - March
Arctostaphylos manzanita ssp. laevigata	Contra Costa manzanita	CRPR 1B.2	Chaparral	No	Contra Costa	Yes	430 - 1100 meters	perennial evergreen shrub	None: no habtat	January - April
Arctostaphylos pallida	pallid manzanita	FT, SE, CRPR 1B.1	Broadleaved upland forest, Chaparral, Cismontane woodland, Closed-cone coniferous forest, Coastal scrub	No	Alameda, Contra Costa	Yes	185 - 465 meters	perennial evergreen shrub	None: no habitat	December - March
Astragalus tener var. tener	alkali milk-vetch	CRPR 1B.2	Alkali playa, Valley & foothill grassland, Vernal pool, Wetland	Marginal	Alameda, Contra Costa, Merced, Monterey, Napa, San Benito, Santa Clara, San Francisco, San Joaquin, Solano, Sonoma, Stanslaus, Yolo	Yes	1 - 60 meters	annual herb	Unlikely: Marginal habitat, not observed during surveys	March - June
Balsamorhiza macrolepis	big-scale balsamroot	CRPR 1B.2	Chaparral, Cismontane woodland, Ultramafic, Valley & foothill grassland	Yes	Alameda, Amador, Butte, Colusa, El Dorado, Lake, Mariposa, Napa, Placer, Santa Clara, Shasta, Solano, Sonoma, Tehama, Tuolumne	No	90 -1555 meters	perennial herb	None: out of range	March - June
Blepharizonia plumosa	big tarplant	CRPR 1B.1	Valley & foothill grassland	Yes	Alameda, Contra Costa, San Joaquin, Solano, Stanislaus	Yes	30 - 505 meters	annual herb	Potential: Fall survey needed to confirm presence/ absence	July - October
California macrophylla	round-leaved filaree	CRPR 1B.2	Cismontane woodland, Valley & foothill grassland	Yes	Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kings, Kern, Los Angeles, Merced, Monterey, Napa, Riverside, Sant Barbara, San Benito, Santa Clara, Santa Catalina Island, Santa Cruz	Yes	15 - 1200 meters	annual herb	Unlikely: not observed during surveys	March - May
Calochortus pulchellus	Mt. Diablo fairy-lantern	CRPR 1B.2	Chaparral, Cismontane woodland, Riparian woodland, Valley & foothill grassland	Yes	Alameda, Contra Costa, Solano	Yes	30-840 meters	perennial bulbiferous herb	Unlikely: not observed during surveys	April - June
Campanula exigua	chaparral harebell	CRPR 1B.2	Chaparral, Ultramafic	No	Alameda, Contra Costa, Merced, San Benito, Santa Clara, Stanislaus	Yes	275 - 1250 meters	annual herb	None: no habitat	May - June

Centromadia parryi ssp. congdonii	Congdon's tarplant	CRPR 1B.1	Valley & foothill grassland	Yes	Alameda, Contra Costa, Monterey, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo, Solano	Yes	0 - 230 meters	annual herb	Potential: Fall survey needed to confirm presence/ absence	May - November
Chloropyron maritimum ssp. palustre	Point Reyes salty bird's-beak	CRPR 1B.2	Marsh & swamp, Salt marsh, Wetland	No	Alameda, Humboldt, Marin, Santa Clara, San Francisco, San Mateo, Sonoma	No	0 - 10 meters	hemiparasitic annual herb	None: no habitat and out of range	June - October
Chorizanthe robusta var. robusta	robust spineflower	FE, CRPR 1B.1	Cismontane woodland, Coastal bluff scrub, Coastal dunes	No	Alameda, Monterey, Marin, Santa Clara, Santa Cruz, San Francisco, San Mateo	No	3 - 300 meters	annual herb	None: no habitat and out of range	April - September
Cicuta maculata var. bolanderi	Bolander's water-hemlock	CRPR 2B.1	Marsh & swamp, Salt marsh, Wetland	No	Contra Costa, Los Angeles, Marin, Sacramento, Santa Barbara, San Luis Obispo, Solano	Yes	0 - 200 meters	perennial herb	None: no habitat	July - September
Cirsium andrewsii	Franciscan thistle	CRPR 1B.2	Broadleaved upland forest, Coastal bluff scrub, Coastal prairie, Coastal scrub, Ultramafic	Marginal	Contra Costa, Marin, San Francisco, San Mateo, Sonoma	Yes	0 - 150 meters	perennial herb	Unlikely: marinal habitat, would have been observed during surveys	March - July
Clarkia concinna ssp. automixa	Santa Clara red ribbons	CRPR 4.3	Chaparral, Cismontane woodland	No	Alameda, Santa Clara, Santa Cruz	No	90 - 1500 meters	annual herb	None: no habitat	April - July
Clarkia franciscana	Presidio clarkia	FE, SE, CRPR 1B.1	Coastal scrub, Ultramafic, Valley & foothill grassland	Yes	Alameda, San Francisco	No	25 - 335 meters	annual herb	None: out of range	May - July
Cordylanthus nidularius	Mt. Diablo bird's-beak	CNPPA: Rare, CRPR 1B.1	Chaparral, Ultramafic	No	Contra Costa	Yes	600 - 800 meters	hemiparasitic annual herb	None: no habitat	June - August
Delphinium californicum ssp. interius	Hospital Canyon larkspur	CRPR 1B.2	Chaparral, Cismontane woodland, Coastal scrub, Meadow & seep	Marginal	Alameda, Contra Costa, Merced, Monterey, San Benito, Santa Clara, San Joaquin, Stanislaus	Yes	195 - 1095 meters	perennial herb	unlikely: Marginal habitat, would have been observed during surveyes	April - June
Dichondra donelliana	California pony's foot	A1	Open slopes and moist fields	Yes	Coastal northern California, SF Bay area, Trinity Mountains	Yes	unknown	perennial herb	Observed	January-March
Dirca occidentalis	western leatherwood	CRPR 1B.2	Broadleaved upland forest, Chaparral, Cismontane woodland, Closed-cone coniferous forest, North coast coniferous forest, Riparian forest,	No	Alameda, Contra Costa, Marin, Santa Clara, San Mateo, Sonoma	Yes	25 - 425 meters	perennial deciduous shrub	None: No habitat	January - April
Eriastrum ertterae	Lime Ridge eriastrum	CRPR 1B.1	Chaparral	No	Contra Costa	Yes	200 - 290 meters	annual herb	None: no habitat	June - July

Eriogonum luteolum var. caninum	Tiburon buckwheat	CRPR 1B.2	Chaparral, Cismontane woodland, Coastal prairie, Ultramafic, Valley & foothill grassland	Marginal	Alameda, Contra Costa, Solano	Yes	3 - 250 meters	annual herb	Unlikely: Fall survey will confirm presence/ absence	April - December
Eriogonum truncatum	Mt. Diablo buckwheat	CRPR 1B.1	Chaparral, Coastal scrub, Valley & foothill grassland	Marginal	Alameda, Contra Costa, Solano	Yes	3 - 350 meters	annual herb	Unlikely: Fall survey will confirm presence/ absence	April - December
Atriplex joaquinana	San Joaquin spearscale	CRPR 1B.2	Alkali playa, Chenopod scrub, Meadow & seep, Valley & foothill grassland	Marginal	Alameda, Contra Costa, Colusa, Glenn, Merced, Monterey, Napa, San Benito, Santa Clara, San Joaquin, San Luis Obispo	Yes	1 - 835 meters	annual herb	Unlikely: Fall survey will confirm presence/ absence	April - October
Fissidens pauperculus	minute pocket moss	CRPR 1B.2	North coast coniferous forest, Redwood	No	Alameda, Butte, Del Norte, Humboldt, Mendocino, Marin, Santa Cruz, San Mateo, Sonoma, Yuba	No	10 - 1024 meters	moss	None: no habitat and out of range	N/A
Fritillaria liliacea	fragrant fritillary	CRPR 1B.2	Coastal prairie, Coastal scrub, Ultramafic, Valley & foothill grassland	Yes	Alameda, Contra Costa, Monterey, Marin, San Benito, Santa Clara, San Francisco, San Mateo, Solano, Sonoma	Yes	3 - 410 meters	perennial bulbiferous herb	Unlikely: would have been observed during surveys; no obs within 5 miles	February - April
Grimmia torenii	Toren's grimmia	CRPR 1B.3	Chaparral, Cismontane woodland, Limestone, Lower montane coniferous forest	No	Contra Costa, Colusa, Lake, Mendocino, Monterey, Santa Cruz, San Mateo	Yes	325 - 1160 meters	moss	None: No habitat	N/A
Helianthella castanea	Diablo helianthella	CRPR 1B.2	Broadleaved upland forest, Chaparral, Cismontane woodland, Coastal scrub, Valley & foothill grassland	Marginal	Alameda, Contra Costa, Marin, San Francisco, San Mateo	Yes	60 - 130 meters	perennial herb	unlikely: Marginal habitat, would have been observed during surveyes	March - June
Hesperolinon breweri	Brewer's western flax	CRPR 1B.2	Chaparral, Cismontane woodland, Ultramafic (serpentine), Valley & foothill grassland	Marginal	Contra Costa, Napa, Solano	Yes	30 - 945 meters	annual herb	Unlikely: Marginal habitat, would likely have been observed during the April botanical survey if present, no obs within 5 miles	May - July
Hoita strobilina	Loma Prieta hoita	CRPR 1B.1	Chaparral, Cismontane woodland, Riparian woodland, Ultramafic	No	Alameda, Contra Costa, Santa Clara, Santa Cruz	Yes	30 - 860 meters	perennial herb	None: no habitat	May - October

Holocarpha macradenia	Santa Cruz tarplant	FT, SE, CRPR 1B.1	Coastal prairie, Coastal scrub, Valley & foothill grassland	Yes	Alameda, Contra Costa, Monterey, Marin , Santa Cruz, Solano	Yes	10 - 220 meters	annual herb	Potential: Fall survey needed to confirm presence/ absence	June - October
Horkelia cuneata var. sericea	Kellogg's horkelia	CRPR 1B.1	Chaparral, Closed-cone coniferous forest, Coastal dunes, Coastal scrub	No	Alameda, Contra Costa, Monterey, Marin , Santa Barbara, Santa Cruz, San Francisco, San Luis Obispo, San Mateo	Yes	10 -200 meters	perennial herb	None: no habitat	April - September
Isocoma arguta	Carquinez goldenbush	CRPR 1B.1	Valley & foothill grassland	Yes	Solano	No	1 - 20 meters	perennial shrub	None: out of range	August - December
Juglans hindsii	Northern California black walnut	CRPR 1B.1	Riparian forest, Riparian woodland	No	Contra Costa, Lake, Napa, Sacramento, Solano, Yolo	Yes	0 - 440 meters	perennial deciduous tree	None: no habitat	April - May
Lasthenia conjugens	Contra Costa goldfields	FE, CRPR 1B.1	Alkali playa, Cismontane woodland, Valley & foothill grassland, Vernal pool, Wetland	Marginal	Alameda, Contra Costa, Mendocino, Monterey, Marin , Napa, Santa Barbara, Santa Clara, Solano, Sonoma	Yes	0 - 470 meters	annual herb	possible	March - June
Leptosiphon acicularis	bristly leptosiphon	CRPR 4.2	CHAPARRAL, CISMONTANE WOODLAND, COASTAL PRAIRIE, VALLEY AND FOOTHILL GRASSLAND.	Marginal	Alameda, Butte, Colusa, Humboldt, Lake, Mendocino, Marin, Napa, San Benito, Santa Clara, San Mateo, and Sonoma Counties	No	55-1,500 meters	annual herb	None: Not documented in County	April-July
Madia radiata	showy golden madia	CRPR 1B.1	Chenopod scrub, Cismontane woodland, Valley & foothill grassland	Yes	Contra Costa, Fresno, Kings, Kern, Monterey, Santa Barbara, San Benito, Santa Clara, San Joaquin, San Luis Obispo, Stanislaus	Yes	25 - 1215 meters	annual herb	possible	March - May
Malacothamnus hallii	Hall's bush-mallow	CRPR 1B.2	Chaparral, Coastal scrub, Ultramafic	No	Contra Costa, Merced, Santa Clara, San Mateo, Stanislaus	Yes	10 - 760 meters	perennial evergreen shrub	None: no habitat	May - October
Meconella oregana	Oregon meconella	CRPR 1B.1	Coastal prairie, Coastal scrub	Marginal	Contra Costa, Santa Clara	Yes	250 - 620 meters	annual herb	unlikely: Marginal habitat, would have been observed during surveyes	March - April
Monolopia gracilens	woodland woollythreads	CRPR 1B.2	Broadleaved upland forest, Chaparral, Cismontane woodland, North coast coniferous forest, Ultramafic, Valley & foothill grassland	Marginal	Alameda, Contra Costa, Monterey, San Benito, Santa Clara, Santa Cruz, San Luis Obispo, San Mateo	Yes	100 - 1200 meters	annual herb	unlikely: Marginal habitat, would have been observed during surveyes	February - July
Navarretia gowenii	Lime Ridge navarretia	CRPR 1B.1	Chaparral	No	Contra Costa, Stanislaus	Yes	180 - 305 meters	annual herb	None: no habitat	May - June
Navarretia nigelliformis ssp. radians	shining navarretia	CRPR 1B.2	Cismontane woodland, Valley & foothill grassland, Vernal pool, Wetland	Yes	Alameda, Contra Costa, Colusa, Fresno, Madera, Merced, Monterey, San Benito, San Joaquin, San Luis Obispo	Yes	76 - 1000 meters	annual herb	Unlikely: not observed during surveys, no obs within 5 miles	April - July

Oenothera deltoides ssp. howellii	Antioch Dunes evening-primrose	FE, SE, CRPR 1B.1	Interior dunes	No	Contra Costa, Sacramento	Yes	0 - 30 meters	perennial herb	None: No habitat	March - September
Phacelia phacelioides	Mt. Diablo phacelia	CRPR 1B.2	Chaparral, Cismontane woodland, Ultramafic	No	Contra Costa, San Benito, Santa Clara, Stanislaus	Yes	500 - 1370 meters	annual herb	None: no habitat	April - May
Plagiobothrys diffusus	San Francisco popcornflower	SE, CRPR 1B.1	Coastal prairie, Valley & foothill grassland	Yes	Alameda, San Benito, Santa Cruz, San Francisco, San Mateo	No	60 - 360 meters	annual herb	None: out of range	March - June
Plagiobothrys glaber	hairless popcornflower	CRPR 1A	Marsh & swamp, Salt marsh, Vernal pool, Wetland	Marginal	Alameda, Marin, San Benito, Santa Clara	No	15 - 180 meters	annual herb	None: out of range	March - May
Polemonium carneum	Oregon polemonium	CRPR 2B.2	Coastal prairie, Coastal scrub, Lower montane coniferous forest	Marginal	Alameda, Del Norte, Humboldt, Marin, San Francisco, Siskiyou, San Mateo, Sonoma	No	0 - 1830 meters	perennial herb	None: Out of range	April - September
Polygonum marinense	Marin knotweed	CRPR 3.1	Brackish marsh, Marsh & swamp, Salt marsh, Wetland	No	Alameda, Humboldt, Marin, Napa, Solano, Sonoma	No	0 - 10 meters	annual herb	None: No habitat and out of range	April - October
Sanicula maritima	adobe sanicle	CNPPA:Rare , CRPR 1B.1	Chaparral, Coastal prairie, Meadow & seep, Ultramafic, Valley & foothill grassland	Yes	Alameda, Monterey, San Francisco, San Luis Obispo	No	30 -240 meters	perennial herb	None: out of range	February - May
Sanicula saxatilis	rock sanicle	CNPPA:Rare , CRPR 1B.2	Broadleaved upland forest, Chaparral, Valley & foothill grassland	Marginal	Contra Costa, Santa Clara	Yes	620 - 1175 meters	perennial herb	Unlikely: marginal habitat, not observed during surveys, no obs within 5 miles	April - May
Senecio aphanactis	chaparral ragwort	CRPR 2B.2	Chaparral, Cismontane woodland, Coastal scrub	No	Alameda, Contra Costa, Fresno, Los Angeles, Merced, Monterey, Orange, Riverside, Santa Barbara, San Benito, Santa Clara, Santa Cruz, Santa Catalina Island, Santa Cruz Island, San Diego, San Luis Obispo	No	15 - 800 meters	annual herb	None: no habitat and out of range	January - April
Streptanthus albidus ssp. peramoenus	most beautiful jewelflower	CRPR 1B.2	Chaparral, Cismontane woodland, Ultramafic, Valley & foothill grassland	Marginal	Alameda, Contra Costa, Monterey, Santa Clara, San Luis Obispo	Yes	95 - 1000 meters	annual herb	Unlikely: Marginal habitat, not observed during surveys	March - October
Streptanthus hispidus	Mt. Diablo jewelflower	CRPR 1B.3	Chaparral, Valley & foothill grassland	Yes	Contra Costa	Yes	365 - 1200 meters	annual herb	Unlikely: not observed during surveys, no obs within 5 miles	March - June

Stuckenia filiformis ssp. alpina	slender-leaved pondweed	CRPR 2B.2	Marsh & swamp, Wetland	No	Alameda, Butte, Contra Costa, El Dorado, Lassen, Merced, Mono, Modoc, Mariposa, Nevada, Placer, Santa Clara, Shasta, Sierra, San Mateo, Solano, Sonoma	Yes	300 - 2150 meters	perennial rhizomatous herb	None: no habitat	May - July
Suaeda californica	California seablite	FE, CRPR 1B.1	Freshwater marsh, Marsh & swamp, Wetland	No	Alameda, Contra Costa, Santa Clara, San Francisco, San Luis Obispo	Yes	0 - 15 meters	perennial evergreen shrub	None: no habitat	July - October
Trifolium hydrophilum	saline clover	CRPR 1B.2	Marsh & swamp, Valley & foothill grassland, Vernal pool, Wetland	Marginal	Alameda, Contra Costa, Colusa Lake, Monterey, Napa, Sacramento, San Benito, Santa Clara, Santa Cruz, San Joaquin, San Luis Obispo, San Mateo, Solano, Sonoma, Yolo	Yes	0 - 300 meters	annual herb	NONE	April - June
Triquetrella californica	coastal triquetrella	CRPR 1B.2	Coastal bluff scrub, Coastal scrub	No	Contra Costa, Del Norte, Mendocino, Marin, San Diego, San Francisco, San Mateo, Sonoma	Yes	10 - 100 meters	moss	None: No habitat	N/A
Tropidocarpum capparideum	caper-fruited tropidocarpum	CRPR 1B.1	Valley & foothill grassland	Yes	Alameda, Contra Costa, Fresno, Glenn, Monterey, Santa Clara, San Joaquin, San Luis Obispo	Yes	1 - 455 meters	annual herb	Unlikely: not observed during surveys, no obs within 5 miles	March - April
Viburnum ellipticum	oval-leaved viburnum	CRPR 2B.3	Chaparral, Cismontane woodland, Lower montane coniferous forest	No	Alameda, Contra Costa, El Dorado, Fresno, Glenn, Humboldt, Lake, Mendocino, Mariposa, Napa, Placer, Shasta, Solano, Sonoma, Tehama	Yes	215 - 1400 meters	perennial deciduous shrub	None: No habitat	May - June

Bent-flowered fiddleneck (*Amsinkia lunaris*); CRPR 1B.2

This fiddleneck is a bristly annual herb about 18 inches tall at most. Like the other fiddlenecks, it has a coiled inflorescence of tubular orange flowers, except for the characteristic bend in the flower tube. The flowers are less than ½ inch long. This species is found in a number of habitats, including grasslands. It has been found from Humboldt to Monterrey Counties and within Contra Costa County at several locations. CNDDB lists eight occurrences for this species within five miles of the Site, several of which are within two miles (Occurrences 9 and 55, for example)

This species is found in grasslands and is known from within two miles of the site. However, this species was not observed during botanical surveys that carried out in January and April 2014, during its March through June blooming period. Therefore, this species is unlikely to occur onsite.

San Joaquin spearscale (*Atriplex joaquinana*); CRPR 1B.2

San Joaquin spearscale is an annual herb endemic to California and found in alkali sink scrub or alkaline grasslands. Its range is generally restricted to the south Sacramento Valley, San Joaquin Valley and the eastern slope of the inner South Coast Ranges (Hickman 1993). This species is found in meadows and seeps and valley and foothill grasslands throughout California. It occurs on clay soils, often in areas of high alkalinity. It occurs between 1 and 835 meters in elevation. San Joaquin spearscale commonly occurs with saltgrass (*Distichlis spicata*), iodinebush (*Allenrolfea occidentalis*), sea-blight (*Suaeda moquinii*), alkali heath (*Frankenia salina*), low barley (*Hordeum depressum*), sand-spurrey (*Spergularia macrotheca*), and various annual species.

San Joaquin spearscale is gray-green in color with sparsely scaled stems and leaves. It is between 1 and 3 feet in height (Baldwin et. al. 2012). It flowers from April through September.

The principal threat to San Joaquin spearscale has been the historic conversion of much of the alkali grassland to agriculture. Present threats include habitat conversion to urban use, overgrazing, and impacts associated with road and utility line construction and maintenance (CNDDB 2015).

The San Joaquin spearscale is usually found in mesic habitats or on the edges of mesic habitats in alkaline areas. The site does not contain any alkaline habitats. In addition, this species would likely have been observed during the April 2014 botanical survey. However, this species can mature later and therefore a fall botanical survey should be conducted to ensure that this species will not be impacted by the project. Mitigation measures will be required if this species is found within the proposed development area.

Big tarplant (*Blepharizonia plumosa*); CRPR 1B.1

Big tarplant is an annual herb in the Asteraceae family that is native and endemic to California. Big tarplant occurs in valley grassland, foothill woodland, and chaparral plant communities. It is found in the Central Coast Ranges and in the adjacent San Francisco Bay area and Central valey. It is extant in Alameda and Contra Costa counties but is believed extirpated in San Joaquin, Stanislaus and Solano counties (CNPS 2015). Dominant species co-occurring with big tarplant include the non-native species Italian ryegrass (*Lolium multiflorum*), soft chess (*Bromus hordeaceus*), yellow star thistle (*Centaurea solstitialis*), ripgut brome (*Bromus diandrus*) and wild oats (*Avena fatua*) (CDFW 2015). It occurs at elevations between 5 and 470 meters.

This species may grow up to six feet tall. The leaves are gray-green, densely pilose and crowded at the base, almost forming a rosette. They are 5.1 to 12.7 cm long and 1 cm wide with serrate to entire margins. Flower heads are large, an inch or more across, and made up of showy white ray flowers with reddish-purple veins on back. Flowers appear from July through October (Baldwin et. al. 2012). The plants are glandular and aromatic.

The project site is likely too disturbed to contain this species. However, a fall botanical survey should be conducted during its blooming period to ensure that this species will not be impacted by the project. Mitigation measures will be required if this species is found within the proposed development area.

Round-leaved filaree *[California macrophylla] (Erodium macrophyllum*); CRPR 1B.1 / *A2

This species is a storks-bill or fillaree that is found almost entirely in somewhat mesic clay soils in woodlands and grasslands. There is one CNDDB occurrence record of round-leaved filaree about nearly 3 miles west of the Site (Occurrence #52) but this sighting is from 1891 (described as "possibly extirpated").

This species is found in similar habitats just under 3 miles from the site. However, this species was not observed during botanical surveys that carried out in January and April 2014, during its March through May blooming period. Therefore, this species is unlikely to occur onsite.

Mt Diablo fairy-lantern (*Calochortus pulchellus*); CRPR 1B.2

Fairy lanterns (or Mariposa lilies) are erect, perennial herbs with often-striking globular flowers. This species grows about 10 inches tall and has a nodding, typically solitary flower, usually pale yellow in color. It is found in shrub- and woodlands around Mt Diablo and

occasionally elsewhere. It is found in valley grassland, foothill woodland, and chaparral plant communities between the elevations of 70 and 780 meters.

This species is a bulb that emerges to bloom in the spring from July to October. It has yellow globe-shaped flowers that appear solitary or in a cluster, consisting of three sepals and three petals. The sepals are usually greenish and "cup" the petals. The flowers are scented, globe-shaped, hermaphrodite, and are pollinated by insects. The fruit is a winged capsule 2 to 3 centimeters in length. The plant may grow up to 1 meter high. It prefers sandy loam soil with a pH ranging from acid to alkaline and partial to full sun with little to moderate amounts of moisture.

CNDDB has one sighting from about four miles to the northeast of the Site (Occurrence 28) from 1989 in Las Trampas Regional Park. However, this species was not observed during botanical surveys that carried out in January and April 2014, during its March through May blooming period. Therefore, this species is unlikely to occur onsite.

Congdon's tarplant (*Centromadia parryi ssp. congdonii*); CRPR 1B.1

Congdon's tarplant is an annual herb in the Asteraceae family that is native and endemic to California. The species is found in valley and foothill grassland in semi-alkaline heavy clay soils on level valley floors. It occurs in six counties within the Sacramento Valley and inner North Coast ranges including Lake, Napa, Colusa, Glenn, Butte, Solano and Sonoma county.

The plant is prostrate to erect with branches bearing long straight hairs, shorter hairs with yellow glands, and stiff spine-like leaves. The flowers are yellow and daisy-like in appearance with ray and disk flowers. They do not age to red or orange like other subspecies of *Centomadia parryi*. It blooms from May to November.

The main threat to this species is development. It has been almost completely replaced by urbanization in coastal central California, and competition from invasive exotic weeds may also have contributed to its current near extinction (Baldwin et. al. 2012).

The project site is likely too disturbed to contain this species. However, a fall botanical survey should be conducted during its blooming period to ensure that this species will not be impacted by the project. Mitigation measures will be required if this species is found within the proposed development area.

California Pony's foot (*Dichondra donelliana*); A1

Dichondra donelliana, or California pony's foot, is a member of convovulaceae family. Similar to others in its family, *D. donelliana* is a low-growing herb that spreads from stolons into dense clusters. It has concave oval leaves, 1.5 – 2.5 cm wide, that are covered in soft hairs

(Baldwin et. al. 2012). It blooms from January to March and it has tiny white flowers (2-3mm). It grows on open slopes and moist fields. It is known to exist on the coast of northern California, the San Francisco Bay area, and the Trinity mountains.

This species was observed on the property in the vicinity of the northwest facing ridge slope outside of the proposed project development area. Therefore, the project is not likely to impact this species. However, the exact location and population of this species was not mapped or enumerated. Therefore, mapping for this species will take place in the spring during its blooming period and mitigation measures will be required if this species is found within the proposed development area.

Tiburon buckwheat (*Eriogonum luteolum* var. *caninum*); CRPR 1B.2

This species is confined to serpentine grasslands and chaparral. CNDDB has two sightings from within five miles of the Site about four miles to the southwest in Oakland, both from serpentine outcrops in grasslands.

The habitat for this species is very marginal. In addition, this species would likely have been observed during the April 2014 botanical survey. However, this species can mature later and therefore a fall botanical survey should be conducted to ensure that this species will not be impacted by the project. Mitigation measures will be required if this species is found within the proposed development area.

Mount Diablo buckwheat (Eriogonum truncatum) CRPR 1B.1

The Mount Diablo buckwheat is an annual herb that is native and endemic to California. It inhabits sandy soils or barren clay spots of chaparral, coastal scrub and valley and foothill grassland habitats. It is found on dry slopes at 300-600 m elevation.

The species is10-70 cm in height, with white to rose colored flowers from mid-April to May (although records show April to December, with May most common).

Mt Diablo buckwheat was thought to be extinct since 1936, but was rediscovered in 2005 in a remote corner of Mt. Diablo State Park. It is thought that competition by introduced non-native plants is responsible for its rarity. In recent years, its historic habitat has been threatened by development pressure (CNPS 2015).

The habitat for this species is marginal. In addition, this species would likely have been observed during the April 2014 botanical survey. However, this species can mature later and therefore a fall botanical survey should be conducted to ensure that this species will not be impacted by the project. Mitigation measures will be required if this species is found within the proposed development area.

Diablo helianthella (*Helianthella castanea*); CRPR 1B.2

Diablo helianthella is a member of the sunflower family with bright yellow flowers that occurs in chaparral and woodland and occasionally grasslands, often in partial shade. According to the CNDDB, there numerous observations of this species within two to five miles of the site, generally to the east of the site in the Las Trampas wilderness and environs.

This species is not likely to occur at the site as it is more commonly found in wood- and shrublands. As well, it's a relatively robust plant and its remnants would probably have been observable during the late fall surveys. In addition, this plant would have been observed during botanical surveys that took place during its March through June blooming period.

Santa Cruz tarplant (*Holocarpha macradenia*); FT, SE, CRPR 1B.1

Santa Cruz tarplant is an annual herb in the Asteraceae family. The species is found in coastal prairie habitats on marine terraces flanking the northern Monterey Bay (and, formerly, around the outer San Francisco Bay) as well as coastal scrub and valley and foothill grasslands. It is extant only in central California in Monterey and Santa Cruz counties and has been extirpated from Alameda, Marin, and Sonoma Counties; the species is found in Contra Costa County only in introduced populations on East Bay Regional Parks property. Remaining natural populations of Santa Cruz tarplant in the San Francisco Bay area were extirpated in 1990s and persist there only as artificially seeded occurrences in Wildcat Canyon Regional Park (Havlik 1987). Since the 1970s, several populations have become extirpated in Santa Cruz County (Palmer 1987) and most others have declined significantly.

Santa Cruz Tarweed is distinguished from other members of its genus by possessing eight to sixteen three-lobed outer ray flowers and 40 to 90 central disk flowers, more than any of the related species. The flowers are situated in dense clusters at the branch tips or along the branch on a very short stem. Its flowering period is from June to November (CNPS 2007, Havlik 1987).

The species is known to tolerate grazing and to decline in pastures where grazing is discontinued, allowing weedy exotics to create a tall overstory that inhibits growth of the lower statured tarplant and other low herbs (Hayes and Holl 2002). A population at the Watsonville Airport, with a mowing regime that simulates grazing, has supported between 400,000 to as many as 27 million plants, fluctuating in relation to rainfall; the site is vulnerable to development.

The project site is likely too disturbed to contain this species. However, a fall botanical survey should be conducted during its blooming period to ensure that this species will not be

impacted by the project. Mitigation measures will be required if this species is found within the proposed development area.

Oregon meconella (*Meconella oregana*); CRPR 1B.1

This small annual herb (also called the white fairy poppy) is found in moist, typically rocky areas in chaparral and grasslands.

Oregon meconella is an annual in the Papaveraceae family that is native to California. It is known from Washington, Oregon and Santa Clara and Contra Costa Counties in California. It occurs primarily in coastal prairie and coastal scrub habitats on gradual to almost 100% slopes from 100 to 450 feet in elevation. The species is found in areas that are wet to moist in spring, but dry out by early summer.

Oregon meconella grows from 2 to 16 centimeters tall with a simple or sparingly branched stem. The basal leaves are spatula-like, entire, and in a rosette. It has single white flowers with six petals and three sepals, emerging from within the axils or terminally. The species has a very short blooming period, which varies, depending on the year, from late March to early April (Baldwin et. al. 2012).

Fire probably played a role historically in maintenance of the habitat both in terms of reducing tree and shrub invasion of its habitat and in terms of expansion and growth of competing grasses and forbs. As an annual, the species probably responds to winter/spring moisture and temperature patterns, but likely faces serious competition from weedy annuals. The proliferation of weedy species poses a significant threat to this species. Recreational use of some sites may also contribute to habitat degradation via soil compaction. Grazing and localized changes in hydrology are also a potential threat (Pojar and MacKinnon 1994).

CNDDB has one occurrence about five miles northwest of the Site near the Sibley Preserve. However, this species was not observed during botanical surveys that carried out in January and April 2014, during its March through April blooming period. Therefore, this species is unlikely to occur onsite.

Woodland woolythreads (*Monolopia graciliens*); CRPR 1B.2

Woodland woolythreads, also known as the woodland monolopia, is an erect herb, somewhat tall (to 32 inches) with a yellow flower head that resembles an aster. It is found scattered through the Bay Area and the mountains to the south. CNDDB has one occurrence nearby, about two miles southwest from the Oakland hills but the record location is very vague.

This species could occur on-site as its native habitat includes grasslands (although it prefers woodlands) and it does occur nearby. However, Site surveys were too late in the year to identify it if it does occur.

This species is found in grasslands and is known from approximately two miles southwest of the site. However, this species was not observed during botanical surveys that carried out in January and April 2014, during its February through July blooming period. Therefore, this species is unlikely to occur onsite.

Most beautiful jewelflower (*Streptanthus albidus* ssp. *peramoenus*); CRPR 1B.2

This subspecies is found primarily in serpentine grassland around parts of the Bay Area.

The most beautiful jewelflower grows on thin stalks up to 4 feet long, with spear-like leaves and small purple to pale pink flowers along the end of the stalk. It is endemic to California and has two main population centers; In the East Bay from Contra Costa to Santa Clara County, and along the southern coast in Monterey and San Luis Obispo Counties (CNPS 2015). Similar to the Chaparral Harebell, the most beautiful jewelflower is found primarily on serpentine soils in chaparral or grassland habitats. It blooms from April to September (Ihsan 2014)

CNDDB has four sightings from within five miles of the Site, mostly to the southwest in the serpentine outcrops in the Oakland hills.

This species is not likely to occur on-site as there is only very marginal habitat on the site and it has not been observed near the Site. In addition, this species was not observed during botanical surveys that carried out in January and April 2014, during its March through October blooming period. Therefore, this species is unlikely to occur onsite.

3. Wildlife Movement Corridors

Wildlife corridors are generally described as pathways or habitat linkages that connect discrete areas of natural open space otherwise separated or fragmented by topography, changes in vegetation, and other natural or human induced factors such as urbanization. The fragmentation of natural habitat creates isolated "islands" of vegetation that may not provide sufficient area or resources to accommodate sustainable populations for a number of species and thus, adversely affecting both genetic and species diversity. Corridors often partially or largely eliminate the adverse effects of fragmentation by 1) allowing animals to move between remaining habitats to replenish depleted populations and increase the gene pool available; 2) providing escape routes from fire, predators, and human disturbances, thus reducing the risk that catastrophic events (such as fire or disease) will result in population or species extinction; and 3) serving as travel paths for individual animals moving throughout

their home range in search of food, water, mates, and other needs, or for dispersing juveniles in search of new home ranges.

The property is really not subject to wildlife movement corridors as the property lies adjacent to established residential communities to the west and the north, which block wildlife movement. Therefore, the primary east-west movement corridor likely occurs beginning approximately 0.5 miles south of the site and northern and southern habitats and movement corridors can also be accessed.

C. WETLANDS AND OTHER SENSITIVE HABITATS

1. Wetlands and Waters of the State/U.S.

"Wetlands" are areas periodically or permanently saturated by surface or groundwater and typically support vegetation adapted to life in saturated (hydric) soil. Wetlands are recognized as important features on a regional and national level due to their high inherent value to fish and wildlife, use as storage areas for storm and floodwaters, promotion of groundwater recharge, and their water filtration and purification functions. Waters of the State/U.S. are typically streams and other waterways that hold flowing water or pond but do not have a predominance of wetland vegetation.

Technical standards for delineating wetlands have been developed by the Corps in its Wetlands Delineation Manual (Army Corps of Engineers, Environmental Laboratory, Technical Report Y-87-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Miss., 1987 ["Delineation Manual"]) and adopted by many local agencies. The upland boundary of Waters of the State/U.S. is defined by the "ordinary high water mark" (OHWM), a line on the stream or channel marked by a topographic change or other feature.

Wetlands are defined by the Corps Section 404 regulations as: "Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions". Thus to be designated a wetland according to Corps regulation, a site must have a predominance of hydrophytic vegetation, evidence of hydric soils, and wetland hydrology under normal circumstances.

Other waters are defined based on water elevations and geomorphic features. In freshwater conditions, the boundary between uplands and other waters is the ordinary high water mark, which is roughly equivalent to the mean annual flood line. In tidal conditions, the boundary is set by the high tide line, roughly equivalent to mean high water.

A jurisdictional wetlands and waters delineation has been completed on the project site and was verified by the US Army Corps of Engineers on September 11, 2015. The majority of the site is uplands, composed primarily of non-native annual grasslands. The jurisdictional areas

on the property total 0.11 acres including 0.092 acres of seasonal wetlands and 0.018 acres of other waters (**Figures 6a, 6b, and 6c**).

Two small drainages lie near the western edge of the site. These sparsely vegetated and eroded channels carry ephemeral runoff into an existing concrete V-ditch, which eventually drain into Moraga Creek. The little vegetation that is found within these channels is primarily upland grasses and therefore, these features are not wetlands.

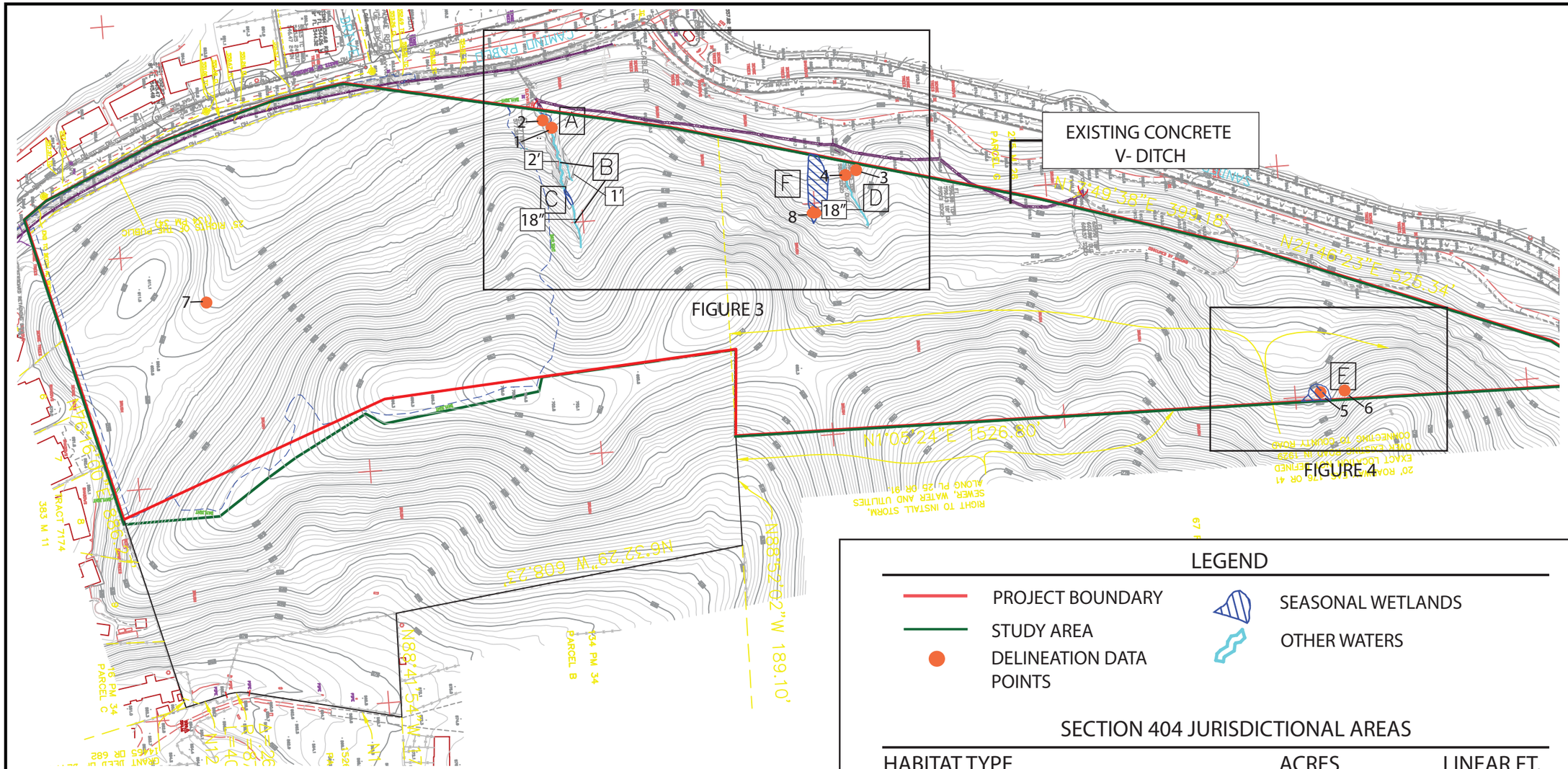
A total of four small seasonal wetlands occur on the property. These occur in very small areas within or at the base of the eroded drainages or as seeps on the side of the west-facing slopes. Vegetation in both these types of areas was dominated by facultative or marginally hydrophytic vegetation. This type of vegetation is consistent with areas that only pond sporadically and drain relatively quickly.

2. Other Special Status Habitats

A total of four special status habitats are known from the region. These habitats include:

1. Serpentine bunchgrass
2. Valley needlegrass grassland
3. Northern Coastal Salt Marsh
4. Northern Maritime Chaparral

None of these habitats are present on the project site. There is no serpentine geology associated with the property and no chaparral vegetation found on the property. While there is a scattering of needlegrass and other native forbs, there are neither enough of them nor are they found in a high enough density on the property to qualify as a special status species habitat. Northern coastal salt marsh is primarily found around the margins of the San Francisco Bay and is characterized by pickleweed (*Salicornia pacifica*), which is not found on the property.



DISCLAIMER: SECTION 404 JURISDICTIONAL MAP

This map exhibits conditions on the site at the time of completion of the delineation. For various reasons, conditions on a site may change, which may affect site wetlandboundaries. Delineation maps generally expire five years after approval by the U.S. ArmyCorps of Engineers (Corps). Because regulations governing delineations are subject to change, this map should be reviewed by a qualified wetland consultant to ensure accuracy if not submitted to the Corps within six (6) months of preparation.

Field Work By: Zentner and Zentner, 04.14.2014, 02.10.2015, 04.02.2015

LEGEND

- PROJECT BOUNDARY
- STUDY AREA
- DELINEATION DATA POINTS
- SEASONAL WETLANDS
- OTHER WATERS

SECTION 404 JURISDICTIONAL AREAS

HABITAT TYPE	ACRES	LINEAR FT.
A. Seasonal Wetlands	0.005	
B. Other Waters	0.012	273.96
C. Seasonal Wetlands	0.003	
D. Other Waters	0.006	121.11
E. Seasonal Wetlands	0.014	
F. Seasonal Wetlands	0.07	

TOTALS	ACRES	LINEAR FT.
Other Waters	0.018	395.07
Seasonal Wetlands	0.092	

TOTAL JURISDICTIONAL AREAS	ACRES	LINEAR FT.
	0.11	395.07

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Land Planning and Restoration
95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 ax: 510.622.8116

FIGURE 6a
JURISDICTIONAL DELINEATION MAP

REVISIONS:	BY:
2.26.15	NBB
03.06.15	NBB
04.02.15	NBB

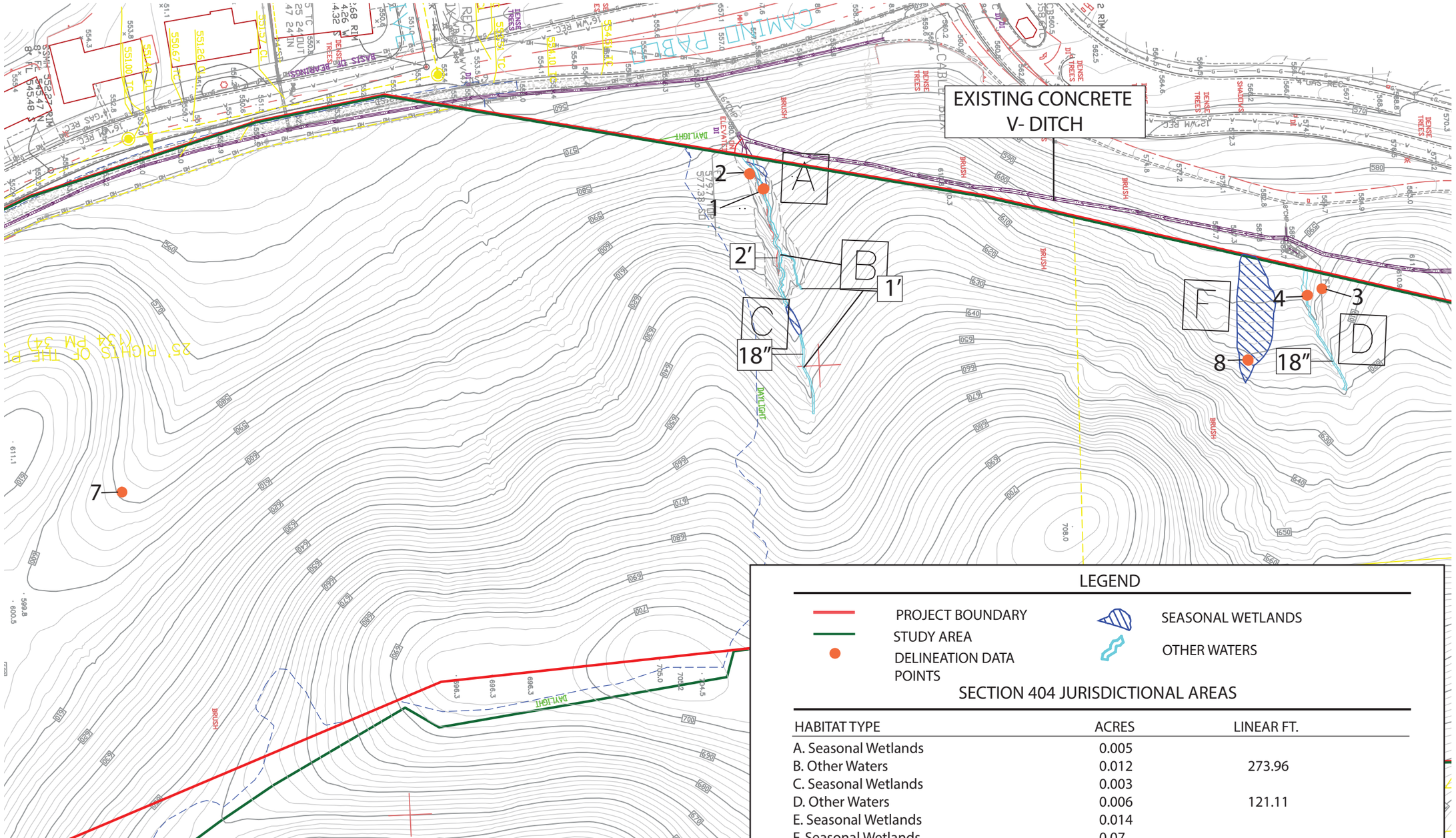
1211 CAMINO PABLO
MORAGA, CA
94556

North
0 100' 200'
SCALE: 1" = 200'

SOURCE: dK CONSULTING
WALNUT CREEK, CA

FILE: D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\Adobe 1004 New Fig 2_ Jurisdictional Delineation_03.06.2015

DATE: 04.02.15
PROJECT : 1004 DPL



LEGEND

- PROJECT BOUNDARY
- STUDY AREA
- DELINEATION DATA POINTS
- SEASONAL WETLANDS
- OTHER WATERS

SECTION 404 JURISDICTIONAL AREAS

HABITAT TYPE	ACRES	LINEAR FT.
A. Seasonal Wetlands	0.005	
B. Other Waters	0.012	273.96
C. Seasonal Wetlands	0.003	
D. Other Waters	0.006	121.11
E. Seasonal Wetlands	0.014	
F. Seasonal Wetlands	0.07	

TOTALS	ACRES	LINEAR FT.
Other Waters	0.018	395.07
Seasonal Wetlands	0.092	

TOTAL JURISDICTIONAL AREAS	ACRES	LINEAR FT.
	0.11	395.07

DISCLAIMER: SECTION 404 JURISDICTIONAL MAP

This map exhibits conditions on the site at the time of completion of the delineation. For various reasons, conditions on a site may change, which may affect site wetlandboundaries. Delineation maps generally expire five years after approval by the U.S. Army Corps of Engineers (Corps). Because regulations governing delineations are subject to change, this map should be reviewed by a qualified wetland consultant to ensure accuracy if not submitted to the Corps within six (6) months of preparation.

Field Work By: Zentner and Zentner, 04.14.2014, 02.10.2015, 04.02.2015

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FIGURE 6b
JURISDICTIONAL MAP
AREAS A - F

REVISIONS:	BY:
ORIGINAL 2.26.15	NBB
3.9.15	NBB
4.2.15	NBB

1211 CAMINO PABLO
MORAGA, CA
94556

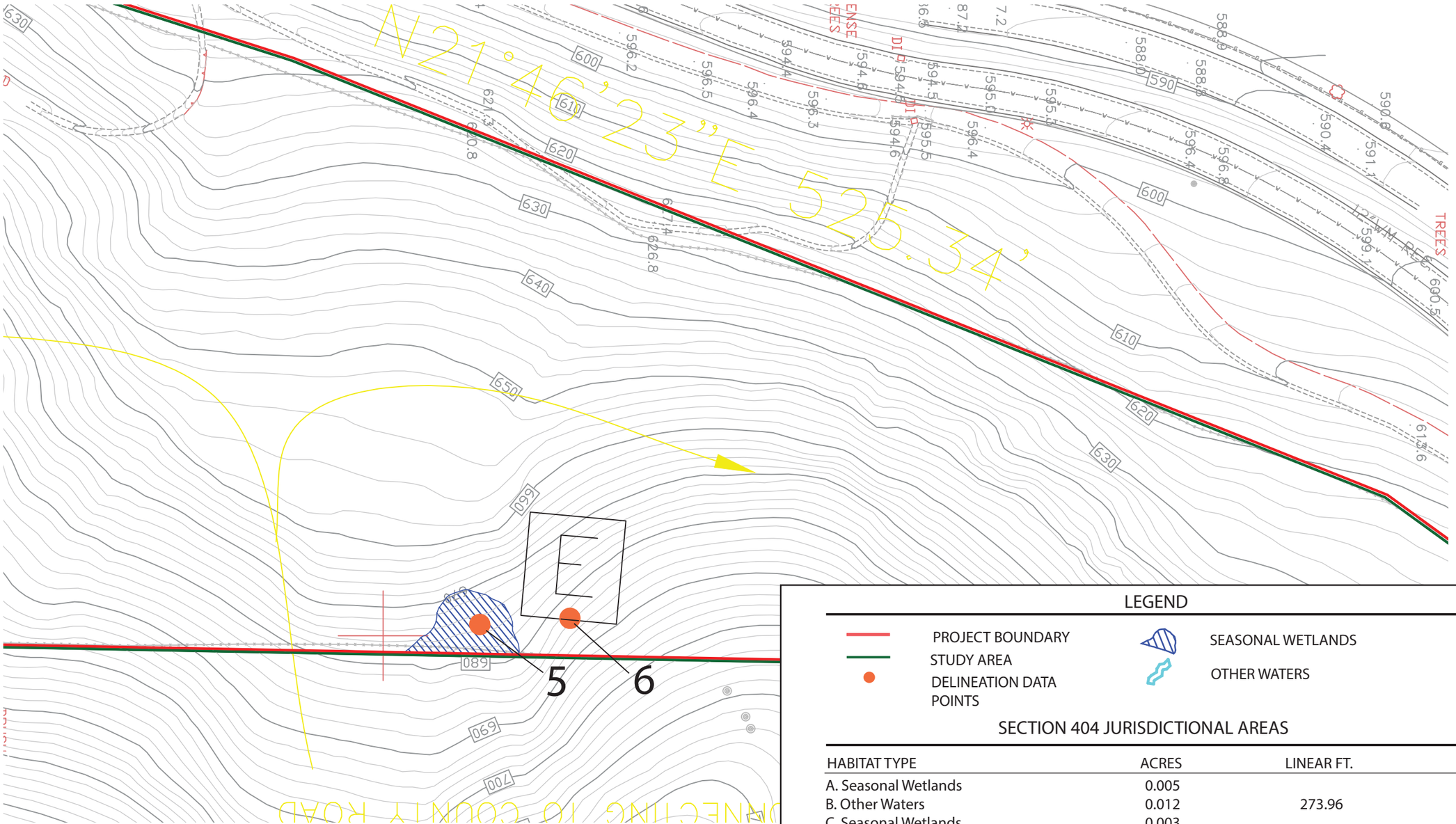
North
0 50' 100'
SCALE: 1" = 100'

SOURCE: dK CONSULTING
WALNUT CREEK, CA

FILE: D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\Adobe 1004 New Fig 3_ Jurisdictional Delineation_03.09.2015

DATE: 04.02.15

PROJECT : 1004 DPL



LEGEND

- PROJECT BOUNDARY
- STUDY AREA
- DELINEATION DATA POINTS
- SEASONAL WETLANDS
- OTHER WATERS

SECTION 404 JURISDICTIONAL AREAS

HABITAT TYPE	ACRES	LINEAR FT.
A. Seasonal Wetlands	0.005	
B. Other Waters	0.012	273.96
C. Seasonal Wetlands	0.003	
D. Other Waters	0.006	121.11
E. Seasonal Wetlands	0.014	
F. Seasonal Wetlands	0.07	

TOTALS	ACRES	LINEAR FT.
Other Waters	0.018	395.07
Seasonal Wetlands	0.092	

TOTAL JURISDICTIONAL AREAS	ACRES	LINEAR FT.
	0.11	395.07

DISCLAIMER: SECTION 404 JURISDICTIONAL MAP

This map exhibits conditions on the site at the time of completion of the delineation. For various reasons, conditions on a site may change, which may affect site wetlandboundaries. Delineation maps generally expire five years after approval by the U.S. Army Corps of Engineers (Corps). Because regulations governing delineations are subject to change, this map should be reviewed by a qualified wetland consultant to ensure accuracy if not submitted to the Corps within six (6) months of preparation.

Field Work By: Zentner and Zentner, 04.14.2014, 02.10.2015, 04.02.2015

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Phone: 510.622.8110 ax: 510.622.8116

FIGURE 6c
JURISDICTIONAL MAP
AREA E

REVISIONS:	BY:
ORIGINAL 2.26.15	NBB
03.09.15	NBB
04.02.15	NBB

1211 CAMINO PABLO
MORAGA, CA
94556

North

0 25' 50

SCALE: 1" = 50'

SOURCE:
dK CONSULTING
WALNUT CREEK, CA

FILE:
D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\Adobe
1004 New Fig 4_ Jurisdictional Delineation_2015.MARCH.09

DATE: 04.02.15

PROJECT : 1004 DPL

III. BIOLOGICAL RESOURCES

A. Regulatory Setting and Federal Framework

1. Federal Endangered Species Act

The Federal Endangered Species Act (FESA) forms the basis for the federal protection of threatened or endangered plants, insects, fish and wildlife. FESA contains four main elements, they are as follows:

- Section 4 (16 USCA §1533): Species listing, Critical Habitat Designation, and Recovery Planning: outlines the procedure for listing endangered plants and wildlife.
- Section 7 (§1536): Federal Consultation Requirement: imposes limits on the actions of federal agencies that might impact listed species.
- Section 9 (§1538): Prohibition on Take: prohibits the "taking" of a listed species by anyone, including private individuals, and State and local agencies.
- Section 10: Exceptions to the Take Prohibition: non-federal agencies can obtain an incidental take permit through approval of a Habitat Conservation Plan.

In the case of salt water fish and other marine organisms, the requirements of FESA are enforced by the National Marine Fisheries Service (NMFS). The USFWS enforces all other cases. Section 9 of FESA as amended, prohibits the "take" of any fish or wildlife species listed under FESA as endangered. Under Federal regulation, "take" of fish or wildlife species listed as threatened is also prohibited unless otherwise specifically authorized by regulation. "Take," as defined by FESA, means "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct." "Harm" includes not only the direct taking of a species itself, but the destruction or modification of the species' habitat resulting in the potential injury of the species. As such, "harm" is further defined to mean "an act which actually kills or injures wildlife; such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering" (50 CFR 17.3).

Section 9 applies to any person, corporation, federal agency, or any local or State agency. If "take" of a listed species is necessary to complete an otherwise lawful activity, this triggers the need to obtain an incidental take permit either through a Section 7 Consultation as discussed further below (for federal actions or private actions that are permitted or funded by a federal agency), or requires preparation of a Habitat Conservation Plan (HCP) pursuant to Section 10 of FESA (for state and local agencies, or individuals, and projects without a federal "nexus").
Section 7(a)(2) of the Act requires that each federal agency consult with the USFWS to ensure that any action authorized, funded or carried out by such agency is not likely to jeopardize the continued existence of an endangered or threatened species or result in the destruction or adverse modification of critical habitat for listed species. The Section 7 consultation process applies only to actions taken by federal agencies, or actions by private parties that require federal agency permits, approval, or funding (for example, a private landowner

applying to the Corps for a permit). Section 7's consultation process is triggered by a determination of the "action agency" (i.e., the federal agency that is carrying out, funding, or approving a project) that the project "may affect" a listed species or critical habitat. If an action is likely to adversely affect a listed species or designated critical habitat, formal consultation with the USFWS is required.

2. Federal Migratory Bird Treaty Act (FMBTA)

The Migratory Bird Treaty Act of 1918 (16 U.S.C. §§ 703-712, July 3, 1918, as amended 1936, 1960, 1968, 1969, 1974, 1978, 1986 and 1989) makes it unlawful to "take" (kill, harm, harass, shoot, etc.) any migratory bird listed in Title 50 of the Code of Federal Regulations, Section 10.13, including their nests, eggs, or young. Migratory birds include geese, ducks, shorebirds, raptors, songbirds, wading birds, seabirds, and passerine birds (such as warblers, flycatchers, swallows, etc.).

3. Federal Clean Water Act

<u>Section 404</u>
Pursuant to Section 404 of the Clean Water Act (33 U.S.C. 1344), the U.S. Army Corps of Engineers (USACE) regulates the discharge of dredged or fill material into "waters of the United States" (33 CFR Part 320 *et seq.*). This requires project applicants to obtain authorization from the USACE prior to discharging dredged or fill material into any water of the United States. The "waters of the United States" are defined in federal regulations at 33 CFR section 328.3, and may include wetlands, ponds, drainages, creeks, streams, and other types of waterbodies, depending on whether any such aquatic feature meets current jurisdictional standards.

To remain in compliance with Section 404 of the Clean Water Act, project proponents and property owners (applicants) are required to acquire authorization from the USACE prior to discharging or otherwise impacting "waters of the United States." This authorization is typically given by reference to compliance with an existing Nationwide Permit(s) or by issuance of a project-specific Individual Permit.

<u>Section 401</u>
Prior to issuance by a Section 404 authorization by the USACE, Section 401 of the federal Clean Water Act requires the State Water Resources Control Board (SWRCB) and the Regional Water Quality Control Boards (RWQCB) to certify, conditionally certify, or waive certification on the question of whether issuance of the USACE permit will violate water quality standards of the State. This certification (or waiver thereof) applies only to the proposed impacts to the "waters of the United States" that are at issue in the proposed Section 404 permit. Potential impacts to "waters of the State" that may not be jurisdictional for the USACE are addressed under the RWQCB's Porter-Cologne Water Quality Control Act statutory authority (see below).

B. STATE FRAMEWORK

1. California Endangered Species Act

In 1984, the state legislated the California Endangered Species Act (CESA) (Fish and Game Code §2050). The basic policy of CESA is to conserve and enhance endangered species and their habitats.

If proposed projects would result in impacts to a State listed species, an "incidental take" permit pursuant to §2081 of CDFG Code would be necessary (versus a Federal incidental take permit for Federal listed species). No §2081 permit may authorize the take of a species for which the Legislature has imposed strict prohibitions on all forms of "take."

State and federal incidental take permits are typically only authorized if applicants are able to demonstrate that impacts on the listed species in question are unavoidable, and can be mitigated to an extent that the reviewing agency can conclude that the proposed impacts would not jeopardize the continued existence of the listed species under review.

2. California Fish and Game Code

<u>Section 4700</u>
In accordance with California Fish and Game Code, Section 4700, "fully protected" mammals or parts thereof may not be taken or possessed (held in captivity) at any time (a) (1), except as provided in Section 2081.7. No provision of this code or any other law shall be construed to authorize the issuance of permits or licenses to take any fully protected mammal, and no permits or licenses heretofore issued shall have any force or effect for that purpose. However, subject to certain notice requirements, the department may authorize the taking of those species for necessary scientific research, including efforts to recover fully protected, threatened, or endangered species. The Salt-marsh harvest mouse (*Reithrodontomys raviventris*) is fully protected.

<u>Sections 3503, 3503.5, 3511, and 3513</u>
CDFG Code §§ 3503, 3503.5, 3511, and 3513 prohibit the take, possession, or destruction of the nest or eggs of any bird. Disturbance that causes nest abandonment and/or loss of reproductive effort (killing or abandonment of eggs or young) is considered "take." Take of any migratory nongame bird is also prohibited, except in compliance with rules promulgated under the Migratory Bird Treaty Act.

All raptors (that is, hawks, eagles, owls) their nests, eggs, and young are protected under California Fish and Game Code (§3503.5). Additionally, "fully protected" birds, such as the white-tailed kite (*Elanus leucurus*) and golden eagle (*Aquila chrysaetos*), are protected under CDFG Code (§3511). "Fully protected" birds may not be taken or possessed (that is, kept in captivity) at any time.

Section 1602

Pursuant to Section 1602 of the Fish and Game Code, CDFG regulates activities that divert, obstruct, or alter stream flow, or substantially modify the bed, channel, or bank of a stream. CDFG's jurisdiction includes the outer extent of any riparian vegetation associated with the stream. Any proposed activity in a natural stream channel that would substantially adversely affect an existing fish and/or wildlife resource, would require entering into a Streambed Alteration Agreement (SBAA) with CDFG prior to commencing work in the stream.

3. Porter-Cologne Water Quality Act

The Porter-Cologne Water Quality Control Act, Water Code § 13260, requires that "any person discharging waste, or proposing to discharge waste, that could affect the waters of the State to file a report of discharge" with the RWQCB through an application for waste discharge (Water Code Section 13260(a)(1). The SWRCB and its several RWQCBs have interpreted this authority to extend to proposed fills of "waters of the State" that include all "waters of the United States" that are subject to the jurisdiction of the USACE, and any other "isolated" waters that are beyond the reach of the USACE claim of jurisdiction.

C. ENVIRONMENTAL ANALYSIS

1. CEQA THRESHOLDS OF SIGNIFICANCE

According to Appendix G of the CEQA Guidelines, the proposed project would have significant impacts on biological resources if it would:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by CDFG or U.S. Fish and Wildlife Service (USFWS).
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by CDFG or USFWS.
- Have a substantial adverse effect on federally protected "wetlands" or "Waters of the U.S." as defined by Section 404 of the Clean Water Act or "Waters of the State" as defined by the Porter-Cologne Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

2. POTENTIAL IMPACTS AND MITIGATION MEASURES

a. Less Than Significant Impacts

Loss of Ruderal and Grassland Habitats

The proposed project will result in the loss of non-native ruderal habitats and annual grassland. These habitats are dominated by non-native species, though they main contain some native species, and these habitats are relatively degraded due to extensive and lengthy disturbance. Loss of these habitats is not a significant impact as there is an abundance of non-native ruderal and grassland habitats in the region. Similarly, impacts to wildlife species that use these habitats are not significant as these species are common and capable of using adjacent lands.

Continued Grazing in Open Space Areas

The open space areas of the site, which will continue to be grazed, are dominated by non-native grassland vegetation and are relatively degraded due to an extensive and lengthy history of disturbance. The eroded areas on the property are primarily due to the existing geology and soils and, as previously noted, by the presence of non-native, annual vegetation that dominates the site. Because the existing land use of the site has been cattle grazing at approximately the current level for at least the last 100 years and likely much longer, no significant changes are expected due to continuing the existing land use. Therefore, continuing the existing grazing land use is not a significant impact.

b. Potentially Significant Impacts Before Mitigation

Special Status Species

1.0 Development of the project could have a potentially significant impact on ground-nesting birds including horned lark or other migratory nesting birds

Impact Analysis

Suitable nesting habitat for California horned lark, other ground nesting birds (excluding burrowing owls), and other migratory nesting birds occurs on the project site or directly adjacent to the project site. These birds are protected under the Migratory Bird Treaty Act (50

CFR 10.13) and their nest, eggs, and young are protected under California CDFG Code §§3503, 3503.5, 3800, and 3513. Any project-related impacts on the nesting success of these species would be considered a significant adverse impact. Potential impacts from the proposed project include loss of nesting habitat, disturbance to nesting birds, and possibly death of adults and/or young. These impacts could be mitigated to a level considered less than significant by Mitigation Measure 1.0-1.

Mitigation Measure

1.0-1 If construction would commence anytime during the nesting/breeding season of the California horned lark or other bird species listed in the Migratory Bird Treaty Act (typically February through September 15), a pre-construction survey of the project vicinity for nesting birds should be conducted. This survey should be conducted by a qualified biologist (experienced with the nesting behavior of bird species of the region) within 14 days prior to the commencement of construction activities that would occur during the nesting/breeding season. The intent of the survey should be to determine if active nests are present within or adjacent to the construction zone within approximately 250 feet. The surveys should be timed such that the last survey is concluded no more than two weeks prior to initiation of construction. If ground disturbance activities are delayed following a survey, then an additional pre-construction survey should be conducted such that no more than two weeks will have elapsed between the last survey and the commencement of ground disturbance activities.

If active nests are found in areas that could be directly or indirectly affected by the project, a no-disturbance buffer zone should be created around active nests during the breeding season or until a qualified biologist determines that all young have fledged. The size of the buffer zones and types of construction activities restricted within them should be determined through consultation with the CDFW depending on the species, taking into account factors such as the following:

- Noise and human disturbance levels at the construction site at the time of the survey and the noise and disturbance expected during the construction activity;

- Distance and amount of vegetation or other screening between the construction site and the nest; and

- Sensitivity of individual nesting species and behaviors of the nesting birds.

The buffer zone around an active nest should be established in the field with orange construction fencing or another appropriate barrier and construction personnel should be instructed on the sensitivity of nest areas. The qualified biologist should serve as a construction monitor during those periods when construction activities

would occur near active nest areas of special status bird species to ensure that no impacts on these nests occur.

Level of Significance After Mitigation: Less Than Significant

1.2 Development of the project could have a potentially significant impact on the Alameda whipsnake

Impact Analysis

Alameda whipsnake are not likely to occur on this site because, as discussed previously, the site contains no elements of core habitat. To ensure against the unlikely possibility of Alameda whipsnake occurrence, preconstruction surveys should be completed (see Avoidance Measure 1.2-3) and the vegetation in the work area should be cleared by hand prior to construction (Avoidance Measure 1.2-6). The site is also not a likely movement habitat for the species due to surrounding development. However, to ensure against the unlikely possibility of Alameda whipsnake might move into the site during construction, exclusion fencing should be completed after vegetation removal (Avoidance Measure 1.2-7). Those measures and Avoidance Measures 1.2-1 through 1.2-17 will be undertaken by the applicant to ensure that Alameda whipsnakes are avoided by the project and that no Alameda whipsnakes are impacted as a result of the project. Avoiding any impacts to the Alameda whipsnake, will ensure that the project would have a less than significant impact on this species.

Avoidance Measures

1.2-1 The number and size of access routes and staging areas, and the total area of activity will be limited to the minimum size necessary to achieve the project goal. Routes and boundaries will be clearly demarcated. Heavy equipment will be restricted to the existing roads, areas to be graded, and a haul route between graded areas only as necessary. The project plans including the proposed haul route shall be reviewed by a qualified biologist prior to approval.

1.2-2 Work activities will be completed between April 1 and November 1.

1.2-3 A qualified biologist who has previous experience conducting biological construction monitoring for Alameda whipsnake, will conduct a presconstruction survey of the construction area for any listed species, but specifically for AWS, within 48 hours of the onset of project work activities. If Alameda whipsnake is found, work on the project will be halted and the US Fish and Wildlife Service (Service) will be notified.

1.2-4 Before any construction activities begin, a qualified biologist with previous project experience with Alameda whipsnake monitoring, will conduct a training session for all construction personnel. At a minimum, the training will include a description of the Alameda whipsnake and their habitat, the importance of these listed species and their habitat, the general measures that are being implemented to conserve the Alameda whipsnake as they relate to the project, the ramifications and consequences including potential fines and penalties of taking threatened species and the boundaries within which the project may be accomplished. Brochures, books and briefings may be used in the training session, provided that a qualified person is on hand to answer any questions. Interpretation shall be provided for non-English speaking workers.

1.2-5 The number and size of access routes and staging areas, and the total area of the activity will be limited to the minimum necessary to achieve the project goal. Routes and boundaries will be clearly demarcated. Heavy equipment will be restricted to the existing road and areas to be graded. Equipment working in the area will be restricted to a 10-mile per hour speed limit.

1.2-6 Vegetation within the areas to be graded will be removed prior to grading. Shrub and understory vegetation will be removed by hand to prevent mortality associated with mowers and other landscaping equipment; grassland vegetation will be removed with hand-held equipment (i.e., weed whackers) immediately after the qualified biologist has surveyed and cleared the area. The qualified biologist will be present during all vegetation removal.

1.2-7 Once vegetation has been removed, wildlife exclusion fencing will be installed around the construction area so that snakes cannot move into the cleared work area. The wildlife exclusion fence will be a minimum of 42-inches tall and the bottom 6 inches will be buried if feasible or otherwise adequately secured to prevent listed species from crawling under the fence. Fence stakes will face the work area. The integrity of the fence will be checked daily and will be continuously maintained until all construction activities are completed to ensure that snakes cannot get through the fence.

1.2-8 A Service-approved biologist will be present during all work at the construction site until such time as Alameda whipsnake surveys have been completed and no Alameda whipsnake have been identified in the construction area, instruction of workers has been completed, and vegetation clearing has been completed. After this time, a construction monitor will be designated to monitor on-site compliance with all minimization measures. The qualified biologist will ensure that this individual receives training outlined above in measure 4 above and in the identification of AWS. The monitor and the Service-approved biologist will have the authority to halt any action that might result in effects that exceed the levels described in these measures.

1.2-9 To reduce the likelihood of vehicle strike, prior to the start of work each day, the qualified biologist or designated construction monitor will survey all roads, including haul roads, within the project area to ensure that no Alameda whipsnakes are located in the roadways.

1.2-10 If Alameda whipsnake are found in the work area at any point, all work activity on the project will be halted, the Service will be notified, and the Service will determine whether additional measures should be implemented.

1.2-11 All material stockpiling and staging areas will be located within project right-of-ways or at designated disturbed/developed areas outside of designated construction zones. Any debris or equipment left overnight will be checked daily prior to use in order to avoid injury and mortality to listed species. Because Alameda whipsnake may take refuge in cavity-like structures such as pipes and may enter stored pipes and become trapped, all construction pipes, culverts, or similar structures that are stored at a construction site for one or more overnight periods will be either securely capped prior to storage, contained within separate wildlife exclusion fencing, or thoroughly inspected by the on-site biologist and/or the on-site monitor for these animals before the pipe is subsequently buried, capped, or otherwise used or moved in any way.

1.2-12 All construction-related holes, capable of entrapping wildlife, will be covered at the end of each workday in a manner that will prevent entrapment. Prior to commencing construction activities each workday, trenches shall be thoroughly inspected for animals.

1.2-13 During project activities, all trash that may attract predators will be properly contained, removed from the construction area and disposed of regularly. Following construction, all trash and construction debris will be removed from work areas.

1.2-14 Vehicle and equipment refueling, repair, and lubrication will only be permitted in designated areas where accidental spills will be contained.

1.2-15 Erosion control Best Management Practices will be implemented in accordance to the San Francisco Bay Regional Water Quality Control Board and other agency permits. Tightly woven fiber netting or similar material will be used for erosion control or other purposes to ensure that Alameda whipsnake do not get trapped. Plastic mono-filament netting (erosion control matting) or similar material will not be used at the project site because animals may become entangled or trapped in it.

1.2-16 All areas temporarily disturbed by construction will be revegetated to pre-project or native conditions, as specified in project-specific revegetation plans.

1.2-17 Landscaping plans for the proposed development will not include any plants categorized by the California Invasive Plant Council (Cal-IPC) as "Invasive Non-Native

Plants that Threaten Wildlands in California" for the California West floristic region (Cal-IPC 2006). Landscaping plans will be reviewed by a qualified professional to ensure that this requirement is satisfied prior to approval by the Town of Moraga. Any substitutions to landscaping plans after approval will be subject to similar review.

These avoidance measures would ensure that there are no impacts to Alameda whipsnake and therefore the project would be considered to have a less than significant on Alameda whipsnake.

Level of Significance After Avoidance: Less Than Significant

SPECIAL-STATUS PLANTS

2.0 The proposed project could have a potentially significant adverse impact on special-status plant species.

Impact Analysis

The project site provides potentially suitable habitat for special-status plant species. None of these species have been observed on-site but directed surveys for fall-blooming species have not yet taken place. To prove absence of these species formal surveys must be conducted at appropriate time of the year. The project site provides potentially suitable habitat for: San Joaquin spearscale, big tarplant, Congdon's tarplant, Santa Cruz tarplant, Tiburon buckwheat, Mount Diablo buckwheat. In addition, though initial surveys indicated that California pony's foot was observed outside the development area, the population should be mapped to ensure no impact occur. Future development activities within the project site could result in the loss of these species. Until such time that formal surveys are conducted that demonstrate absence of these species, impacts to these species are regarded as potentially significant pursuant to CEQA. These impacts could be mitigated to levels considered less than significant by Mitigation Measure 2.0-1.

Mitigation Measure

2.0-1 Prior to Town approval of any specific development, special status plant surveys shall be conducted in appropriate habitats during the appropriate period in which the species are most identifiable. These surveys shall be in compliance with all CDFW (2009), USFWS (1996), and CNPS (2001) published survey guidelines.

If the survey finds that there are no special-status plants on the property or within the proposed project site, then there would be no further mitigation and the project may proceed, provided all other applicable permits and authorizations are obtained for the project.

If special-status plant species are found, populations will be mapped and enumerated. If any populations are found within the proposed development area, project

development plans shall consider avoidance to the extent practicable. If avoidance is not practicable while otherwise obtaining the project's objectives, then other suitable measures and mitigation shall be implemented as detailed below.

The following measures shall be implemented if special-status plants are found on the project site:

- Initially the practicability of avoidance shall be evaluated as noted above.
- If avoidance is not practicable, a mitigation plan shall be developed and approved by the Town for implementation of steps 1 through 3 below prior to site disturbance.

The mitigation plan shall include the following elements:

1. Prior to construction within the project area, a qualified botanist shall collect the seeds, propagules, and top soils, or other part of the plant that would ensure successful replanting of the population elsewhere. The seeds, propagules, or other plantable portion of all plants shall be collected at the appropriate time of the year.
2. Half of the seeds and top soils collected shall be appropriately stored in long-term storage at a botanic garden or museum (for example, Rancho Santa Ana Botanic Garden). The other half of the seeds, propagules, or other plantable portion of all plants shall be planted at the appropriate time of year (late-fall months) in an area of the subject property or off-site, protected property that will not be impacted by the project.
3. This area shall be fenced with permanent fencing (for example, chain link fencing) to ensure protection of the species. The applicant shall hire a qualified biologist to conduct annual monitoring surveys of the transplanted plant population for a five year period and shall prepare annual monitoring reports reporting the success or failure of the transplanting effort. These reports shall be submitted to the City no later than December 1st each monitoring year.
4. These steps shall be implemented prior to site disturbance.

If the seeding/transplanting effort fails, the stored seeds and top soils can be taken out of long-term storage and sown in another location (either onsite or offsite) deemed suitable by the Town. This seeding effort shall then be monitored for an additional three year period to ensure survivorship of the new population. Annual monitoring reports shall be submitted to the Town for the three year period.

A CNDDB form shall be filled out and submitted to CDFW for any special-status plant species identified within the project site.

In lieu of the above prescribed mitigation, as allowed in writing by the Town, mitigation requirements may be satisfied via the purchase of qualified mitigation credits or the preservation of offsite habitat.

When implemented, these measures would reduce potentially significant adverse impacts on special-status plant species to a level considered less than significant.

Level of Significance After Mitigation: Less Than Significant

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APPENDIX A

State and Federal Species Lists

Selected Elements by Common Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: BIOS selection

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
adobe sanicle *Sanicula maritima*	PDAPI1Z0D0	None	Rare	G2	S2	1B.1
Alameda Island mole *Scapanus latimanus parvus*	AMABB02031	None	None	G5T1Q	S1	SSC
Alameda song sparrow *Melospiza melodia pusillula*	ABPBXA301S	None	None	G5T2?	S2?	SSC
Alameda whipsnake *Masticophis lateralis euryxanthus*	ARADB21031	Threatened	Threatened	G4T2	S2	
alkali milk-vetch *Astragalus tener var. tener*	PDFAB0F8R1	None	None	G2T2	S2	1B.2
American badger *Taxidea taxus*	AMAJF04010	None	None	G5	S3	SSC
American peregrine falcon *Falco peregrinus anatum*	ABNKD06071	Delisted	Delisted	G4T4	S3S4	FP
Antioch Dunes evening-primrose *Oenothera deltoides ssp. howellii*	PDONA0C0B4	Endangered	Endangered	G5T1	S1	1B.1
Antioch efferian robberfly *Efferia antiochi*	IIDIP07010	None	None	G1G2	S1S2	
bald eagle *Haliaeetus leucocephalus*	ABNKC10010	Delisted	Endangered	G5	S2	FP
Bay checkerspot butterfly *Euphydryas editha bayensis*	IILEPK4055	Threatened	None	G5T1	S1	
bent-flowered fiddleneck *Amsinckia lunaris*	PDBOR01070	None	None	G2?	S2?	1B.2
Berkeley kangaroo rat *Dipodomys heermanni berkeleyensis*	AMAFD03061	None	None	G3G4T1	S1	
big free-tailed bat *Nyctinomops macrotis*	AMACD04020	None	None	G5	S3	SSC
big tarplant *Blepharizonia plumosa*	PDAST1C011	None	None	G2	S2	1B.1
big-scale balsamroot *Balsamorhiza macrolepis*	PDAST11061	None	None	G2	S2	1B.2
black skimmer *Rynchops niger*	ABNNM14010	None	None	G5	S2	SSC
Bolander's water-hemlock *Cicuta maculata var. bolanderi*	PDAPI0M051	None	None	G5T3T4	S2	2B.1
Brewer's western flax *Hesperolinon breweri*	PDLIN01030	None	None	G2	S2	1B.2
Bridges' coast range shoulderband *Helminthoglypta nickliniana bridgesi*	IMGASC2362	None	None	G3T1	S1	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
burrowing owl *Athene cunicularia*	ABNSB10010	None	None	G4	S3	SSC
cackling (=Aleutian Canada) goose *Branta hutchinsii leucopareia*	ABNJB05035	Delisted	None	G5T3	S2	
California black rail *Laterallus jamaicensis coturniculus*	ABNME03041	None	Threatened	G3G4T1	S1	FP
California clapper rail *Rallus longirostris obsoletus*	ABNME05016	Endangered	Endangered	G5T1	S1	FP
California horned lark *Eremophila alpestris actia*	ABPAT02011	None	None	G5T3Q	S3	WL
California least tern *Sternula antillarum browni*	ABNNM08103	Endangered	Endangered	G4T2T3Q	S2	FP
California linderiella *Linderiella occidentalis*	ICBRA06010	None	None	G2G3	S2S3	
California red-legged frog *Rana draytonii*	AAABH01022	Threatened	None	G2G3	S2S3	SSC
California seablite *Suaeda californica*	PDCHE0P020	Endangered	None	G1	S1	1B.1
California tiger salamander *Ambystoma californiense*	AAAAA01180	Threatened	Threatened	G2G3	S2S3	SSC
caper-fruited tropidocarpum *Tropidocarpum capparideum*	PDBRA2R010	None	None	G1	S1	1B.1
Carquinez goldenbush *Isocoma arguta*	PDAST57050	None	None	G1	S1	1B.1
chaparral harebell *Campanula exigua*	PDCAM020A0	None	None	G2	S2	1B.2
chaparral ragwort *Senecio aphanactis*	PDAST8H060	None	None	G3?	S2	2B.2
coast horned lizard *Phrynosoma blainvillii*	ARACF12100	None	None	G3G4	S3S4	SSC
coastal triquetrella *Triquetrella californica*	NBMUS7S010	None	None	G2	S2	1B.2
Congdon's tarplant *Centromadia parryi ssp. congdonii*	PDAST4R0P1	None	None	G3T2	S2	1B.1
Contra Costa goldfields *Lasthenia conjugens*	PDAST5L040	Endangered	None	G1	S1	1B.1
Contra Costa manzanita *Arctostaphylos manzanita ssp. laevigata*	PDERI04273	None	None	G5T2	S2	1B.2
Cooper's hawk *Accipiter cooperii*	ABNKC12040	None	None	G5	S4	WL
Diablo helianthella *Helianthella castanea*	PDAST4M020	None	None	G2	S2	1B.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
ferruginous hawk *Buteo regalis*	ABNKC19120	None	None	G4	S3S4	WL
foothill yellow-legged frog *Rana boylii*	AAABH01050	None	None	G3	S3	SSC
fragrant fritillary *Fritillaria liliacea*	PMLIL0V0C0	None	None	G2	S2	1B.2
Franciscan thistle *Cirsium andrewsii*	PDAST2E050	None	None	G3	S3	1B.2
golden eagle *Aquila chrysaetos*	ABNKC22010	None	None	G5	S3	FP
great blue heron *Ardea herodias*	ABNGA04010	None	None	G5	S4	
hairless popcornflower *Plagiobothrys glaber*	PDBOR0V0B0	None	None	GH	SH	1A
Hall's bush-mallow *Malacothamnus hallii*	PDMAL0Q0F0	None	None	G2	S2	1B.2
hoary bat *Lasiurus cinereus*	AMACC05030	None	None	G5	S4	
Hospital Canyon larkspur *Delphinium californicum ssp. interius*	PDRAN0B0A2	None	None	G3T3	S3	1B.2
Kellogg's horkelia *Horkelia cuneata var. sericea*	PDROS0W043	None	None	G4T2	S2?	1B.1
Lee's micro-blind harvestman *Microcina leei*	ILARA47040	None	None	G1	S1	
Lime Ridge eriastrum *Eriastrum ertterae*	PDPLM030F0	None	None	G1	S1	1B.1
Lime Ridge navarretia *Navarretia gowenii*	PDPLM0C120	None	None	G1	S1	1B.1
Loma Prieta hoita *Hoita strobilina*	PDFAB5Z030	None	None	G2	S2	1B.1
longfin smelt *Spirinchus thaleichthys*	AFCHB03010	Candidate	Threatened	G5	S1	SSC
Lum's micro-blind harvestman *Microcina lumi*	ILARA47050	None	None	G1	S1	
Marin knotweed *Polygonum marinense*	PDPGN0L1C0	None	None	G2Q	S2	3.1
mimic tryonia (=California brackishwater snail) *Tryonia imitator*	IMGASJ7040	None	None	G2	S2	
minute pocket moss *Fissidens pauperculus*	NBMUS2W0U0	None	None	G3?	S2	1B.2
monarch - California overwintering population *Danaus plexippus pop. 1*	IILEPP2012	None	None	G4T2T3	S2S3	

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
most beautiful jewelflower *Streptanthus albidus ssp. peramoenus*	PDBRA2G012	None	None	G2T2	S2	1B.2
Mt. Diablo bird's-beak *Cordylanthus nidularius*	PDSCR0J0F0	None	Rare	G1	S1	1B.1
Mt. Diablo buckwheat *Eriogonum truncatum*	PDPGN085Z0	None	None	G2	S2	1B.1
Mt. Diablo fairy-lantern *Calochortus pulchellus*	PMLIL0D160	None	None	G2	S2	1B.2
Mt. Diablo jewelflower *Streptanthus hispidus*	PDBRA2G0M0	None	None	G1	S1	1B.3
Mt. Diablo manzanita *Arctostaphylos auriculata*	PDERI04040	None	None	G2	S2	1B.3
Mt. Diablo phacelia *Phacelia phacelioides*	PDHYD0C3Q0	None	None	G1	S1	1B.2
Northern California black walnut *Juglans hindsii*	PDJUG02040	None	None	G1	S1	1B.1
Northern Coastal Salt Marsh *Northern Coastal Salt Marsh*	CTT52110CA	None	None	G3	S3.2	
northern harrier *Circus cyaneus*	ABNKC11010	None	None	G5	S3	SSC
Northern Maritime Chaparral *Northern Maritime Chaparral*	CTT37C10CA	None	None	G1	S1.2	
obscure bumble bee *Bombus caliginosus*	IIHYM24380	None	None	G4?	S1S2	
Oregon meconella *Meconella oregana*	PDPAP0G030	None	None	G2G3	S1	1B.1
Oregon polemonium *Polemonium carneum*	PDPLM0E050	None	None	G3G4	S2	2B.2
oval-leaved viburnum *Viburnum ellipticum*	PDCPR07080	None	None	G4G5	S3?	2B.3
pallid bat *Antrozous pallidus*	AMACC10010	None	None	G5	S3	SSC
pallid manzanita *Arctostaphylos pallida*	PDERI04110	Threatened	Endangered	G1	S1	1B.1
Point Reyes salty bird's-beak *Chloropyron maritimum ssp. palustre*	PDSCR0J0C3	None	None	G4?T2	S2	1B.2
prairie falcon *Falco mexicanus*	ABNKD06090	None	None	G5	S4	WL
Presidio clarkia *Clarkia franciscana*	PDONA050H0	Endangered	Endangered	G1	S1	1B.1
robust spineflower *Chorizanthe robusta var. robusta*	PDPGN040Q2	Endangered	None	G2T1	S1	1B.1

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
rock sanicle *Sanicula saxatilis*	PDAPI1Z0H0	None	Rare	G2	S2	1B.2
round-leaved filaree *California macrophylla*	PDGER01070	None	None	G3?	S3?	1B.2
Sacramento perch *Archoplites interruptus*	AFCQB07010	None	None	G2G3	S1	SSC
saline clover *Trifolium hydrophilum*	PDFAB400R5	None	None	G2	S2	1B.2
saltmarsh common yellowthroat *Geothlypis trichas sinuosa*	ABPBX1201A	None	None	G5T3	S3	SSC
salt-marsh harvest mouse *Reithrodontomys raviventris*	AMAFF02040	Endangered	Endangered	G1G2	S1S2	FP
salt-marsh wandering shrew *Sorex vagrans halicoetes*	AMABA01071	None	None	G5T1	S1	SSC
San Bruno elfin butterfly *Callophrys mossii bayensis*	IILEPE2202	Endangered	None	G4T1	S1	
San Francisco dusky-footed woodrat *Neotoma fuscipes annectens*	AMAFF08082	None	None	G5T2T3	S2S3	SSC
San Francisco popcornflower *Plagiobothrys diffusus*	PDBOR0V080	None	Endangered	G1Q	S1	1B.1
San Joaquin kit fox *Vulpes macrotis mutica*	AMAJA03041	Endangered	Threatened	G4T2	S2	
San Joaquin Pocket Mouse *Perognathus inornatus*	AMAFD01060	None	None	G2G3	S2S3	
San Joaquin spearscale *Extriplex joaquinana*	PDCHE041F3	None	None	G2	S2	1B.2
Santa Clara red ribbons *Clarkia concinna ssp. automixa*	PDONA050A1	None	None	G5?T3	S3	4.3
Santa Cruz tarplant *Holocarpha macradenia*	PDAST4X020	Threatened	Endangered	G1	S1	1B.1
Serpentine Bunchgrass *Serpentine Bunchgrass*	CTT42130CA	None	None	G2	S2.2	
sharp-shinned hawk *Accipiter striatus*	ABNKC12020	None	None	G5	S4	WL
shining navarretia *Navarretia nigelliformis ssp. radians*	PDPLM0C0J2	None	None	G4T2	S2	1B.2
showy golden madia *Madia radiata*	PDAST650E0	None	None	G2	S2	1B.1
silver-haired bat *Lasionycteris noctivagans*	AMACC02010	None	None	G5	S3S4	
slender silver moss *Anomobryum julaceum*	NBMUS80010	None	None	G4G5	S2	4.2

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
slender-leaved pondweed *Stuckenia filiformis ssp. alpina*	PMPOT03091	None	None	G5T5	S3	2B.2
Suisun song sparrow *Melospiza melodia maxillaris*	ABPBXA301K	None	None	G5T3	S3	SSC
Swainson's hawk *Buteo swainsoni*	ABNKC19070	None	Threatened	G5	S3	
Tiburon buckwheat *Eriogonum luteolum var. caninum*	PDPGN083S1	None	None	G5T2	S2	1B.2
tidewater goby *Eucyclogobius newberryi*	AFCQN04010	Endangered	None	G3	S3	SSC
Toren's grimmia *Grimmia torenii*	NBMUS32330	None	None	G2	S2	1B.3
Townsend's big-eared bat *Corynorhinus townsendii*	AMACC08010	None	Candidate Threatened	G3G4	S2	SSC
tricolored blackbird *Agelaius tricolor*	ABPBXB0020	None	None	G2G3	S1S2	SSC
Valley Needlegrass Grassland *Valley Needlegrass Grassland*	CTT42110CA	None	None	G3	S3.1	
western leatherwood *Dirca occidentalis*	PDTHY03010	None	None	G2	S2	1B.2
western mastiff bat *Eumops perotis californicus*	AMACD02011	None	None	G5T4	S3S4	SSC
western pond turtle *Emys marmorata*	ARAAD02030	None	None	G3G4	S3	SSC
western snowy plover *Charadrius alexandrinus nivosus*	ABNNB03031	Threatened	None	G3T3	S2	SSC
white-tailed kite *Elanus leucurus*	ABNKC06010	None	None	G5	S3S4	FP
woodland woollythreads *Monolopia gracilens*	PDAST6G010	None	None	G3	S3	1B.2
yellow warbler *Setophaga petechia*	ABPBX03010	None	None	G5	S3S4	SSC
Yuma myotis *Myotis yumanensis*	AMACC01020	None	None	G5	S4	

Record Count: 121

APPENDIX B

Definitions
for
Special Status Species Designations

DEFINITIONS FOR SPECIAL STATUS SPECIES DESIGNATIONS

Federal Endangered Species Act

The following are the standard definitions for the status designations under the federal Endangered Species Act (ESA), implementing regulations and relevant notices (as published in the Federal Register). The ESA is administered by the U.S. Fish and Wildlife Service (USFWS).

Endangered – A species that is in danger of extinction throughout all or a significant portion of its range.

Threatened – A species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Proposed for Listing – Taxa formally noticed as being under review to determine whether listing as threatened or endangered is warranted.

Candidate – Taxa for which USFWS has on file sufficient information on biological vulnerability and threat to support a proposed rule to list the species as endangered or threatened. Proposals to list have not yet been issued because this action is precluded by other listing activity. Species in this category are assigned a listing priority in order to assist the FWS in determining those species most in need of protection.

[Note: As of February 1996, the USFWS eliminated the differing categories of candidate species and now has only one category of candidate species as defined above.]

California Endangered Species Act

The following are the standard definitions for the status classifications under the California Endangered Species Act (CESA), administered by the California Department of Fish and Game (CDFG), now renamed the California Department of Fish and Wildlife (CDFW).

Endangered species – A native California bird, mammal, fish, amphibian, reptile or plant (species or subspecies) is endangered when it is in serious danger of becoming extinct throughout all, or a significant portion of, its range due to one or more causes, including loss of habitat, change of habitat, over-exploitation, predation, competition or disease (CDFW Code, Section 2062).

Threatened species – A native bird, mammal, fish, amphibian, reptile or plant (subspecies or species) is threatened when, although not presently threatened with extinction, it is likely to become an endangered species in the foreseeable future in the absence of special protection and management efforts. Any animal listed as "rare" by the Commission on or before January 1, 1985, is a threatened species (CDFW Code, Section 2067).

Candidate species – A native California species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant is a candidate when the Fish and Wildlife Commission (Commission) has formally noticed it as being under review by the CDFW to determine whether listing as threatened or endangered is warranted, or when it is the subject of a proposed rulemaking by the Commission to list as threatened or endangered (CDFW Code, Section 2068).

California Department of Fish and Game

Fully Protected – Fully Protected species may not be taken or possessed without a permit from the Fish and Wildlife Commission. Information of Fully Protected species can be found in the CDFW Code, (birds at §3511, mammals at §4700, reptiles and amphibians at §5050, and fish at §5515). Additional information on Fully Protected fish can be found in the California Code of Regulations, Title 14, Division 1, Subdivision 1, Chapter 2, Article 4, §5.93. The category of Protected Amphibians and reptiles in Title 14 has been repealed.

Species of Special Concern – A California species of special concern is a plant or animal species or subspecies that is possibly declining or is vulnerable to extirpation and may be considered for listing or for special management and protection measures. These species, although not legally protected under the CESA, are monitored by the CDFW.

It is the goal and responsibility of the CDFW to maintain viable populations of all native species. To this end, the CDFW has designated certain species as “Species of Special Concern” because declining population levels, limited ranges, and/or continuing threats have made them vulnerable to extinction. The goal of designating species as “Species of Special Concern” is to halt or reverse their decline by calling attention to their plight and addressing the issues of concern early enough to secure their long term viability. Not all “Species of Special Concern” have declined equally; some species may be just starting to decline, while others may have already reached the point where they meet the criteria for listing as a “Threatened” or “Endangered” species under the State and/ or Federal Endangered Species Acts.

California Native Plant Protection Act

The California Native Plant Protection Act (CNPPA), administered by the CDFW, protects "rare" plant species.

Rare – A native California plant (species, subspecies or variety) is rare when, although not presently threatened with extinction, it is in such small numbers throughout its range that it may become endangered if its present environment worsens (CDFW Code, Section 1901).

California Native Plant Society (CNPS) List of Rare, Threatened and Endangered Vascular Plants of California

The CNPS maintains a list of rare, threatened and endangered vascular plants of California which summarizes the distribution, rarity, endangerment, and ecology of these plants. CNPS updates this list approximately every four years. The most recent edition (8th ed.) was published in December 2010. The CNPS listing designations are as follows:

California Rare Plant Rank (CRPR) 1A – The plants Ranked as 1A are presumed extinct because they have not been seen or collected in the wild in California for many years. All of the List 1A plants meet the definitions of "rare", "endangered", or "threatened" contained in Fish and Game Code Section 1901 (Native Plant Protection Act), and Sections 2062 and 2067 (CESA).

CRPR 1B – The plants Ranked as 1B are rare throughout their range, and all but a few are endemic to California. List 1B plants are considered vulnerable under present circumstances or have a high potential for becoming so because of their limited or vulnerable habitat, low numbers of individuals per population, or their limited number of populations. As with List 1A plants, all of the 1B plants meet the definitions of "rare", "endangered", or "threatened" contained in Sections 1901, 2062 and 2067 of the Fish and Game Code.

CRPR 2 – Except for being common outside California, Rank 2 plants are defined similarly to List 1B plants.

CRPR 3 – Rank 3 contains plants about which more information is needed to assign them to one of the other lists or reject them. Some List 3 plants meet the definitions of "rare", "endangered", or "threatened" contained in Sections 1901, 2062 and 2067 of the Fish and Game Code.

CRPR 4 – The plants in Rank 4 are of limited distribution or infrequent throughout a broader area in California, and their susceptibility to threat appears low at this time. These plants are uncommon enough that their status should be monitored regularly. Very few List 4 plants meet the definitions of "rare", "endangered", or "threatened" contained in Sections 1901, 2062

and 2067 of the Fish and Game Code, and few, if any, are eligible for state listing.

CNPS Threat Code extensions and their meanings:

.1 – Seriously endangered in California

.2 – Fairly endangered in California

.3 – Not very endangered in California

CNPS Local Listings (Alameda and Contra Costa Counties)

***A1** or ***A2** – Species in Alameda and Contra Costa Counties listed as rare, threatened or endangered statewide by federal or state agencies or by the state level of CNPS.

A1x – Species previously known from Alameda or Contra Costa Counties, but now presumed extirpated here.

A1 – Species currently known from two or less regions in Alameda and Contra Costa Counties.

A2 – Species currently known from three to five regions in the two counties, or, if more, meeting other important criteria such as small populations, stressed or declining populations, small geographical range, limited or threatened habitat, etc.

A1? – Species with taxonomic or distribution problems that make it unclear if they actually occur here.

Special Animals

California Department of Fish and Wildlife (CDFW)

Special Animals – Special animals is a general term that refers to all of the taxa that the California Natural Diversity Database (CNDDB) is interested in tracking, regardless of their legal or protection status. This list is also referred to as the list of "species at risk" or "special status species". The CDFW considers the taxa on this list to be those of greatest conservation need and were used in the development of California's Wildlife Action Plan (CDFG 2009). Special animals includes a broad list of agency designations.
For more information see: http://www.dfg.ca.gov/biogeodata/cnddb/pdfs/SPAnimals.pdf

Watch List – The Watch List consists of taxa that were previously Species of Special Concern (SSC's) but no longer merit SSC status or which do not meet SSC criteria but for which there is concern and a need for additional information to clarify status.

Other "Special Animal" Status Codes:

The status of species on the Special Animals List according to other conservation organizations is provided. Taxa on these lists are reviewed for inclusion in the CNDDB Special Animals List, but are not automatically included. For example, taxa that are regionally rare within a portion of California may not be included, because they may be of lesser conservation concern across their full range in California.

These species, which are also tracked regardless of their legal or protection status, are provided below.

U.S Fish and Wildlife Service (USFWS)

Birds of Conservation Concern – The goal of the Birds of Conservation Concern report is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent the US Fish and Wildlife Service's highest conservation priorities and draw attention to species in need of conservation action.

National Marine Fisheries Service (NMFS) also known as NOAA Fisheries

Species of Concern – NOAA Fisheries is responsible for the management, conservation, and protection of living marine resources within the United States Exclusive Economic Zone. Species of Concern are those species about which we have some concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act (ESA). Though NMFS wishes to draw proactive attention and conservation action to these species, "Species of concern" status does not carry any procedural or substantive protections under the ESA.

Bureau of Land Management

Sensitive – According to BLM Manual 6840, a Bureau Sensitive Species must meet the following criteria to be considered for sensitive species listing:

- They must be native species found on BLM-administrated lands for which BLM has the capability to significantly affect the conservation status of the species through management.
- Information is available that a species has recently undergone, is undergoing, or is predicted to undergo a downward trend such that the viability of the species or a

distinct population segment of the species is at risk across all or a significant portion of the species range.

- The species depends on ecological refugia or specialized or unique habitats on BLM-administrated lands, and there is evidence that such areas are threatened with alteration such that the continued viability of the species in that area would be at risk.
- All federally designated candidate species, proposed species, and delisted species in the 5 years following their delisting shall be conserved as Bureau Sensitive Species.

Once a species is declared sensitive by the BLM, it is their obligation to determine its distribution and manage the species' habitat.

California Dept. of Forestry & Fire Protection

CDF Sensitive – California Department of Forestry and Fire Protection classifies "sensitive species" as those species that warrant special protection during timber operations. The list of "sensitive species" is given in §895.1 (Definitions) of the California Forest Practice Rules.

International Union for Conservation of Nature (IUCN)

IUCN List – The IUCN assesses, on a global scale, the conservation status of species, subspecies, varieties and even selected subpopulations in order to highlight taxa threatened with extinction, and therefore promote their conservation. Detailed information on the IUCN and the Red List is available at: http://www.iucnredlist.org

Marine Mammal Commission

Species of Special Concern – Section 202 of the Marine Mammal Protection Act directs the Marine Mammal Commission, in consultation with its Committee of Scientific Advisors, to make recommendations to the Department of Commerce, the Department of the Interior, and other federal agencies on research and management actions needed to conserve species of marine mammals. To meet this charge, the Commission devotes special attention to particular species and populations that are vulnerable to various types of human-related activities, impacts, and contaminants. Such species may include marine mammals listed as Endangered or Threatened under the Endangered Species Act or as depleted under the Marine Mammal Protection Act. In addition, the Commission often directs special attention to other species or populations of marine mammals not so listed whenever special conservation challenges arise that may affect them.

More information on the Marine Mammal Protection Act and the Marine Mammal Species of Special Concern list is available at: http://www.mmc.gov/species/welcome.shtml

U.S Forest Service

Sensitive – USDA Forest Service defines sensitive species as plant and animal species identified by a regional forester that are not listed or proposed for listing under the Federal Endangered Species Act for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density, or significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution. Regional Foresters identify sensitive species occurring within each region. California is the Pacific Southwest Region (Region 5).
More information is available at: http://www.fs.usda.gov/main/r5/plants-animals and at: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5435266.xlsx

American Bird Conservancy

WatchList of Birds of Conservation Concern – The United States WatchList is a joint project between the American Bird Conservancy and the National Audubon Society. It reflects a comprehensive analysis of all the bird species in the United States. It reveals those in greatest need of immediate conservation attention to survive a convergence of environmental challenges, including habitat loss, invasive species, and global warming. The list builds on the species assessments conducted for many years by Partners in Flight (PIF) for land birds. It uses those same PIF standards but it is expanded to cover all bird species, not just land birds. The list is based on the latest available research and assessments from the bird conservation community, along with data from the Christmas Bird Count and Breeding Bird Survey. More information is available at:
http://www.abcbirds.org/abcprograms/science/watchlist/index.html

American Fisheries Society (AFS)

AFS List – Designations for freshwater and diadromous species were taken from the paper: Jelks,.L., S.J. Walsh, N.M. Burkhead, S.Contreras-Balderas, E. Díaz-Pardo, D.A. Hendrickson, J. Lyons, N.E. Mandrak, F. McCormick, J.S. Nelson, S.P. Platania, B.A. Porter, C.B. Renaud, J. J. Schmitter-Soto, E.B. Taylor, and M.L. Warren, Jr. 2008. Conservation status of imperiled North American freshwater and diadromous fishes. Fisheries 33(8):372-407. Available at:
http://www.fisheries.org/afs/docs/fisheries/fisheries_3308.pdf
Designations for marineand estuarine species were taken from the paper: Musick, J.T. et al. 2000. "Marine, Estuarine, and Diadromous Fish Stocks at Risk of Extinction in North America (Exclusive of Pacific Salmonids). Fisheries 25(11):6-30. Available at:
http://www.flmnh.ufl.edu/fish/sharks/sawfish/Reprint1390.pdf

Western Bat Working Group (WBWG)

WBWG List – The WBWG is comprised of agencies, organizations and individuals interested in bat research, management and conservation from the 13 western states and provinces. The goals are (1) to facilitate communication among interested parties and reduce risks of species decline or extinction; (2) to provide a mechanism by which current information on bat ecology, distribution and research techniques can be readily accessed; and (3) to develop a forum to discuss conservation strategies, provide technical assistance and encourage education programs. Species are ranked as High, Medium, or Low Priority in each of 10 regions in western North America. Because California includes multiple regions where a species may have different WBWG Priority ranks, the CNNDB includes categories for Medium-High, and Low-Medium Priority. The CNDDB tracks bat species that are at least Low-Medium Priority in California. More information is available at: http://www.wbwg.org

The Xerces Society

Red List – The Xerces Society is an international non-profit organization dedicated to protecting biological diversity through invertebrate conservation. The Society advocates for invertebrates and their habitatsby working with scientists, land managers, educators, and citizens on conservation and education projects. Their core programs focus on endangered species, native pollinators, and watershed health. More information on the Red List is available at:
http://www.xerces.org

Special Status Species Abbreviations

Federal Endangered Species Act

FE	Federally-listed as endangered
FT	Federally-listed as threatened
FPE	Federally proposed for listing as endangered or threatened
FC	Federal candidate for listing as endangered or threatened

State Endangered Species Act

SE	State-listed as endangered
ST	State-listed as threatened
SC	State candidate for listing as endangered or threatened

California Department of Fish and Wildlife

CFP	Fully protected
CSC	California species of special concern

California Native Plant Protection Act

CNPPA: Rare	Rare plant

California Native Plant Society

CRPR	California Rare Plant Rank

SPECIAL ANIMALS (SA)

California Department of Fish and Wildlife

CDFW: WL	Watch list
CDFW: SA	Special Animal

US Fish and Wildlife Service

USFWS:BCC	Birds of Conservation Concern

NMFS (NOAA Fisheries)

NMFS: SC	Species of Concern

Bureau of Land Management

BLM:S	Sensitive

California Dept. of Forestry & Fire Protection

CDFS:S	Sensitive

International Union for Conservation of Nature

IUCN:CD	Conservation Dependent
IUCN:CR	Critically Endangered
IUCN:DD	Data Deficient
IUCN:EN	Endangered
IUCN:LC	Least Concern
IUCN:NT	Near Threatened
IUCN:VU	Vulnerable

Marine Mammal Commission

MMC:SSC	Species of Special Concern

National Marine Fisheries Service

NMFS:SC	Species of Special Concern

U.S Forest Service

USFS:S	Sensitive

Western Bat Working Group

WBWG: H	High priority
WBWG: LM	low-medium priority
WBWG: M	medium priority
WBWG: MH	medium-high priority

Xerces Society Red List

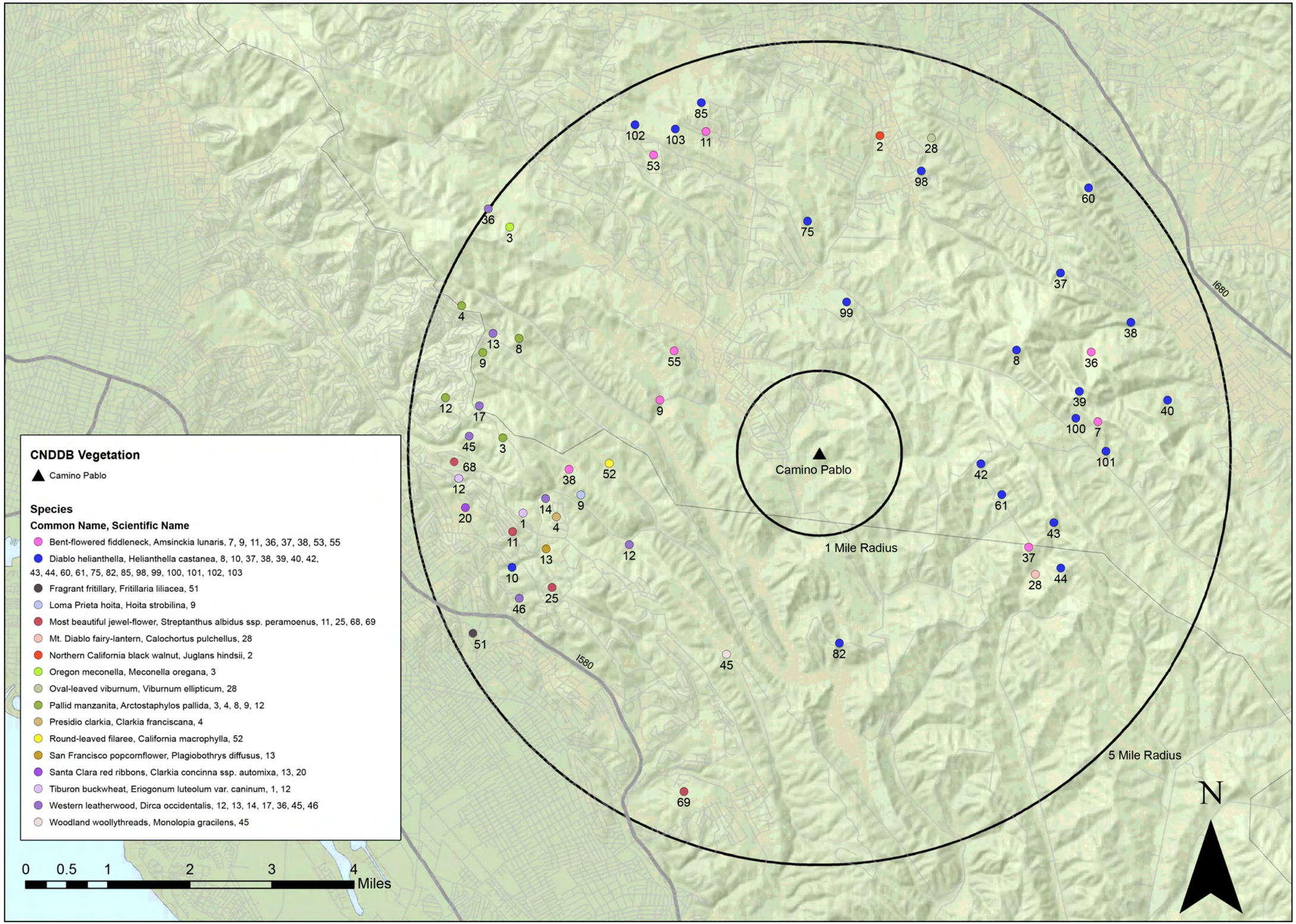
X: CI	Critically imperiled
X: DD	Data deficient
X: IM	Imperiled
X: VU	Vulnerable

American Bird Conservancy

ABC: WLBBC	US Watchlist of Birds of Conservation Concern

American Fisheries Society

AMS: E	Endangered
AMS: T	Threatened
AMS: V	Vulnerable



ZENTNER and ZENTNER
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95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 ax: 510.622.8116

FIGURE 3
CNDDB VEGETATION ANALYSIS

REVISIONS:	BY:

CAMINO PABLO
MORAGA, CALIFORNIA

SOURCE:
GIS CNDDB DECMEBER DATA

FILE:
F:\1000-1100\1004 Camino Pablo

DATE:
12/18/2013

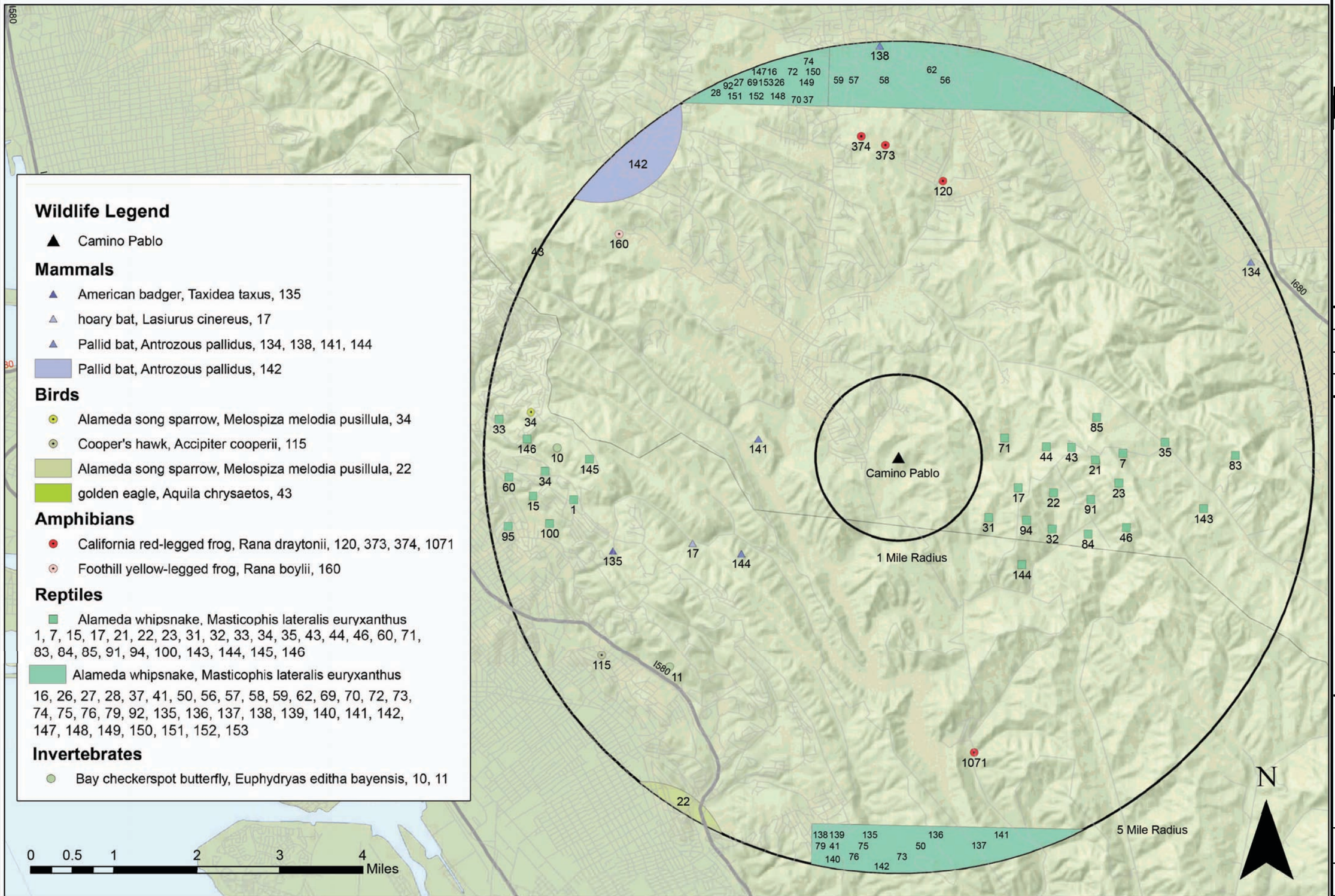

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FIGURE 4
CNDDB WILDLIFE ANALYSIS

REVISIONS:	BY:

CAMINO PABLO
MORAGA, CALIFORNIA

SOURCE:
GIS CNDDB DECMEBER DATA

FILE:
F:\1000-1100\1004 Camino Pablo

DATE:
12/18/2013

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CAMINO PABLO

SECTION 404 JURISDICTIONAL DELINEATION

Project No.:
1004 DPL

Zentner and Zentner

Oakland

Prepared for:
Dobbins Properties, LLC

Issued:
March 2015

Land Planning and Restoration

Project Name:

Camino Pablo

Owner/Project Proponent:

Dobbins Properties, LLC.
1901 West Kettleman Lane, Suite 102
Lodi, CA 95242

Jurisdictional Delineation By:

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Field Assessments:

Sean Micallef, Partner/Chief Ecologist
Nancy Banh-Boudreau, Ecological Designer/Project Manager
John Zentner, Principal

April 2014 and February 2015

Camino Pablo

Jurisdictional Delineation

I. INTRODUCTION

A. Purpose

This report and accompanying map of the Camino Pablo property (hereafter referred to as the "project site") in Contra Costa County, present a delineation of jurisdictional "waters of the U.S." As defined in the Clean Water Act, "waters of the U.S." include coastal waters, rivers, streams (including intermittent streams), lakes, ponds, and wetlands. Any discharge of fill or dredged material into waters of the U.S. is subject to regulation by the Army Corps of Engineers ("Corps") under Section 404 of the Clean Water Act.

B. Location

The Camino Pablo property is in south-central Contra Costa County on the southern outskirts of the Town of Moraga (*Figure 1*). Access is via Camino Pablo. Camino Pablo and Sanders Ranch form the site's western border. The southern border abuts the Moraga Highlands subdivision while the eastern border is undeveloped open space; parts of which are owned by East Bay Municipal Utility District (EBMUD). The Site's APN is 258-290-023 and the street address is 1211 Camino Pablo.

C. Site Description

The site consists of a roughly triangular-shaped property bounded by streets and subdivisions on the west and south and undeveloped open space on the east. The site is approximately 24 acres and is almost entirely a heavily grazed, grassland-dominated ridge trending north-south and adjacent slopes. Vegetation is dominated almost completely by non-native annual grasslands, reflecting the grazing regime.

1. Topography

The site is centered on a ridge that runs from north to south and is slightly curved west. The topographic high is approximately 702 feet and the low is about 574 feet.

2. General Soil Types

The Camino Pablo site is composed almost entirely of Los Osos Clay loam at a slope of 15-30 % (LhE). There may be a small amount of Conejo clay loam at 2 to 5% slopes (CeB) at the most southern tip of the property.

Los Osos clay loam is a hilly, upland soil with good drainage. It is underlain by soft, fine-grained sandstone and shale. Vegetation includes annual grasses, forbs, and oaks, as well as thick shrub in few areas. Permeability is slow and the available water capacity is 4 to 7 inches. Root depth can penetrate 24 to 40 inches into the profile. This series is commonly used for range, wildlife habitat, watershed, and urban structures. LhE in particular is used for rangeland, likely due to a moderate hazard of erosion when the soil is bare as well as medium runoff issues. Los Osos clay loam is not on the list of hydric soils of California (NRCS 2014).

CeB is a gently sloping soil in upland valley areas. Vegetation is commonly annual grasses and a few oaks and sycamores. Permeability is slow and roots can penetrate more than 60 inches deep. Runoff issues and erosion are slight even where soil is tilled and exposed.

3. Major Vegetation Types or Habitats On-Site

The site primarily consists of upland grassland habitats, but also includes seasonal wetlands and drainages jurisdictional as "other waters". The uplands are dominated by non-native grasses and forbs and dominated by Italian ryegrass (*Festuca perennis*), ripgut brome (*Bromus diandrus*), foxtail barley (*Hordeum murinum*), wild oats (*Avena fatua),* and redstem filaree (*Erodium cicutarium*).

The eroded drainages are sparsely vegetated by a similar mix of vegetation as the grasslands. There is an individual willow (*Salix sp.*) present in the largest jurisdictional waterway. The seasonal wetlands also contain a similar mix of the non-native grass species mentioned above, though one seasonal wetland area contains a sparse population of iris-leaved rush (*Juncus xiphioides*).

4. Observations on the Current and Historical Uses of the Property

The Camino Pablo site is currently a grazed ranchland and has been used as ranchland for many decades.

5. Ecological Setting

The site comprises of a portion of a relatively steep, rolling ridge that runs north to south. The watershed of the site consists of primarily of ephemeral waterways in the drainages of the slopes. Water on the west side of the property is intercepted at roadside drainages along Camino Pablo Blvd. Existent concrete v-ditches run northeast to southwest along Sanders Ranch Rd. There are approximately 2,180 linear feet of v-ditch adjacent to the property, with 483 linear feet actually within the property. From the site, the drains connect with Moraga Creek and become part of the greater San Leandro watershed. Moraga Creek flows into the Upper San Leandro Reservoir, and then into San Leandro Creek, which exits to the bay at Arrowhead Marsh, between the Oakland Airport and Alameda.

Erosion is prevalent across the site due to the history of grazing and is apparent in minor slumps and bank erosion in the jurisdictional waterways onsite. Small seasonal wetlands occur in a only a couple of locations on the property, both at the base of the largest jurisdictional waterway and at the base of a wide drainage at a higher elevation. Two jurisdictional waterways occur on the site, as noted by the appearance of bed and bank.

Photo 1: View of the site's annual grasslands from the western side of the ridge looking east and downslope. April 14, 2014.

II. JURISDICTIONAL DELINEATION

A. Introduction

As defined by the Army Corps of Engineers (Corps), "wetlands" are areas periodically or permanently saturated by surface or groundwater and typically support vegetation adapted to life in saturated (hydric) soil. Wetlands are recognized as important features on a regional and national level due to their high inherent value to fish and wildlife, use as storage areas for storm and floodwaters, promotion of groundwater recharge, and their water filtration and purification functions. "Other waters" include tributaries or drainage ditches which exhibit perennial or ephemeral flow to a navigable waterway, wetland, or other significant water feature. Other waters may not necessarily be wetlands.

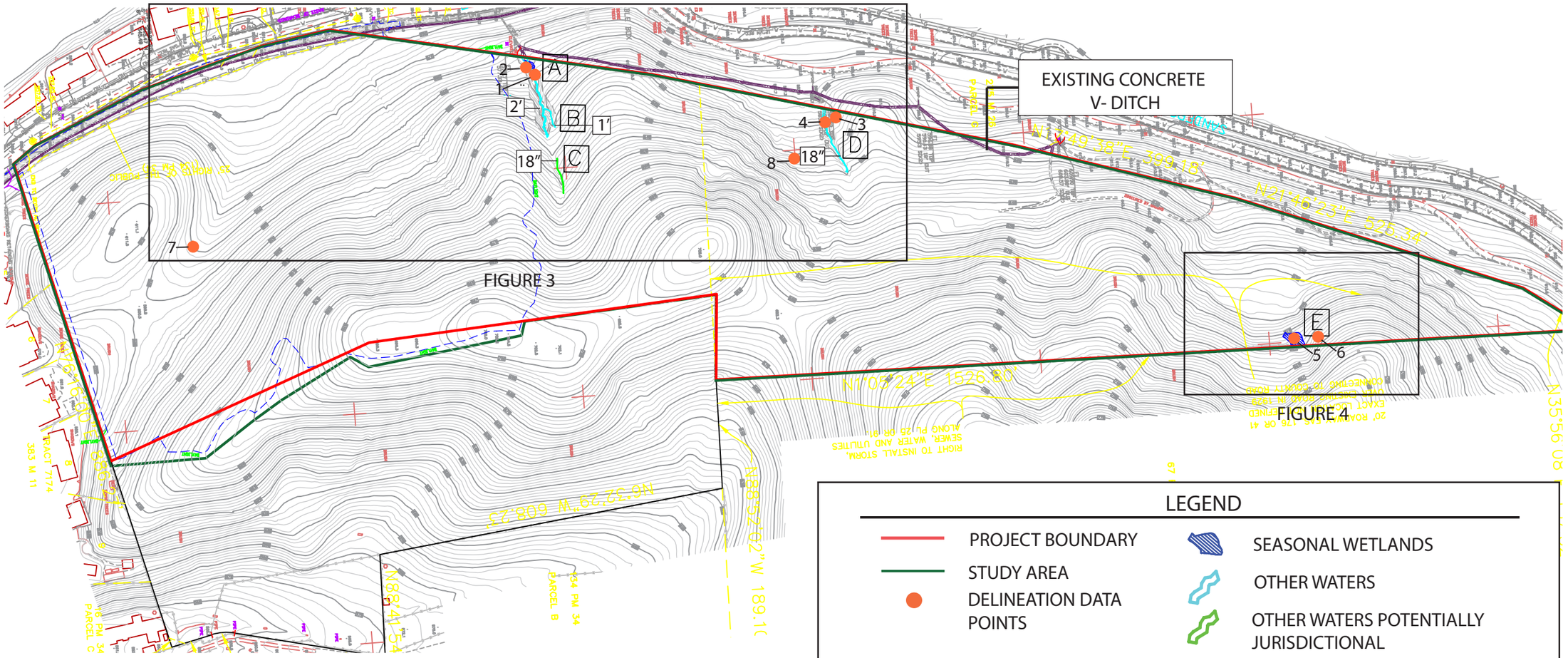
B. Methods

Boundaries between jurisdictional areas and uplands were investigated using the routine on-site assessment procedure, Section D, Subsection 2, page 57 of the 1987 "Corps of Engineers Wetlands Delineation Manual" (Environmental Laboratory 1987; hereafter the "Delineation Manual") as modified by the new Interim Arid West Supplement to the Delineation Manual (Environmental Laboratory 2006; hereafter the AWS). Dominant plant species, soil characteristics, and hydrology indicators were noted within a 10-foot by 10-foot plot at each sample point (Appendix A contains delineation data sheets and *Figures 2 through 4* contain draft jurisdictional delineation maps). Wetlands were distinguished from uplands on this site by the presence of: 1) hydrophytic vegetation, 2) wetland hydrology, and 3) hydric soils (defined below). Data point(s) were mapped onto a 1-inch to 200-foot scale map (Figure 2) and detailed areas are shown in *Figures 3 and 4*.

1. Hydrophytic Vegetation

Hydrophytic vegetation is dominated by plant species that can tolerate prolonged inundation or soil saturation during the growing season. More than 50% of the dominant species must be wetland indicators of FAC, FACW and OBL or outweigh them using a prevalence index for the vegetation to be considered hydrophytic. These wetland indicators, or hydrophytes, are listed in the Delineation Manual as OBL, FACW, and FAC. Other plants are listed as FACU or NI, and unlisted plants are considered as UPL. These abbreviations are defined as follows:

OBL	Obligate Wetland Plants	Plants that occur over 99% of the time in wetlands



LEGEND

- PROJECT BOUNDARY
- STUDY AREA
- DELINEATION DATA POINTS
- SEASONAL WETLANDS
- OTHER WATERS
- OTHER WATERS POTENTIALLY JURISDICTIONAL

SECTION 404 JURISDICTIONAL AREAS

HABITAT TYPE	ACRES	LINEAR FT.
A. Seasonal Wetlands	0.005	
B. Other Waters	0.010	197.19
C. Other Waters Potentially Jurisdictional	0.002	64.94
D. Other Waters	0.006	121.11
E. Seasonal Wetlands	0.014	
TOTALS	**ACRES**	**LINEAR FT.**
Other Waters	0.016	383.24
Seasonal Wetlands	0.019	
Other Waters Potentially Jurisdictional	0.002	
TOTAL JURISDICTIONAL AREAS	**ACRES**	**LINEAR FT.**
	0.037	383.24

DISCLAIMER: SECTION 404 JURISDICTIONAL MAP

This map exhibits conditions on the site at the time of completion of the delineation. For various reasons, conditions on a site may change, which may affect site wetlandboundaries. Delineation maps generally expire five years after approval by the U.S. ArmyCorps of Engineers (Corps). Because regulations governing delineations are subject to change, this map should be reviewed by a qualified wetland consultant to ensure accuracy if not submitted to the Corps within six (6) months of preparation.

Field Work By: Zentner and Zentner, 04.14.2014, 02.10.2015

ZENTNER and ZENTNER
Land Planning and Restoration
95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 ax: 510.622.8116

FIGURE 2
JURISDICTIONAL DELINEATION MAP

REVISIONS:	BY:
ORIGINAL 2.24.15	NBB
2.26.15	NBB

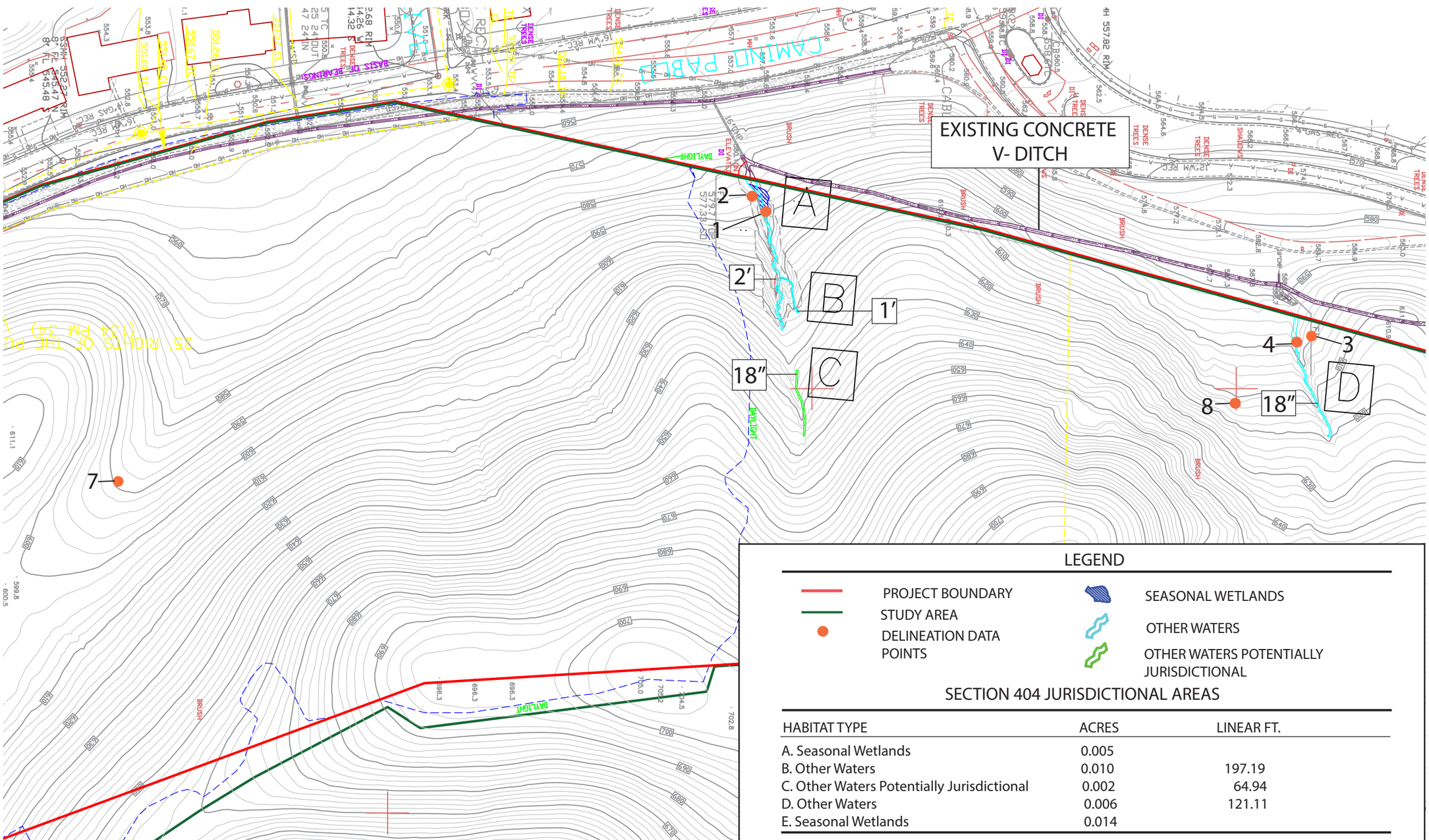
1004 CAMINO PABLO
1211 CAMINO PABLO
MORAGA, CA
94556

North
0 100' 200'
SCALE: 1" = 200'

SOURCE: D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\CAD Drawings

FILE: D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\Adobe 1004 New Fig 2_ Jurisdictional Delineation_02.26.2015

DATE: 02.26.15



LEGEND

- PROJECT BOUNDARY
- STUDY AREA
- DELINEATION DATA POINTS
- SEASONAL WETLANDS
- OTHER WATERS
- OTHER WATERS POTENTIALLY JURISDICTIONAL

SECTION 404 JURISDICTIONAL AREAS

HABITAT TYPE	ACRES	LINEAR FT.
A. Seasonal Wetlands	0.005	
B. Other Waters	0.010	197.19
C. Other Waters Potentially Jurisdictional	0.002	64.94
D. Other Waters	0.006	121.11
E. Seasonal Wetlands	0.014	

TOTALS	ACRES	LINEAR FT.
Other Waters	0.016	383.24
Seasonal Wetlands	0.019	
Other Waters Potentially Jurisdictional	0.002	

TOTAL JURISDICTIONAL AREAS	ACRES	LINEAR FT.
	0.037	383.24

DISCLAIMER: SECTION 404 JURISDICTIONAL MAP

This map exhibits conditions on the site at the time of completion of the delineation. For various reasons, conditions on a site may change, which may affect site wetlandboundaries. Delineation maps generally expire five years after approval by the U.S. Army Corps of Engineers (Corps). Because regulations governing delineations are subject to change, this map should be reviewed by a qualified wetland consultant to ensure accuracy if not submitted to the Corps within six (6) months of preparation.

Field Work By: Zentner and Zentner, 04.14.2014, 02.10.2015

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Land Planning and Restoration
95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 ax: 510.622.8116

FIGURE 3
JURISDICTIONAL MAP
AREAS A - D

REVISIONS:	BY:
ORIGINAL 2.26.15	NBB

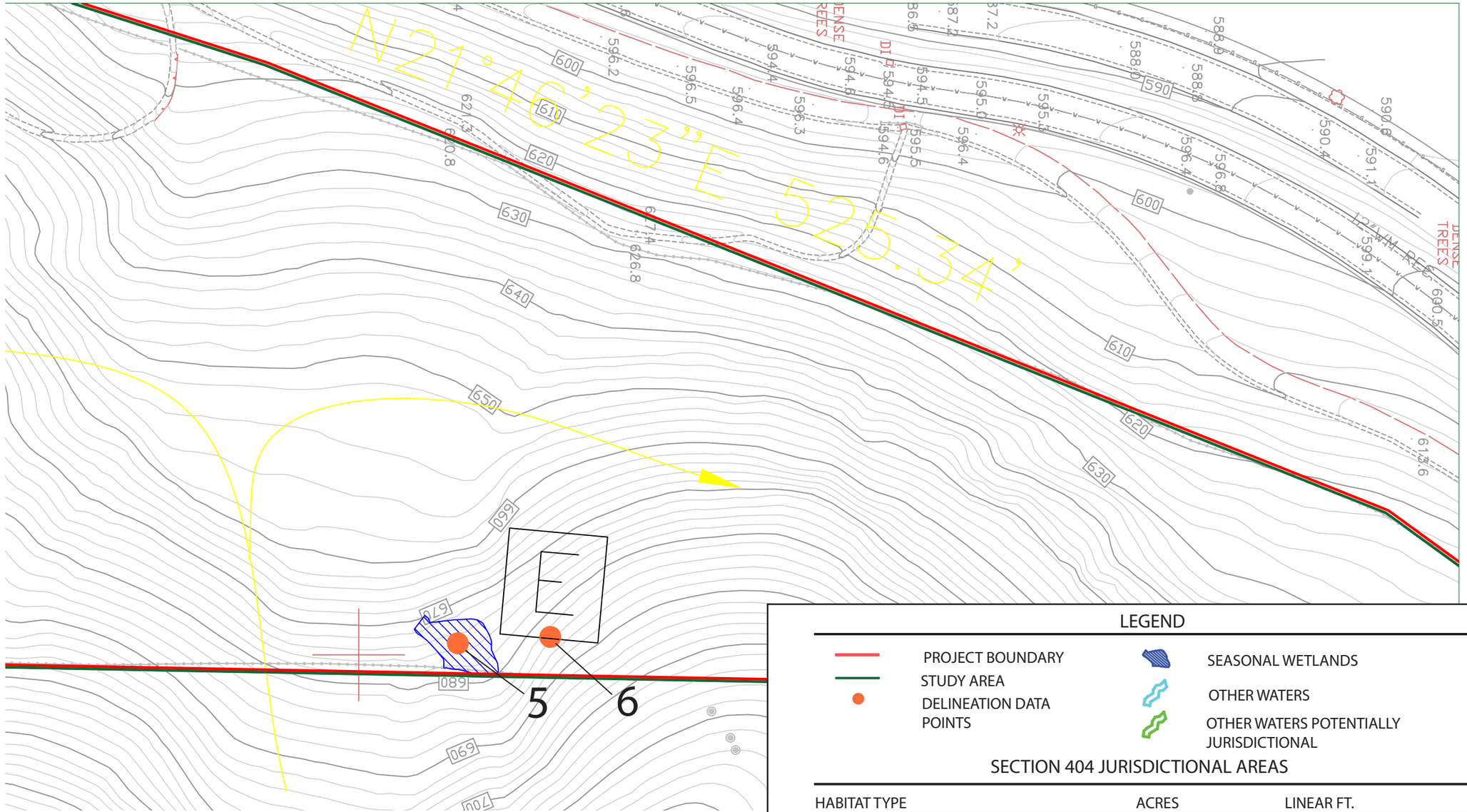
1004 CAMINO PABLO
1211 CAMINO PABLO
MORAGA, CA
94556

North
0 50' 100'
SCALE: 1" = 100'

SOURCE: D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\CAD Drawings

FILE: D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\Adobe 1004 New Fig 3_ Jurisdictional Delineation_02.26.2015

DATE: 02.26.15



LEGEND

- PROJECT BOUNDARY
- STUDY AREA
- DELINEATION DATA POINTS
- SEASONAL WETLANDS
- OTHER WATERS
- OTHER WATERS POTENTIALLY JURISDICTIONAL

SECTION 404 JURISDICTIONAL AREAS

HABITAT TYPE	ACRES	LINEAR FT.
A. Seasonal Wetlands	0.005	
B. Other Waters	0.010	197.19
C. Other Waters Potentially Jurisdictional	0.002	64.94
D. Other Waters	0.006	121.11
E. Seasonal Wetlands	0.014	

TOTALS	ACRES	LINEAR FT.
Other Waters	0.016	383.24
Seasonal Wetlands	0.019	
Other Waters Potentially Jurisdictional	0.002	

TOTAL JURISDICTIONAL AREAS	ACRES	LINEAR FT.
	0.037	383.24

DISCLAIMER: SECTION 404 JURISDICTIONAL MAP

This map exhibits conditions on the site at the time of completion of the delineation. For various reasons, conditions on a site may change, which may affect site wetlandboundaries. Delineation maps generally expire five years after approval by the U.S. Army Corps of Engineers (Corps). Because regulations governing delineations are subject to change, this map should be reviewed by a qualified wetland consultant to ensure accuracy if not submitted to the Corps within six (6) months of preparation.

Field Work By: Zentner and Zentner, 04.14.2014, 02.10.2015

ZENTNER and ZENTNER
Land Planning and Restoration
95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 ax: 510.622.8116

FIGURE 4
JURISDICTIONAL MAP
AREA E

REVISIONS:	BY:
ORIGINAL 2.26.15	NBB

1004 CAMINO PABLO
1211 CAMINO PABLO
MORAGA, CA
94556

North

0 25' 50

SCALE: 1" = 50'

SOURCE:
D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\CAD Drawings

FILE:
D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\Adobe 1004 New Fig 4_ Jurisdictional Delineation_02.26.2015

DATE: 02.26.15

FACW	Facultative Wetland Plants	Plants that occur 67% to 99% of the time in wetlands
FAC	Facultative Plants	Plants likely to occur 33% to 67% of the time in wetlands
FACU	Facultative Upland Plants	Plants that occur 1% to 33% of the time in wetlands, but which occur more frequently in uplands
NI	Non-indicator plants	These must be checked against the National Indicator List and could be changed to a wetter or drier status
UPL	Upland Plants	Plants that occur less than 1% of the time in wetlands

Note: The 3 facultative categories are subdivided by (+) and (-) modifiers. FAC+ species are considered to be wetter (have a greater estimated probability of occurring in wetlands) than FAC species. FAC- species are considered to be drier (have a lesser estimated probability of occurring in wetlands) than FAC species.

2. Hydric Soils

Hydric soils develop under the low oxygen conditions typical of prolonged inundation or saturation, and generally show visible indications of chemical reduction. The hydric nature of a soil is most often indicated by low matrix chromas of 0 to 1, or 2 with mottles, and is determined by comparing the wetted soil with Munsell Soil Color Charts. The hydric nature of a soil may also be indicated by the presence of manganese or iron nodules, or other more subtle characteristics.

3. Wetland Hydrology

Common wetland hydrology indicators demonstrate inundation or saturation and include observations of standing water, saturated soils, algal mats, water-matted detritus, and water stains on rocks or other objects. In evaluating these hydrology indicators some attention must be given to the frequency and duration of inundation, and the effects of recent weather, unusual flooding and climatic fluctuations. According to the AWS, an area must have "14 or more days of flooding or ponding or a water table 12 inches (30 centimeters) or less below the soil surface, during the growing season at a minimum frequency of 5 years in 10 (50 percent or higher probability)" to satisfy the hydrology standard. The old standard (US Army Corps 1987 Manual) was that an area must have ponding for 5% of the growing season (18 days in California) or a water table at a depth equal to 80% of the root mass.

4. Other Waters

The Corps also regulates "other waters tributary to waters of the U.S." Boundaries between uplands and other waters are determined based on water elevations and geomorphic features. In freshwater conditions, the boundary between uplands and other waters is the ordinary high water mark (OHWM). In tidal conditions, the boundary is set by the high tide line, roughly equivalent to mean high water.

Photo 2: View of ephemeral channel B with a small willow and upland grassland vegetation. April 14, 2014.

C. Results

The majority of the site is uplands, composed primarily of grasslands. Jurisdictional areas total 0.037 acres and included two small seasonal wetlands and 'other waters'. The jurisdictional areas are shown in *Figures 2 through 4*.

1. Jurisdictional Areas

a. Other Waters

Total Area: 0.018 acres
(Including 0.002 acres of potentially jurisdictional area)
Areas: B, D, and C (potentially jurisdictional)

Two small drainages lie near the western edge of the site. These sparsely vegetated and eroded channels carry ephemeral runoff into an existing concrete V-ditch, which eventually drain into Moraga Creek. The southern channel is broken in two, with the upper portion (Area C) not connecting to the lower (Area B) and separated by a relatively broad stretch of unbroken grassland, though likely connecting hydrologically. While a lone willow grows in Channel B, the eroded channels contain little vegetation (mainly upland grasses and forbs along the bank) and are not wetlands. The channels do contain bed and banks and were delineated to the OHWM.

While channel D connects directly into the concrete v-ditch, channel B drains to a very small seasonal wetland (Area A) at its base just above the v-ditch.

b. Seasonal Wetland

Total Area: 0.019 acres
Areas: A, and E
Data Points: 1 and 5

The two small seasonal wetlands onsite occur at the base of drainages. Area A is a very small seasonal wetland at the base of drainage B. It is relatively sparsely vegetated with primarily FAC vegetation amongst iris-leaved rush (*Juncus xiphiodes*; OBL). Area E is a seasonal seep below a drainage slump. Surface saturation and a small amount of surface water was observed during the 2014 drought year in April, while more water was present in February 2015.

i. Vegetation

The vegetation of the seasonal wetlands is dominated by FAC vegetation, primarily Italian ryegrass. Iris-leaved rush (OBL) was also observed in the Area A wetland, with hydrophytes exceeding 50% of the dominants. In Area E, Italian ryegrass was the primary vegetation, with little else, though sampling was completed during a drought year and vegetation could have been suppressed. Hydrophytes were the dominant vegetation in Area E.

Table 1 below lists the common and occasional dominants of the seasonal wetlands.

Table 1
Seasonal Wetland Vegetation

Common Name	***Scientific Name***	***Regional Indicator***
Common Dominants		
Italian ryegrass	*Festuca perennis*	FAC
iris-leaved rush	*Juncus xiphioides*	OBL
soft chess brome	*Bromus hordeaceus*	FACU
Occasional Dominants		
Mediterranean barley	*Hordeum marinum*	FAC
white sweet clover	*Trifolium repens*	FACU

ii. Soils

The site soils are Los Osos clay loams, which are not on the list of hydric soils. However, the soils at sample point 5 in Area E were dark to slightly gleyed with a color of 2.5YR 3/0, indicating yearly prolonged saturation. The soil showed a slight presence of reduced iron in the soil with slight root oxidation in the upper 2-inches. The soils in sample point 1 (Area A) were primarily silts brought down by the eroded channel above.

iii. Hydrology

Both of the areas are seasonally inundated and are at the base of erosion features. Area A is a small depression that holds water for an extended period after water has stopped flowing in the channel. The extended saturation and slight gleying of soils in Area E, even in drought conditions indicate the presence of a seep. Water appears to trickle through this area for many weeks to months after relatively heavy rainfall.

2. Non-jurisdictional Areas

a. Grassland

Data Points: 2, 3, 4, 6, 7, and 8

Most of the site is annual grassland containing non-native, upland grasses and forbs. There was no evidence of hydrologic indicators in most of the upland grassland areas.

i. Vegetation

The grasslands are dominated by UPL plants with some FAC and FACU vegetation. Upland vegetation generally exceeded hydrophytes by a 3:1 margin or more in the annual grasslands.

The common dominants of the grassland are provided in Table 2 below

Photo 3: View of the grassland with a portion of the concrete v-ditch. April 14, 2014.

Table 2
Grassland Vegetation

Common Name	***Scientific Name***	***Regional Indicator***
Common Dominants		
red-stem filaree	*Erodium cicutarium*	UPL
soft chess	*Bromus hordeaceus*	FACU
Italian ryegrass	*Festuca perennis*	FAC
Occasional Dominants		
Wild oats	*Avena fatua*	UPL
white clover	*Trifolium repens*	FACU
rose clover	*Trfolium hirtum*	UPL
ripgut	*Bromus diandrus*	UPL

ii. Soils

In general, the upland soils were found to by clay loams with a color of 2.5YR 4/2. These are relatively dark but loamy soils. The soil at some of the data points had inclusions of both lighter and darker mottles.

iii. Hydrology

All of the sample locations, except for data point 8, in the annual grasslands failed the hydrology criteria with no ponded water, saturation or evidence of wetland hydrology during the surveys.

The area surrounding data point 8, which is on a relatively steep slope, was dry during the April 2014 surveys, but was saturated after heavy rains in February 2015. The lack of hydric vegetation indicate that while some water trickles through the area after extended heavy rains, it normally does not hold water long enough to support hydric vegetation.

References

SCS. 1977. Soil Survey of Contra Costa County, California.

NRCS, 1986 (updated 2010). Hydric Soils of California, Soil Conservation Service, USDA.

Appendix A

Wetland Delineation Data Sheets

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Camino Pablo City/County: Moraga/Contra Costa Sampling Date: 4/14/14

Applicant/Owner: Dossins Properties, LLC State: CA Sampling Point: 1

Investigator(s): Sean Micallef & Jessie Olson Section, Township, Range: _____

Landform (hillslope, terrace, etc.): Hillslope Local relief (concave, convex, none): Concave Slope (%): 2%

Subregion (LRR): _____ Lat: 37.8135979°N Long: 122.115073°W Datum: _____

Soil Map Unit Name: Los Osos Clay Loam NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.) Drought

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No ____
Hydric Soil Present?	Yes X	No ____
Wetland Hydrology Present?	Yes X	No ____

Is the Sampled Area within a Wetland? Yes X No ____

Remarks: Seasonal Wetland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	____ = Total Cover		

Sapling/Shrub Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
5.			
	____ = Total Cover		

Herb Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1. Juncus xiph	15	Y	OBL
2. Plantago lanceolata	2	/	FAC
3. Hordeum marinum	10	Y	FAC
4. Erodium cicutarium	2	/	UPL
5. Festuca (Lolium) perennis	60	Y	FAC
6. Trifolium (Lupinus) fepens	10	Y	FACU
7. Geranium dissectum	2	/	UPL
8. Trif hirtum	2	/	
	103 = Total Cover		

Woody Vine Stratum (Plot size: ____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
	____ = Total Cover		

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species	15	x 1 =	15
FACW species		x 2 =	
FAC species	70	x 3 =	210
FACU species	10	x 4 =	40
UPL species		x 5 =	
Column Totals:	95 (A)		265 (B)

Prevalence Index = B/A = 2.79

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks: Very Small Seasonal Wetland at bottom of Channel

SOIL

Sampling Point: 1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
10"	10YR 3/1						Silty Clay	with lots of Sediment

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

Mostly Silts from Erosion in Channel above wetland

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- X Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No X Depth (inches): _____

Water Table Present? Yes ___ No X Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): _____

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Bottom portion of Ephemeral channel
is a very small seasonal wetland

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Camino Pablo City/County: Moraga / Contra Costa Sampling Date: 4/14/14

Applicant/Owner: Dobbins Properties, LLC State: _____ Sampling Point: 2

Investigator(s): Sean M, Jessie D Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No _____	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No _____	
Wetland Hydrology Present?	Yes _____	No _____	

Remarks:

Upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Erodium cic	60	Y	UPL
2. Bromus diandrus	10	Y	UPL
3. Bromus hordeaceus	30	Y	FACU
4. Lolium	15	Y	FAC
5. Hordeum marinum	10	Y	FAC
6.			
7.			
8.			
	125 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	25	x 3 = 75
FACU species	30	x 4 = 120
UPL species	70	x 5 = 350
Column Totals:	125 (A)	545 (B)

Prevalence Index = B/A = 4.36

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

Upland Vegetation Dominant

SOIL

Sampling Point: 2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
10	2.5YR 4/2						Silty clay loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

No Soil Indicators

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No indicators

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Camino Pablo City/County: Moraga / Contra Costa Sampling Date: 4/14/14

Applicant/Owner: Dobbins Properties, LLC State: _____ Sampling Point: 3

Investigator(s): Sean M, Jessie D Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

Upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)			
1. Erodium cic	40	Y	UPL
2. Avena fatua	5	—	UPL
3. Plantago lanceolata	10	Y	FAC
4. Vicia Sativa	2.5	—	FACU
5. Lolium	25	Y	FAC
6. Bromus hordeaceus	25	Y	FACU
7.			
8.			
	107.5 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 5 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 40 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	—	x 1 =
FACW species	—	x 2 =
FAC species	35	x 3 = 105
FACU species	25	x 4 = 100
UPL species	40	x 5 = 200
Column Totals:	100 (A)	405 (B)

Prevalence Index = B/A = 4

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

Upland Vegetation is dominant

SOIL

Sampling Point: 3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
7	2.5YR 4/2						Silty clay	
								Some
								lighter & darker
								mottles

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

No Soil indicators

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrologic indicators

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Camino Pablo City/County: Moraga, Contra Costa Sampling Date: 4/14/14

Applicant/Owner: Dobsins Properties, LLC State: CA Sampling Point: 4

Investigator(s): Sean Micallef, Jessie Olson Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation X, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

Upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)			
1. Geranium circutarium	10%	Y	UPL
2. Festuca perennis	25%	Y	FAC
3. Bromus hordeaceus	40%	Y	FACU
4. Trifolium repens	10%	Y	FACU
5. Erodium dissectum	2%	—	UPL
6. Glyceria triticoides	3%	—	FAC
7. Picris echioides	2%	—	FACU
8. Medicago polymorpha	1%	—	FACU
Trifolium hirtum	1%		UPL
	100% = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 25% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species	25	x 3 = 75
FACU species	58	x 4 = 232
UPL species	10	x 5 = 50
Column Totals:	93 (A)	357 (B)

Prevalence Index = B/A = 3.6

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

Upland Vegetation dominates

SOIL

Sampling Point: 4

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
7	2.5YR	4/2					Clay-y silt	lighter & darker mottles

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

No indicators

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No indicators

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Camino Pablo City/County: Moraga, Contra Costa Sampling Date: 4/14/14

Applicant/Owner: Dobbins Prop LLC State: CA Sampling Point: 5

Investigator(s): Sean M, Jessie O Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes X	No _____	**Is the Sampled Area within a Wetland?** Yes X No _____
Hydric Soil Present?	Yes X	No _____	
Wetland Hydrology Present?	Yes X	No _____	

Remarks: Seasonal Wetland Seep

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Lolium (Festuca Perennis)	100	Y	FAC
2. Brassica Nigra	<1%	N	
3. Medicago polymorpha	<1%	N	
4.			
5.			
6.			
7.			
8.			
	_____ = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species	100	x 3 =	300
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	100 (A)		300 (B)

Prevalence Index = B/A = 3

Hydrophytic Vegetation Indicators:

X Dominance Test is >50%

X Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No _____

Remarks: Marginal – As Lolium in primary vegetation. Wetland vegetation possibly suppressed by persistent drought conditions

SOIL

Sampling Point: 5

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
10"	2.5 YR 3/0						Silty Clay	
								Slightly gleyed
								v. Slight root redox in
								upper 2"
								- Slight presence of
								reduced iron in soil

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: ___

Depth (inches): ___

Hydric Soil Present? Yes X No ___

Remarks:

Wetland indicators are present

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**) v. Slight
- ___ Drift Deposits (B3) (**Nonriverine**) Slight
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- X Biotic Crust (B12) Algae in cattle prints
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- X Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): ½" ≈ 3" in cattle prints

Water Table Present? Yes X No ___ Depth (inches): Seep

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): ___

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Seasonal Seep hydrology present

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Camino Pablo City/County: Moraga, Contra Costa Sampling Date: 4/14/14

Applicant/Owner: Dobbins Prop LLC State: _____ Sampling Point: 6

Investigator(s): Sean M, Jessie O Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

Upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Avena fatua	35	Y	UPL
2. Erodium cic	40	Y	UPL
3. Collum	10	Y	FAC
4. Medicago polymorpha	1	—	FACU
5. Sonchus asper	1	—	FAC
6. Hordeum murinum	5	—	FACU
7.			
8.			
	92 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	_____	x 1 = _____
FACW species	_____	x 2 = _____
FAC species	11	x 3 = 33
FACU species	6	x 4 = 24
UPL species	75	x 5 = 375
Column Totals:	92 (A)	432 (B)

Prevalence Index = B/A = 4.75

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

Upland Vegetation is dominant

SOIL

Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
10	2.5YR 4/2						Silty clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

No indicators

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No indicators

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Camino Pablo City/County: Moraga / Contra Costa Sampling Date: 4/14/14

Applicant/Owner: Dobbins Pray LLC State: _____ Sampling Point: 7

Investigator(s): Sean M & Jessie D Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes _____	No X	
Wetland Hydrology Present?	Yes _____	No X	

Remarks:

Upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		
Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		
Herb Stratum (Plot size: _____)			
1. Bromus hordeaceus	45	Y	FACU
2. Erodium cicutarium	10	Y	UPL
3. Convolvulus arvensis	7	~~N~~	UPL
4. Lolium (Festuca perennis)	3.5	Y	FAC
5. Medicago polymorpha	1	~~N~~	FACU
6.			
7.			
8.			
	98 = Total Cover		
Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum _____ % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	—	x 1 =
FACW species	—	x 2 =
FAC species	35	x 3 = 105
FACU species	46	x 4 = 184
UPL species	17	x 5 = 85
Column Totals:	98 (A)	374 (B)

Prevalence Index = B/A = 3.82

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

Upland vegetation dominates

SOIL

Sampling Point: _____

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
10"	2.5 YR 4/2						Silty Clay Loam	

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes _____ No X

Remarks:

No indicators

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes _____ No _____ Depth (inches): _____

Water Table Present? Yes _____ No _____ Depth (inches): _____

Saturation Present? (includes capillary fringe) Yes _____ No _____ Depth (inches): _____

Wetland Hydrology Present? Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No indicators

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Camino Pablo City/County: Moraga/Contra Costa Sampling Date: 2/10/15

Applicant/Owner: Dobbins Properties LLC State: _____ Sampling Point: 8

Investigator(s): Sean M & Nancy Bayh-Boudreau Section, Township, Range: _____

Landform (hillslope, terrace, etc.): _____ Local relief (concave, convex, none): _____ Slope (%): _____

Subregion (LRR): _____ Lat: _____ Long: _____ Datum: _____

Soil Map Unit Name: _____ NWI classification: _____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No _____ (If no, explain in Remarks.)

Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____

Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present?	Yes _____	No X	**Is the Sampled Area within a Wetland?** Yes _____ No X
Hydric Soil Present?	Yes ✓	No _____	
Wetland Hydrology Present?	Yes ✓	No _____	

Remarks:

Mesic Upland

VEGETATION – Use scientific names of plants.

Tree Stratum (Plot size: _____)	Absolute % Cover	Dominant Species?	Indicator Status
1.			
2.			
3.			
4.			
	_____ = Total Cover		

Sapling/Shrub Stratum (Plot size: _____)			
1.			
2.			
3.			
4.			
5.			
	_____ = Total Cover		

Herb Stratum (Plot size: _____)			
1. Xanthium Spinosum	5	~~N~~	FACU
2. Geranium dissectum	7	~~N~~	UPL
3. Rumex crispus	3	~~N~~	FAC
4. Festuca perennis	30	Y	FAC
5. Cirsium vulgare	10	Y	UPL
6. Bromus hordeaceus	10	Y	FACU
7.			
8.			
	65 = Total Cover		

Woody Vine Stratum (Plot size: _____)			
1.			
2.			
	_____ = Total Cover		

% Bare Ground in Herb Stratum 35 % Cover of Biotic Crust _____

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	_____	x 1 = _____
FACW species	_____	x 2 = _____
FAC species	33	x 3 = 99
FACU species	15	x 4 = 60
UPL species	17	x 5 = 85
Column Totals:	65 (A)	244 (B)

Prevalence Index = B/A = 3.75

Hydrophytic Vegetation Indicators:

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes _____ No X

Remarks:

Upland Vegetation is dominant

SOIL

Sampling Point: 8

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Features Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
10"	10YR 3/2						Clay loam	Very slight root oxidation

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

Indicators for Problematic Hydric Soils[3]:

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if present):

Type: _____

Depth (inches): _____

Hydric Soil Present? Yes X No ___

Remarks:

light root oxidation

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

In cattle foot prints

Surface Water Present? Yes X No ___ Depth (inches): _____

Water Table Present? Yes ___ No ___ Depth (inches): _____

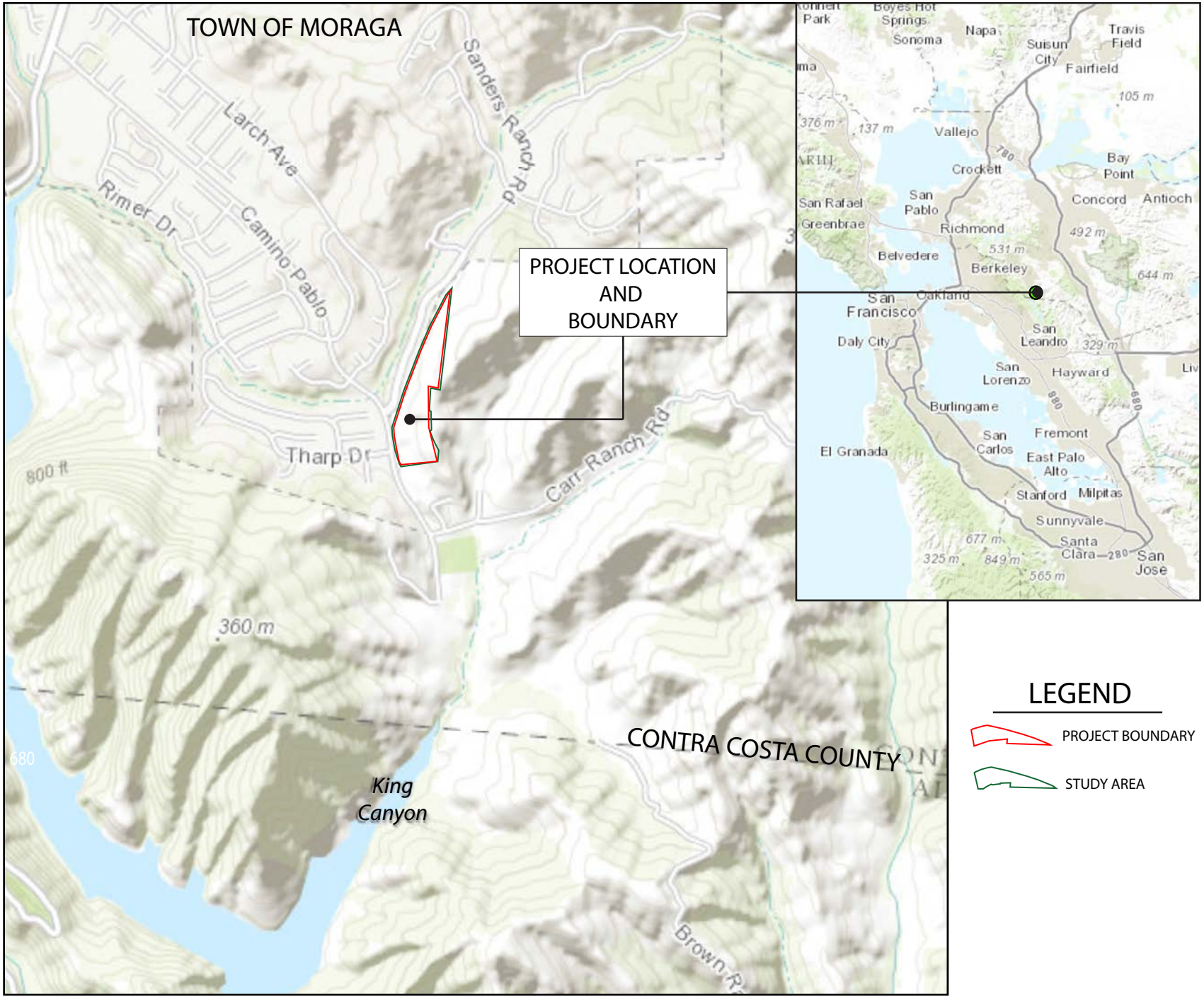
Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): _____

Wetland Hydrology Present? Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Slight wetland hydrology After heavy rainfall



ZENTNER and ZENTNER
Land Planning and Restoration
95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 Fax: 510.622.8116

FIGURE 1
SITE LOCATION

REVISIONS:	BY:

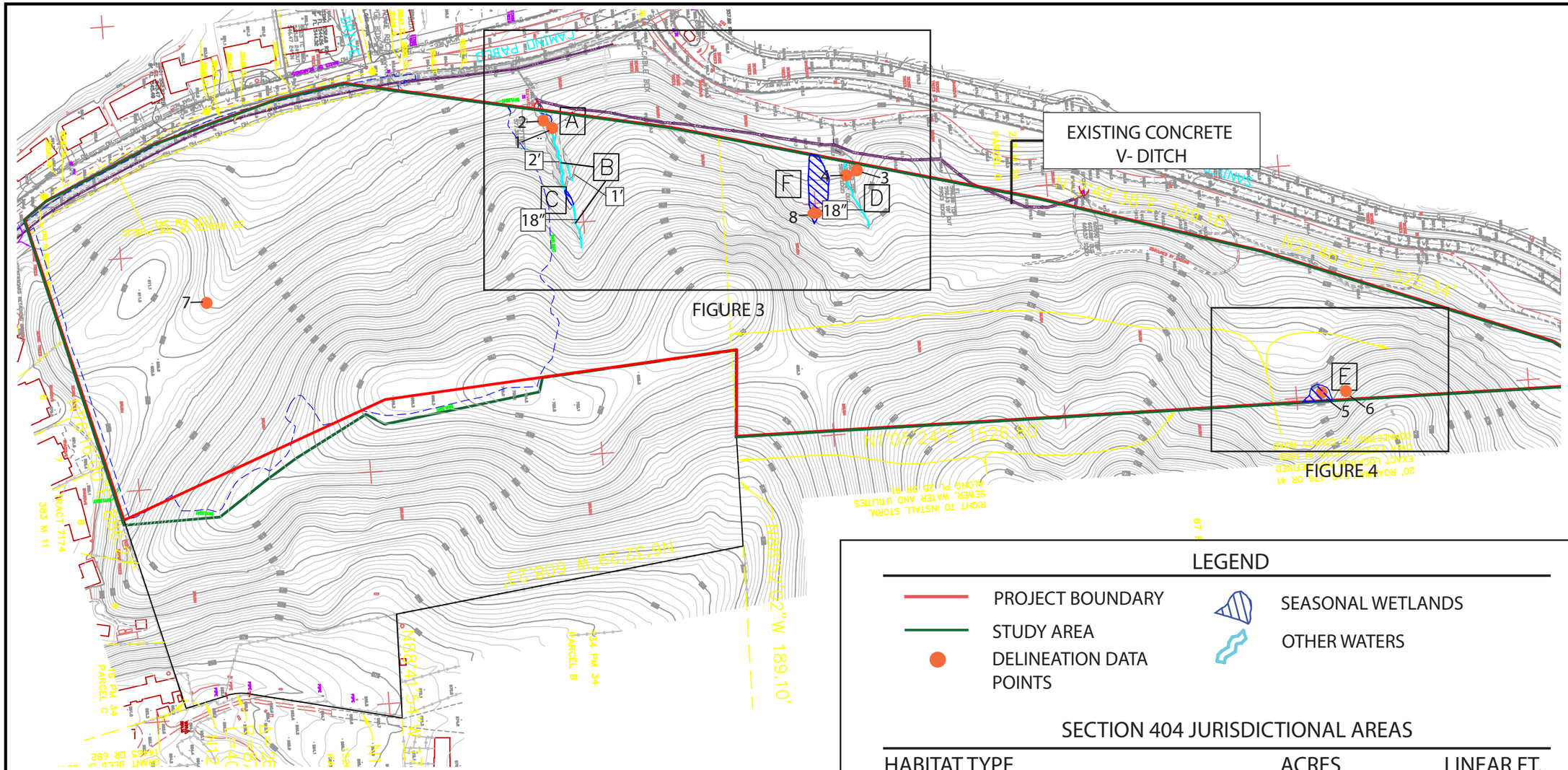
CAMINO PABLO
MORAGA, CALIFORNIA

N

SOURCE:
ArcGIS MAP

FILE:

DATE:



DISCLAIMER: SECTION 404 JURISDICTIONAL MAP

This map exhibits conditions on the site at the time of completion of the delineation. For various reasons, conditions on a site may change, which may affect site wetlandboundaries. Delineation maps generally expire five years after approval by the U.S. ArmyCorps of Engineers (Corps). Because regulations governing delineations are subject to change, this map should be reviewed by a qualified wetland consultant to ensure accuracy if not submitted to the Corps within six (6) months of preparation.

Field Work By: Zentner and Zentner, 04.14.2014, 02.10.2015, 04.02.2015

LEGEND

- PROJECT BOUNDARY
- STUDY AREA
- DELINEATION DATA POINTS
- SEASONAL WETLANDS
- OTHER WATERS

SECTION 404 JURISDICTIONAL AREAS

HABITAT TYPE	ACRES	LINEAR FT.
A. Seasonal Wetlands	0.005	
B. Other Waters	0.012	273.96
C. Seasonal Wetlands	0.003	
D. Other Waters	0.006	121.11
E. Seasonal Wetlands	0.014	
F. Seasonal Wetlands	0.07	

TOTALS	ACRES	LINEAR FT.
Other Waters	0.018	395.07
Seasonal Wetlands	0.092	

TOTAL JURISDICTIONAL AREAS	ACRES	LINEAR FT.
	0.11	395.07

ZENTNER and ZENTNER
Land Planning and Restoration
95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 ax: 510.622.8116

FIGURE 2
JURISDICTIONAL DELINEATION MAP

REVISIONS:	BY:
2.26.15	NBB
03.06.15	NBB
04.02.15	NBB

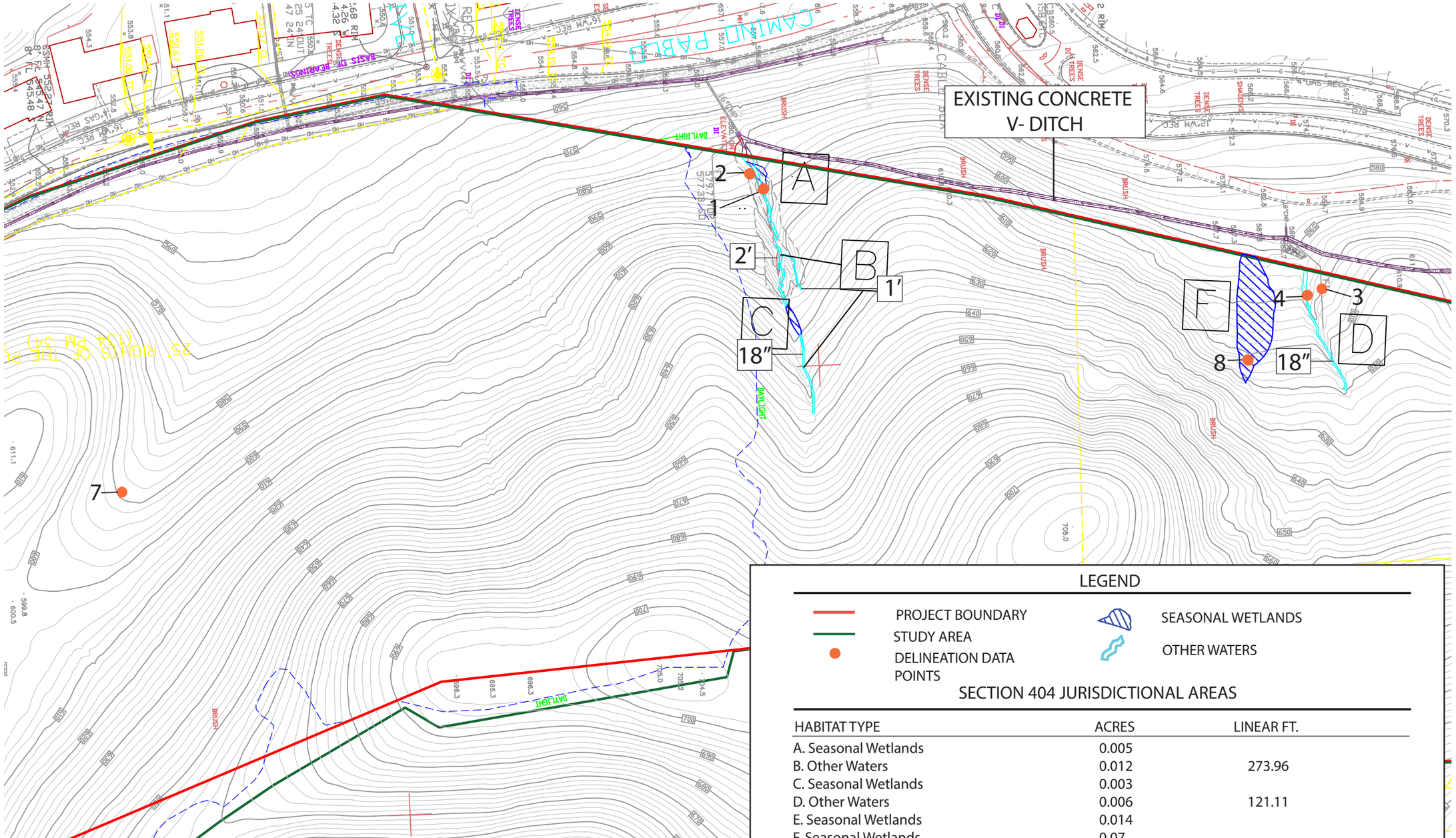
1211 CAMINO PABLO
MORAGA, CA
94556

North
0 100' 200'
SCALE: 1" = 200'

SOURCE: dK CONSULTING
WALNUT CREEK, CA

FILE: D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\Adobe 1004 New Fig 2_ Jurisdictional Delineation_03.06.2015

DATE: 04.02.15
PROJECT : 1004 DPL



LEGEND

- PROJECT BOUNDARY
- STUDY AREA
- DELINEATION DATA POINTS
- SEASONAL WETLANDS
- OTHER WATERS

SECTION 404 JURISDICTIONAL AREAS

HABITAT TYPE	ACRES	LINEAR FT.
A. Seasonal Wetlands	0.005	
B. Other Waters	0.012	273.96
C. Seasonal Wetlands	0.003	
D. Other Waters	0.006	121.11
E. Seasonal Wetlands	0.014	
F. Seasonal Wetlands	0.07	

TOTALS	ACRES	LINEAR FT.
Other Waters	0.018	395.07
Seasonal Wetlands	0.092	

TOTAL JURISDICTIONAL AREAS	ACRES	LINEAR FT.
	0.11	395.07

DISCLAIMER: SECTION 404 JURISDICTIONAL MAP

This map exhibits conditions on the site at the time of completion of the delineation. For various reasons, conditions on a site may change, which may affect site wetlandboundaries. Delineation maps generally expire five years after approval by the U.S. Army Corps of Engineers (Corps). Because regulations governing delineations are subject to change, this map should be reviewed by a qualified wetland consultant to ensure accuracy if not submitted to the Corps within six (6) months of preparation.

Field Work By: Zentner and Zentner, 04.14.2014, 02.10.2015, 04.02.2015

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FIGURE 3
JURISDICTIONAL MAP
AREAS A - F

REVISIONS:	BY:
ORIGINAL 2.26.15	NBB
3.9.15	NBB
4.2.15	NBB

1211 CAMINO PABLO
MORAGA, CA
94556

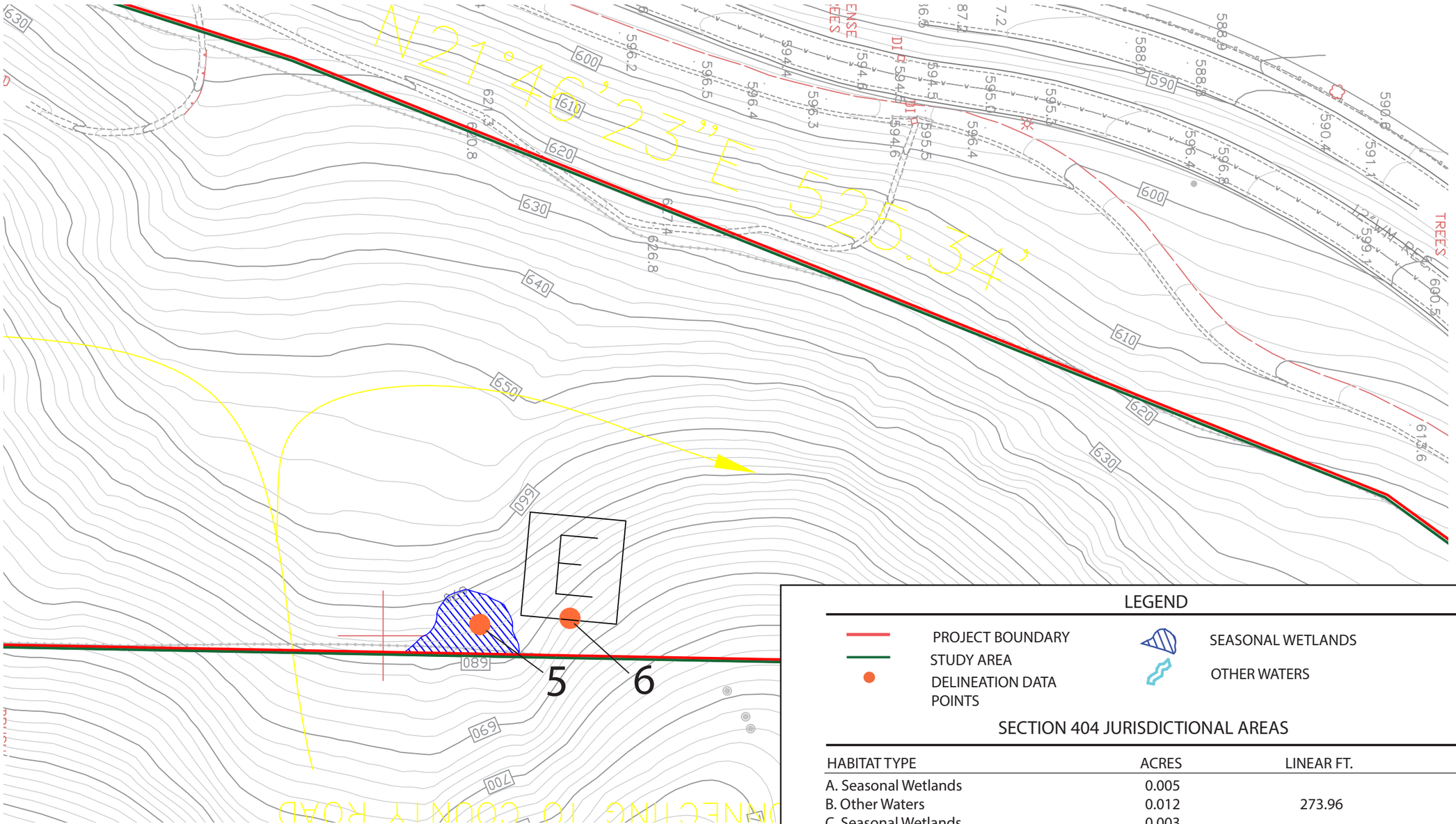
North
0 50' 100'
SCALE: 1" = 100'

SOURCE: dK CONSULTING
WALNUT CREEK, CA

FILE: D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\Adobe 1004 New Fig 3_ Jurisdictional Delineation_03.09.2015

DATE: 04.02.15

PROJECT : 1004 DPL



LEGEND

- PROJECT BOUNDARY
- STUDY AREA
- DELINEATION DATA POINTS
- SEASONAL WETLANDS
- OTHER WATERS

SECTION 404 JURISDICTIONAL AREAS

HABITAT TYPE	ACRES	LINEAR FT.
A. Seasonal Wetlands	0.005	
B. Other Waters	0.012	273.96
C. Seasonal Wetlands	0.003	
D. Other Waters	0.006	121.11
E. Seasonal Wetlands	0.014	
F. Seasonal Wetlands	0.07	

TOTALS	ACRES	LINEAR FT.
Other Waters	0.018	395.07
Seasonal Wetlands	0.092	

TOTAL JURISDICTIONAL AREAS	ACRES	LINEAR FT.
	0.11	395.07

DISCLAIMER: SECTION 404 JURISDICTIONAL MAP

This map exhibits conditions on the site at the time of completion of the delineation. For various reasons, conditions on a site may change, which may affect site wetlandboundaries. Delineation maps generally expire five years after approval by the U.S. Army Corps of Engineers (Corps). Because regulations governing delineations are subject to change, this map should be reviewed by a qualified wetland consultant to ensure accuracy if not submitted to the Corps within six (6) months of preparation.

Field Work By: Zentner and Zentner, 04.14.2014, 02.10.2015, 04.02.2015

ZENTNER and ZENTNER
Land Planning and Restoration
95 Linden Street, Ste. 3, Oakland, CA 94607
Phone: 510.622.8110 ax: 510.622.8116

FIGURE 4
JURISDICTIONAL MAP
AREA E

REVISIONS:	BY:
ORIGINAL 2.26.15	NBB
03.09.15	NBB
04.02.15	NBB

1211 CAMINO PABLO
MORAGA, CA
94556

North

0 25' 50

SCALE: 1" = 50'

SOURCE:
dK CONSULTING
WALNUT CREEK, CA

FILE:
D:\Graphics\PROJECTS\1000-1100\1004 Camino Pablo\Adobe
1004 New Fig 4_ Jurisdictional Delineation_2015.MARCH.09

DATE: 04.02.15

PROJECT : 1004 DPL

WOOD BIOLOGICAL CONSULTING, Inc.
65 Alta Hill Way
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Fax: (925) 939-4026
e-mail: mike@wood-biological.com
www.wood-biological.com

August 27, 2015

Douglas Herring & Associates
Mr. Douglas Herring
1331 Linda Vista Drive
El Cerrito, CA 94530

RE: Biological Peer Review, South Camino Pablo Annexation Project, Moraga

Dear Doug:

At your request I have conducted a review of materials prepared in support of the proposed South Camino Pablo Annexation Project located in unincorporated Contra Costa County. Specifically, this memorandum presents a peer review of biological technical reports prepared on behalf of the developer, Dobbins Properties, LLC, which is proposing to build a 13 lot subdivision on a 23.92-acre parcel (APN 258-290-023). The subject property is located at 1121 Camino Pablo.

The objective of this effort is to determine the adequacy of the biological technical studies in terms supporting the preparation of a Mitigated Negative Declaration (MND) and completing an adequate environmental review pursuant to the California Environmental Quality Act (CEQA).

Methods

Technical documents prepared in support of the development and the parcel's annexation to the Town of Moraga and reviewed as part of this effort include the following:

- Zentner and Zentner. 2014. *Camino Pablo Property; Biotic Resources Assessment*. March
- Zentner and Zentner. 2014. *Camino Pablo; Special Status Plant Species Assessment.* May.
- Zentner and Zentner. 2015. *Camino Pablo; Section 404 Jurisdictional Delineation*. March.
- D/K Consulting. 2015. *Vesting Tentative Map, South Camino Pablo Annexation Project, Subidivision #9396.* July.

In addition to the review of these documents, this analysis included the following:

- Review of current databases maintained by the California Department of Fish and Wildlife (CNDDB, 2015) and the California Native Plant Society (CNPS, 2015); printouts are provided in Attachments 1 and 2.
- Performance of a single reconnaissance-level survey by a qualified biologist on August 27, 2015.

Results

Setting

The Biotic Resources Assessment (BRA) includes a rather brief discussion of the project setting (vegetation and wildlife). Characterization of the site as consisting of heavily grazed grassland dominated by non-native annual grasses and forbs is accurate and appropriate. While the Setting section of the BRA makes no mention of the presence of seasonal wetlands and other waters of the U.S. they are discussed in the Special Status Habitat section of the report. Text provided in the Plant Species Assessment and Jurisdictional Delineation reports provide additional narrative describing the setting and context of the subject property.

Special-Status Habitats

I concur with the conclusion contained in the BRA that no special-status natural communities (other than the wetlands) are present on site. I also concur with the characterization and mapping of wetlands and other waters of the U.S. presented in the jurisdictional delineation report. This report provides adequate detail to permit an analysis of impacts under CEQA. However, there is no assessment of impacts. Furthermore, the mitigation measures relating to wetlands and waters of the U.S. outlined in the BRA are incomplete and would need to be expanded to meet CEQA standards.

Special-Status Animals

Regarding special-status species, the BRA is based on a review of a review of the California Natural Diversity Database (CNDDB). While not mentioned in the Methods section, their list of target species is based on a query of only two USGS 7.5-minute quadrangles (Oakland East and Las Trampas Ridge). While these are the two quadrangles in which the subject property is centered, a proper list of target species is typically based on the quadrangle in which a site occur and the eight surrounding quadrangles (i.e, Las Trampas Ridge, Hayward, San Leandro, Clayton, Diablo, Dublin, Walnut Creek, Briones Valley, and Oakland East).

Based on a review of these nine quadrangles, the target species list contains an additional 35 animal species that should have been evaluated. Based on existing habitats, the potential for occurrence of all but three can be ruled out due to the lack of suitable habitat or the fact that the project site is well outside of the known range. Special-status animals for which further analysis is warranted include burrowing owl, California horned lark, and San Francisco

dusky-footed woodrat. The BRA does not account for potential occurrence of and significant impacts on nesting migratory birds; no impact avoidance, minimization or mitigation measures are proposed and would need to be incorporated into the CEQA review. The BRA provides very little detail in how the potential for occurrence of target species was assessed, as is often provided in a tabular format.

The BRA presents only a brief mention of the federally and state-listed threatened species Alameda whipsnake (AWS; *Masticophis lateralis euryxanthus*). While I don't disagree that AWS is not likely to occur on site, the arguments made in the BRA are not strong enough to support a CEQA review. The BRA also makes a slight misrepresentation the conclusions in our report for the Rancho Laguna project (Wood Biological Consulting and M. Jennings). While we concluded that habitats at that site "are not considered optimal for AWS breeding", we also stated that there is a "low to moderate potential for AWS to disperse across the property". The BRA omitted that conclusion. As a result, fencing and biological monitoring were required during construction. To withstand scrutiny during CEQA review, this would be a more conservative approach in addressing this species.

The BRA makes only passing mention of the fact the subject property falls within designated Critical Habitat (see Attachment 3). A more detailed discussion of the species' primary constituent habitat elements, as well as the context of the site in relation to Critical Habitat and known occupied habitats is warranted. Although Critical Habitat only receives protection under Section 7 of the federal Endangered Species Act through the prohibition against destruction or adverse modification of Critical Habitat with regard to actions carried out, funded, or authorized by a Federal agency. As stated in the BRA states, impacts to wetlands would result from project implementation; this constitutes a federal nexus and would trigger consultation with the U.S. Fish and Wildlife Service (USFWS).

Even if impacts to wetlands can be avoided and no other federal nexus exists, the CEQA analysis should provide more a rigorous assessment of the potential effects on AWS. In communication with Brian Acord[1], development within Critical Habitat should be based on "*communication / consultation with the US Fish and Wildlife Service and with the Department's Habitat Conservation and Planning Branch, probably through the HabCon representative at the CDFW Region 3 office*". [2] Furthermore, in their response to comments included in the Final Rule for the designation of AWS Critical Habitat, the USFWS writes, "*the Final Economic Analysis assumes that all future development in critical habitat will require mitigation, regardless of whether a Federal nexus or some other mechanism (e.g., a signal to local officials that the land has ecological value with protection implemented through CEQA)*".[3] No such analysis has been

[1] CNDDB Zoology Lead

[2] Email dated August 25; see Attachment 4

[3] FR 71, No. 190, October 2, 2006, p. 58186, available at http://www.gpo.gov/fdsys/pkg/FR-2006-10-02/html/06-8367.htm

prepared. At a very minimum, the proposed project should include avoidance measures to ensure no AWS are taken during construction, as described above.

Special-Status Plants

As stated above, the list of target special-status plant species is based on a review of occurrence records for only two USGS quadrangles. A review of records for nine quadrangles is generally performed when creating lists of target species. Based on the CNDDB, the potential for occurrence of an additional 33 plant species should have been evaluated. Based on the CNPS data set, another ten species would be added to the list of target species. Considering a more inclusive target species list, suitable or marginally suitable habitat is present on site for seven special-status plant species.

The accepted protocol for conducting rare plant surveys (CDFG, 2009; CNPS, 2001; USFWS, 2001) specify that they be performed during each season in which target species, if present, would be identifiable. Field work for the plant assessment survey was performed on January 2 and April 14; a summer survey was not performed. During my brief site reconnaissance, I noted the presence of an additional three native herbs and seven non-native forbs not included on the species inventory.[4]

Potentially occurring special-status plant species for which suitable or marginally suitable habitat is present and which would not have been detectable during January and April surveys include:

- *Blepharizonia plumosa* (1B.1) – potential for occurrence: low.
- *Centromadia parryi* ssp. *congdonii* (1B.2) – potential for occurrence: very low.
- *Holocarpha macradenia* (Fed Endangered, 1B.1) – potential for occurrence: very low.
- *Navarretia nigelliformis* ssp. *radians* (1B.2) – potential for occurrence: low.
- *Leptosiphon acicularis* (4.2) – potential for occurrence: low.

Potentially occurring special-status plant species for which suitable or marginally suitable habitat is present and which were not included on the list of target species prepared for the January and April surveys include:

- *Balsamorhiza macrolepis* (1B.2) – potential for occurrence: very low.
- *Eriogonum truncatum* (1B.1) – potential for occurrence: very low.
- *Lasthenia conjugens* (Fed. Endangered, 1B.1) – potential for occurrence: very low.
- *Madia radiata* (1B.1) – potential for occurrence: low
- *Sanicula saxatilis* (1B.2) – potential for occurrence: very low.

[4] Additional native plant taxa identified during the site reconnaissance include *Epilobium brachycarpum*, *Juncus bufonius* var. *congestus*, and *Lagophylla ramossissima* (the unidentified willow on the inventory is *Salix lasiolepis*); non-native taxa identified include *Aira caryophylla*, *Chamaesyce maculata*, *Lactuca serriola*, *Lactuca saligna*, *Polopogon monspeliensis*, *Trifolium frageriferum*, and *Torillis arvensis*.

- *Androsace elongata* ssp. *acuta* (4.2) – potential for occurrence: low.

The Plant Assessment report provides very little detail in how the potential for occurrence of target species was assessed, as is often provided in a tabular format. The BRA includes more discussion on both counts, and it was prepared prior to the completion of the last focused plant survey.

In reviewing the species inventory included with the rare plant assessment report I see that *Dichondra donelliana* was detected. Moraga represents a substantial geographic disjunction for this species, which known in Contra Costa County only from the edge of San Francisco Bay (e.g., Point Molate). It is considered locally significant, having a ranking of A1 (Lake, 2010), meeting the criteria for consideration under CEQA. If present, this species should be enumerated and mapped. If impacts would occur, mitigation measures should be proposed.

Another species listed in the inventory, *Epilobium ciliatum* should have been identified to sub-specific status; *E.c.* ssp. c. is common and widespread. However, *E.c.* ssp. *watsonii* is included on Lake's list of rare, unusual and significant plants. It is assigned a rarity rank of "B", considered a high priority watch list. Although species on this list are not deemed significant in the sense of CEQA, the protocol for a proper "floristic survey" require the identification of all plant species to a level sufficient to determine their status as rare (CDFG, 2009).

Discussion

To be deemed adequate, the environmental document (i.e., Mitigated Negative Declaration, Environmental Impact Report) must include a complete and accurate description of the project setting. An adequate "Setting" section must be based on the following:

1. An accurate description of the vegetation communities including dominant species, significant secondary species, level of historic and/or recent disturbance, etc.
2. Accurate habitat mapping.
3. Review of available data and relevant literature.
4. Appropriately time surveys following correct protocol.
5. A proper evaluation of all special-status habitat features and plant and animal species occurring in the region.
6. Consideration of Critical Habitat for federally listed species.
7. Evaluation of applicable Habitat Conservation Plans and local laws, policies and guidelines.

As the support documents for the environmental review, the technical reports must provide the necessary information to meet these standards. Furthermore, they must provide sufficient

Conclusion

The characterization of the setting, albeit highly abbreviated, is accurate. Although the narrative is sparse by current standards, there is sufficient information contained in the BRA, the Plant Assessment report and the Jurisdictional Delineation report to complete the setting section of the CEQA document.

The delineation of wetlands and other waters of the U.S. is complete and adequate for incorporation into a CEQA document.

The evaluation of potentially occurring special-status wildlife species is not sufficient to complete an adequate CEQA review. The list of target species is incomplete. There is no discussion of the potential for occurrence of migratory birds. There is no discussion of the significance of developing within Critical Habitat for AWS. The analysis of potential effects on AWS is unlikely to hold up to review by the agencies, and there is no discussion of suitable impact avoidance measures for this species.

The evaluation of potentially occurring special-status plant species is not sufficient to complete an adequate CEQA review. The list of target species is incomplete. A summer survey was not performed and is warranted for summer-flowering special-status plant species. The Plant Assessment report notes the presence of one species, impacts on which would be regarded as significant under CEQA; the species is neither mapped nor enumerated in the report.

Sincerely,

Michael Wood

Enclosures: Literature Cited
Attachment 1 – CNDDB printout
Attachment 2 – CNPS printout
Attachment 3 – Alameda whipsnake Critical Habitat map
Attachment 4 – Communication with Brian Acord, CNDDB

Literature Cited

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Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Query Criteria: Quad is (Briones Valley (3712282) or Clayton (3712188) or Diablo (3712178) or Dublin (3712168) or Hayward (3712261) or Las Trampas Ridge (3712271) or Oakland East (3712272) or San Leandro (3712262) or Walnut Creek (3712281))

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Accipiter cooperii Cooper's hawk	ABNKC12040	None	None	G5	S4	WL
Accipiter striatus sharp-shinned hawk	ABNKC12020	None	None	G5	S4	WL
Agelaius tricolor tricolored blackbird	ABPBXB0020	None	None	G2G3	S1S2	SSC
Ambystoma californiense California tiger salamander	AAAAA01180	Threatened	Threatened	G2G3	S2S3	SSC
Amsinckia lunaris bent-flowered fiddleneck	PDBOR01070	None	None	G2?	S2?	1B.2
Anomobryum julaceum slender silver moss	NBMUS80010	None	None	G4G5	S2	4.2
Antrozous pallidus pallid bat	AMACC10010	None	None	G5	S3	SSC
Aquila chrysaetos golden eagle	ABNKC22010	None	None	G5	S3	FP
Archoplites interruptus Sacramento perch	AFCQB07010	None	None	G2G3	S1	SSC
Arctostaphylos auriculata Mt. Diablo manzanita	PDERI04040	None	None	G2	S2	1B.3
Arctostaphylos manzanita ssp. laevigata Contra Costa manzanita	PDERI04273	None	None	G5T2	S2	1B.2
Arctostaphylos pallida pallid manzanita	PDERI04110	Threatened	Endangered	G1	S1	1B.1
Ardea herodias great blue heron	ABNGA04010	None	None	G5	S4	
Astragalus tener var. tener alkali milk-vetch	PDFAB0F8R1	None	None	G2T2	S2	1B.2
Athene cunicularia burrowing owl	ABNSB10010	None	None	G4	S3	SSC
Balsamorhiza macrolepis big-scale balsamroot	PDAST11061	None	None	G2	S2	1B.2
Blepharizonia plumosa big tarplant	PDAST1C011	None	None	G2	S2	1B.1
Bombus caliginosus obscure bumble bee	IIHYM24380	None	None	G4?	S1S2	
Branta hutchinsii leucopareia cackling (=Aleutian Canada) goose	ABNJB05035	Delisted	None	G5T3	S2	

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Buteo regalis ferruginous hawk	ABNKC19120	None	None	G4	S3S4	WL
Buteo swainsoni Swainson's hawk	ABNKC19070	None	Threatened	G5	S3	
California macrophylla round-leaved filaree	PDGER01070	None	None	G3?	S3?	1B.1
Callophrys mossii bayensis San Bruno elfin butterfly	IILEPE2202	Endangered	None	G4T1	S1	
Calochortus pulchellus Mt. Diablo fairy-lantern	PMLIL0D160	None	None	G2	S2	1B.2
Campanula exigua chaparral harebell	PDCAM020A0	None	None	G2	S2	1B.2
Centromadia parryi ssp. congdonii Congdon's tarplant	PDAST4R0P1	None	None	G3T2	S2	1B.1
Charadrius alexandrinus nivosus western snowy plover	ABNNB03031	Threatened	None	G3T3	S2	SSC
Chloropyron maritimum ssp. palustre Point Reyes salty bird's-beak	PDSCR0J0C3	None	None	G4?T2	S2	1B.2
Chorizanthe robusta var. robusta robust spineflower	PDPGN040Q2	Endangered	None	G2T1	S1	1B.1
Cicuta maculata var. bolanderi Bolander's water-hemlock	PDAPI0M051	None	None	G5T3T4	S2	2B.1
Circus cyaneus northern harrier	ABNKC11010	None	None	G5	S3	SSC
Cirsium andrewsii Franciscan thistle	PDAST2E050	None	None	G3	S3	1B.2
Clarkia concinna ssp. automixa Santa Clara red ribbons	PDONA050A1	None	None	G5?T3	S3	4.3
Clarkia franciscana Presidio clarkia	PDONA050H0	Endangered	Endangered	G1	S1	1B.1
Cordylanthus nidularius Mt. Diablo bird's-beak	PDSCR0J0F0	None	Rare	G1	S1	1B.1
Corynorhinus townsendii Townsend's big-eared bat	AMACC08010	None	Candidate Threatened	G3G4	S2	SSC
Danaus plexippus pop. 1 monarch - California overwintering population	IILEPP2012	None	None	G4T2T3	S2S3	
Delphinium californicum ssp. interius Hospital Canyon larkspur	PDRAN0B0A2	None	None	G3T3	S3	1B.2
Dipodomys heermanni berkeleyensis Berkeley kangaroo rat	AMAFD03061	None	None	G3G4T1	S1	
Dirca occidentalis western leatherwood	PDTHY03010	None	None	G2	S2	1B.2

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Efferia antiochi Antioch efferian robberfly	IIDIP07010	None	None	G1G2	S1S2	
Elanus leucurus white-tailed kite	ABNKC06010	None	None	G5	S3S4	FP
Emys marmorata western pond turtle	ARAAD02030	None	None	G3G4	S3	SSC
Eremophila alpestris actia California horned lark	ABPAT02011	None	None	G5T3Q	S3	WL
Eriastrum ertterae Lime Ridge eriastrum	PDPLM030F0	None	None	G1	S1	1B.1
Eriogonum luteolum var. caninum Tiburon buckwheat	PDPGN083S1	None	None	G5T2	S2	1B.2
Eriogonum truncatum Mt. Diablo buckwheat	PDPGN085Z0	None	None	G2	S2	1B.1
Eucyclogobius newberryi tidewater goby	AFCQN04010	Endangered	None	G3	S3	SSC
Eumops perotis californicus western mastiff bat	AMACD02011	None	None	G5T4	S3S4	SSC
Euphydryas editha bayensis Bay checkerspot butterfly	IILEPK4055	Threatened	None	G5T1	S1	
Extriplex joaquinana San Joaquin spearscale	PDCHE041F3	None	None	G2	S2	1B.2
Falco mexicanus prairie falcon	ABNKD06090	None	None	G5	S4	WL
Fissidens pauperculus minute pocket moss	NBMUS2W0U0	None	None	G3?	S2	1B.2
Fritillaria liliacea fragrant fritillary	PMLIL0V0C0	None	None	G2	S2	1B.2
Geothlypis trichas sinuosa saltmarsh common yellowthroat	ABPBX1201A	None	None	G5T3	S3	SSC
Grimmia torenii Toren's grimmia	NBMUS32330	None	None	G2	S2	1B.3
Haliaeetus leucocephalus bald eagle	ABNKC10010	Delisted	Endangered	G5	S2	FP
Helianthella castanea Diablo helianthella	PDAST4M020	None	None	G2	S2	1B.2
Helminthoglypta nickliniana bridgesi Bridges' coast range shoulderband	IMGASC2362	None	None	G3T1	S1	
Hesperolinon breweri Brewer's western flax	PDLIN01030	None	None	G2	S2	1B.2
Hoita strobilina Loma Prieta hoita	PDFAB5Z030	None	None	G2	S2	1B.1

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Holocarpha macradenia Santa Cruz tarplant	PDAST4X020	Threatened	Endangered	G1	S1	1B.1
Horkelia cuneata var. sericea Kellogg's horkelia	PDROS0W043	None	None	G4T2	S2?	1B.1
Isocoma arguta Carquinez goldenbush	PDAST57050	None	None	G1	S1	1B.1
Juglans hindsii Northern California black walnut	PDJUG02040	None	None	G1	S1	1B.1
Lasionycteris noctivagans silver-haired bat	AMACC02010	None	None	G5	S3S4	
Lasiurus cinereus hoary bat	AMACC05030	None	None	G5	S4	
Lasthenia conjugens Contra Costa goldfields	PDAST5L040	Endangered	None	G1	S1	1B.1
Laterallus jamaicensis coturniculus California black rail	ABNME03041	None	Threatened	G3G4T1	S1	FP
Linderiella occidentalis California linderiella	ICBRA06010	None	None	G2G3	S2S3	
Madia radiata showy golden madia	PDAST650E0	None	None	G2	S2	1B.1
Malacothamnus hallii Hall's bush-mallow	PDMAL0Q0F0	None	None	G2	S2	1B.2
Masticophis lateralis euryxanthus Alameda whipsnake	ARADB21031	Threatened	Threatened	G4T2	S2	
Meconella oregana Oregon meconella	PDPAP0G030	None	None	G2G3	S1	1B.1
Melospiza melodia maxillaris Suisun song sparrow	ABPBXA301K	None	None	G5T3	S3	SSC
Melospiza melodia pusillula Alameda song sparrow	ABPBXA301S	None	None	G5T2?	S2?	SSC
Microcina leei Lee's micro-blind harvestman	ILARA47040	None	None	G1	S1	
Microcina lumi Lum's micro-blind harvestman	ILARA47050	None	None	G1	S1	
Monolopia gracilens woodland woollythreads	PDAST6G010	None	None	G3	S3	1B.2
Myotis yumanensis Yuma myotis	AMACC01020	None	None	G5	S4	
Navarretia gowenii Lime Ridge navarretia	PDPLM0C120	None	None	G1	S1	1B.1
Navarretia nigelliformis ssp. radians shining navarretia	PDPLM0C0J2	None	None	G4T2	S2	1B.2

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Neotoma fuscipes annectens San Francisco dusky-footed woodrat	AMAFF08082	None	None	G5T2T3	S2S3	SSC
Northern Coastal Salt Marsh Northern Coastal Salt Marsh	CTT52110CA	None	None	G3	S3.2	
Northern Maritime Chaparral Northern Maritime Chaparral	CTT37C10CA	None	None	G1	S1.2	
Nyctinomops macrotis big free-tailed bat	AMACD04020	None	None	G5	S3	SSC
Oenothera deltoides ssp. howellii Antioch Dunes evening-primrose	PDONA0C0B4	Endangered	Endangered	G5T1	S1	1B.1
Perognathus inornatus San Joaquin Pocket Mouse	AMAFD01060	None	None	G2G3	S2S3	
Phacelia phacelioides Mt. Diablo phacelia	PDHYD0C3Q0	None	None	G1	S1	1B.2
Phrynosoma blainvillii coast horned lizard	ARACF12100	None	None	G3G4	S3S4	SSC
Plagiobothrys diffusus San Francisco popcornflower	PDBOR0V080	None	Endangered	G1Q	S1	1B.1
Plagiobothrys glaber hairless popcornflower	PDBOR0V0B0	None	None	GH	SH	1A
Polemonium carneum Oregon polemonium	PDPLM0E050	None	None	G3G4	S2	2B.2
Polygonum marinense Marin knotweed	PDPGN0L1C0	None	None	G2Q	S2	3.1
Rallus longirostris obsoletus California clapper rail	ABNME05016	Endangered	Endangered	G5T1	S1	FP
Rana boylii foothill yellow-legged frog	AAABH01050	None	None	G3	S3	SSC
Rana draytonii California red-legged frog	AAABH01022	Threatened	None	G2G3	S2S3	SSC
Reithrodontomys raviventris salt-marsh harvest mouse	AMAFF02040	Endangered	Endangered	G1G2	S1S2	FP
Rynchops niger black skimmer	ABNNM14010	None	None	G5	S2	SSC
Sanicula maritima adobe sanicle	PDAPI1Z0D0	None	Rare	G2	S2	1B.1
Sanicula saxatilis rock sanicle	PDAPI1Z0H0	None	Rare	G2	S2	1B.2
Scapanus latimanus parvus Alameda Island mole	AMABB02031	None	None	G5T1Q	S1	SSC
Senecio aphanactis chaparral ragwort	PDAST8H060	None	None	G3?	S2	2B.2

Selected Elements by Scientific Name

California Department of Fish and Wildlife

California Natural Diversity Database

Species	Element Code	Federal Status	State Status	Global Rank	State Rank	Rare Plant Rank/CDFW SSC or FP
Serpentine Bunchgrass Serpentine Bunchgrass	CTT42130CA	None	None	G2	S2.2	
Setophaga petechia yellow warbler	ABPBX03010	None	None	G5	S3S4	SSC
Sorex vagrans halicoetes salt-marsh wandering shrew	AMABA01071	None	None	G5T1	S1	SSC
Spirinchus thaleichthys longfin smelt	AFCHB03010	Candidate	Threatened	G5	S1	SSC
Sternula antillarum browni California least tern	ABNNM08103	Endangered	Endangered	G4T2T3Q	S2	FP
Streptanthus albidus ssp. peramoenus most beautiful jewelflower	PDBRA2G012	None	None	G2T2	S2	1B.2
Streptanthus hispidus Mt. Diablo jewelflower	PDBRA2G0M0	None	None	G1	S1	1B.3
Stuckenia filiformis ssp. alpina slender-leaved pondweed	PMPOT03091	None	None	G5T5	S3	2B.2
Suaeda californica California seablite	PDCHE0P020	Endangered	None	G1	S1	1B.1
Taxidea taxus American badger	AMAJF04010	None	None	G5	S3	SSC
Trifolium hydrophilum saline clover	PDFAB400R5	None	None	G2	S2	1B.2
Triquetrella californica coastal triquetrella	NBMUS7S010	None	None	G2	S2	1B.2
Tropidocarpum capparideum caper-fruited tropidocarpum	PDBRA2R010	None	None	G1	S1	1B.1
Tryonia imitator mimic tryonia (=California brackishwater snail)	IMGASJ7040	None	None	G2	S2	
Valley Needlegrass Grassland Valley Needlegrass Grassland	CTT42110CA	None	None	G3	S3.1	
Viburnum ellipticum oval-leaved viburnum	PDCPR07080	None	None	G4G5	S3?	2B.3
Vulpes macrotis mutica San Joaquin kit fox	AMAJA03041	Endangered	Threatened	G4T2	S2	

Record Count: 120

CNPS California Native Plant Sc Rare and Endangered Plant Inventory

Plant List

71 matches found. *Click on scientific name for details*

Search Criteria

Found in 9 Quads around 37122G1

Scientific Name	Common Name	Family	Lifeform	Rare Plant Rank	State Rank	Global Rank
Amsinckia lunaris	bent-flowered fiddleneck	Boraginaceae	annual herb	1B.2	S2?	G2?
Androsace elongata ssp. acuta	California androsace	Primulaceae	annual herb	4.2	S3S4	G5?T3T4
Anomobryum julaceum	slender silver moss	Bryaceae	moss	4.2	S2	G4G5
Arabis blepharophylla	coast rockcress	Brassicaceae	perennial herb	4.3	S4	G4
Arctostaphylos auriculata	Mt. Diablo manzanita	Ericaceae	perennial evergreen shrub	1B.3	S2	G2
Arctostaphylos manzanita ssp. laevigata	Contra Costa manzanita	Ericaceae	perennial evergreen shrub	1B.2	S2	G5T2
Arctostaphylos pallida	pallid manzanita	Ericaceae	perennial evergreen shrub	1B.1	S1	G1
Astragalus tener var. tener	alkali milk-vetch	Fabaceae	annual herb	1B.2	S2	G2T2
Balsamorhiza macrolepis	big-scale balsamroot	Asteraceae	perennial herb	1B.2	S2	G2
Blepharizonia plumosa	big tarplant	Asteraceae	annual herb	1B.1	S2	G2
Calandrinia breweri	Brewer's calandrinia	Montiaceae	annual herb	4.2	S34	G4
California macrophylla	round-leaved filaree	Geraniaceae	annual herb	1B.2	S3?	G3?
Calochortus pulchellus	Mt. Diablo fairy-lantern	Liliaceae	perennial bulbiferous herb	1B.2	S2	G2
Calochortus umbellatus	Oakland star-tulip	Liliaceae	perennial bulbiferous herb	4.2	S4	G4
Campanula exigua	chaparral harebell	Campanulaceae	annual herb	1B.2	S2	G2
Castilleja ambigua var. ambigua	johnny-nip	Orobanchaceae	annual herb (hemiparasitic)	4.2	S4	G4T5
Centromadia parryi ssp. congdonii	Congdon's tarplant	Asteraceae	annual herb	1B.1	S2	G3T2
Chloropyron maritimum ssp. palustre	Point Reyes bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	1B.2	S2	G4?T2
Chorizanthe robusta var. robusta	robust spineflower	Polygonaceae	annual herb	1B.1	S1	G2T1
Cirsium andrewsii	Franciscan thistle	Asteraceae	perennial herb	1B.2	S3	G3
Clarkia concinna ssp. automixa	Santa Clara red ribbons	Onagraceae	annual herb	4.3	S3	G5?T3

Clarkia franciscana	Presidio clarkia	Onagraceae	annual herb	1B.1	S1	G1
Collomia diversifolia	serpentine collomia	Polemoniaceae	annual herb	4.3	S4	G4
Cordylanthus nidularius	Mt. Diablo bird's-beak	Orobanchaceae	annual herb (hemiparasitic)	1B.1	S1	G1
Delphinium californicum ssp. interius	Hospital Canyon larkspur	Ranunculaceae	perennial herb	1B.2	S3	G3T3
Dirca occidentalis	western leatherwood	Thymelaeaceae	perennial deciduous shrub	1B.2	S2	G2
Eriastrum ertterae	Lime Ridge eriastrum	Polemoniaceae	annual herb	1B.1	S1	G1
Eriogonum luteolum var. caninum	Tiburon buckwheat	Polygonaceae	annual herb	1B.2	S2	G5T2
Eriogonum truncatum	Mt. Diablo buckwheat	Polygonaceae	annual herb	1B.1	S2	G2
Eriophyllum jepsonii	Jepson's woolly sunflower	Asteraceae	perennial herb	4.3	S3	G3
Extriplex joaquinana	San Joaquin spearscale	Chenopodiaceae	annual herb	1B.2	S2	G2
Fissidens pauperculus	minute pocket moss	Fissidentaceae	moss	1B.2	S2	G3?
Fritillaria liliacea	fragrant fritillary	Liliaceae	perennial bulbiferous herb	1B.2	S2	G2
Grimmia torenii	Toren's grimmia	Grimmiaceae	moss	1B.3	S2	G2
Helianthella castanea	Diablo helianthella	Asteraceae	perennial herb	1B.2	S2	G2
Hesperolinon breweri	Brewer's western flax	Linaceae	annual herb	1B.2	S2	G2
Hoita strobilina	Loma Prieta hoita	Fabaceae	perennial herb	1B.1	S2	G2
Holocarpha macradenia	Santa Cruz tarplant	Asteraceae	annual herb	1B.1	S1	G1
Horkelia cuneata var. sericea	Kellogg's horkelia	Rosaceae	perennial herb	1B.1	S2?	G4T2
Iris longipetala	coast iris	Iridaceae	perennial rhizomatous herb	4.2	S3	G3
Juglans californica	Southern California black walnut	Juglandaceae	perennial deciduous tree	4.2	S3	G3
Juglans hindsii	Northern California black walnut	Juglandaceae	perennial deciduous tree	1B.1	S1	G1
Lasthenia conjugens	Contra Costa goldfields	Asteraceae	annual herb	1B.1	S1	G1
Lathyrus jepsonii var. jepsonii	Delta tule pea	Fabaceae	perennial herb	1B.2	S2	G5T2
Leptosiphon acicularis	bristly leptosiphon	Polemoniaceae	annual herb	4.2	S3	G3
Malacothamnus hallii	Hall's bush-mallow	Malvaceae	perennial evergreen shrub	1B.2	S2	G2
Meconella oregana	Oregon meconella	Papaveraceae	annual herb	1B.1	S1	G2G3
Micropus amphibolus	Mt. Diablo cottonweed	Asteraceae	annual herb	3.2	S3S4	G3G4
Monardella antonina ssp. antonina	San Antonio Hills monardella	Lamiaceae	perennial rhizomatous herb	3	S1S3	G4T1T3Q
Monolopia gracilens	woodland woolythreads	Asteraceae	annual herb	1B.2	S2S3	G2G3
Navarretia gowenii	Lime Ridge navarretia	Polemoniaceae	annual herb	1B.1	S1	G1
Navarretia nigelliformis ssp. radians	shining navarretia	Polemoniaceae	annual herb	1B.2	S2	G4T2

Oenothera deltoides ssp. howellii	Antioch Dunes evening-primrose	Onagraceae	perennial herb	1B.1	S1	G5T1
Phacelia phacelioides	Mt. Diablo phacelia	Boraginaceae	annual herb	1B.2	S1	G1
Piperia michaelii	Michael's rein orchid	Orchidaceae	perennial herb	4.2	S3	G3
Plagiobothrys diffusus	San Francisco popcorn-flower	Boraginaceae	annual herb	1B.1	S1	G1Q
Plagiobothrys glaber	hairless popcorn-flower	Boraginaceae	annual herb	1A	SH	GH
Polemonium carneum	Oregon polemonium	Polemoniaceae	perennial herb	2B.2	S2	G3G4
Polygonum marinense	Marin knotweed	Polygonaceae	annual herb	3.1	S2	G2Q
Ranunculus lobbii	Lobb's aquatic buttercup	Ranunculaceae	annual herb	4.2	S3	G4
Sanicula maritima	adobe sanicle	Apiaceae	perennial herb	1B.1	S2	G2
Sanicula saxatilis	rock sanicle	Apiaceae	perennial herb	1B.2	S2	G2
Senecio aphanactis	chaparral ragwort	Asteraceae	annual herb	2B.2	S2	G3?
Streptanthus albidus ssp. peramoenus	most beautiful jewel-flower	Brassicaceae	annual herb	1B.2	S2	G2T2
Streptanthus hispidus	Mt. Diablo jewel-flower	Brassicaceae	annual herb	1B.3	S1	G1
Stuckenia filiformis ssp. alpina	slender-leaved pondweed	Potamogetonaceae	perennial rhizomatous herb	2B.2	S3	G5T5
Suaeda californica	California seablite	Chenopodiaceae	perennial evergreen shrub	1B.1	S1	G1
Trifolium hydrophilum	saline clover	Fabaceae	annual herb	1B.2	S2	G2
Triquetrella californica	coastal triquetrella	Pottiaceae	moss	1B.2	S2	G2
Tropidocarpum capparideum	caper-fruited tropidocarpum	Brassicaceae	annual herb	1B.1	S1	G1
Viburnum ellipticum	oval-leaved viburnum	Adoxaceae	perennial deciduous shrub	2B.3	S3	G5

Suggested Citation

CNPS, Rare Plant Program. 2015. Inventory of Rare and Endangered Plants (online edition, v8-02). California Native Plant Society, Sacramento, CA. Website http://www.rareplants.cnps.org [accessed 24 August 2015].

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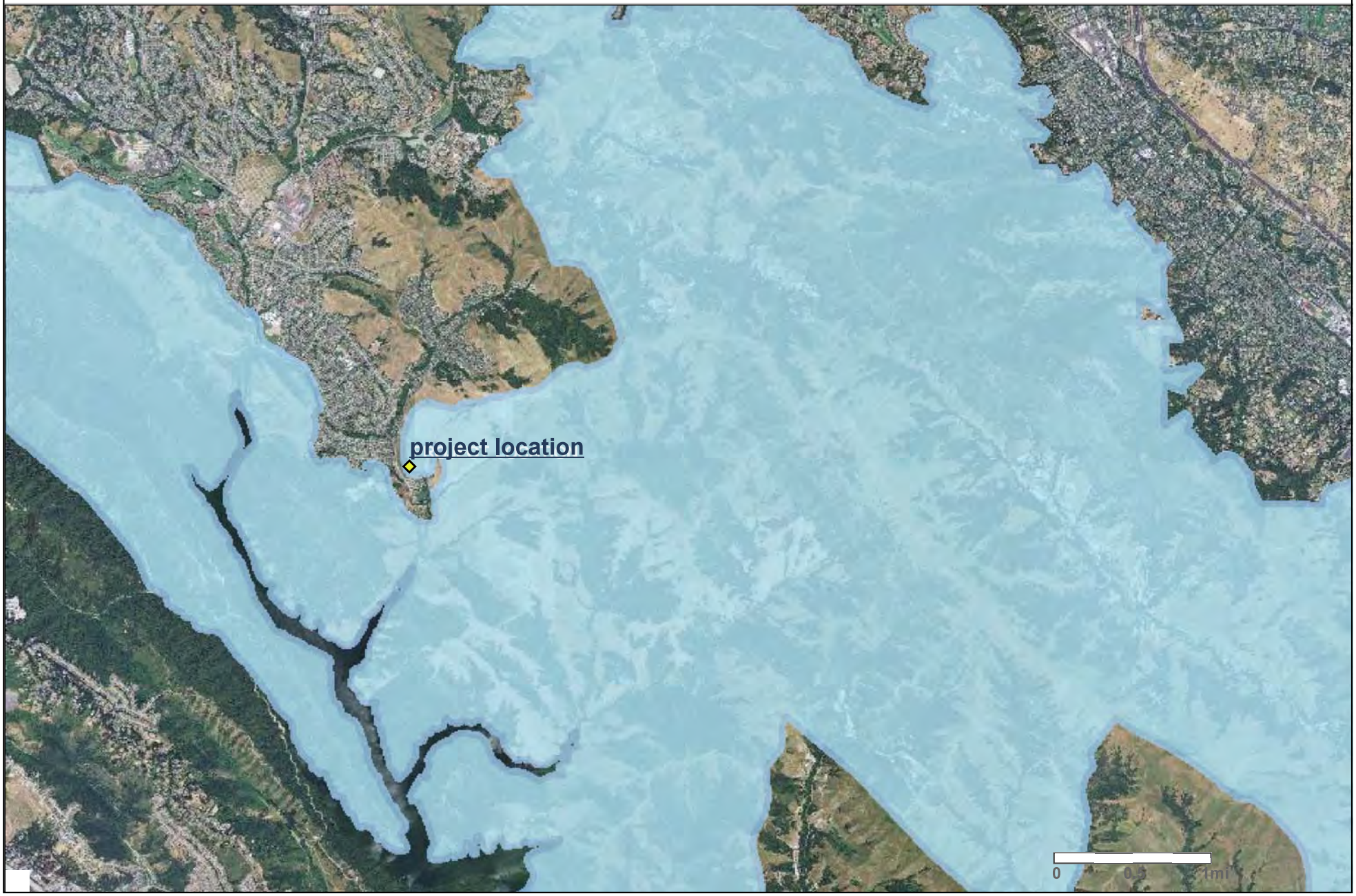
CALIFORNIA DEPARTMENT OF FISH and WILDLIFE BIOS

ATTACHMENT 3

ALAMEDA WHIPSNAKE CRITICAL HABITAT



ATTACHMENT 4

Mike Wood

Subject: FW: suppressed data request
Attachments: 20150825 Camino Pablo.pdf

From: Acord, Brian@Wildlife [mailto:Brian.Acord@wildlife.ca.gov]
Sent: Tuesday, August 25, 2015 12:08 PM
To: Mike Wood
Subject: RE: suppressed data request

Good morning Mike,
I'm not in a position to advise or comment on a development project within designated critical habitat for a particular species, or even in the case of where an area is suitable habitat that may impact a listed species. This just simply isn't my job or expertise. For Alameda whipsnake (AWS, *Masticophis lateralis euryxanthus*), both a federally and state Threatened species, there needs to be communication/consultation with the US Fish and Wildlife Service and with the Department's Habitat Conservation and Planning Branch, probably through the HabCon representative at the CDFW Region 3 office (https://www.wildlife.ca.gov/Regions/3/Contact). It is never appropriate to use to use the CNDDB database as a justification for a negative declaration; on the ground field investigation is always needed to properly asses impacts.

There are several known occurrences within 3 miles of this site (detailed below), and the site appears to be within continuous and suitable habitat. It is impossible for the CNDDB to know where all AWS are at, but considering the proximity, I don't think it would be surprising to find AWS at or near the site of interest.

There are 24 Element Occurrences (EO) for Alameda whipsnake within 5 miles of this site. However, for simplicity, I've chosen to detail the 9 EOs that intersect a 3 mile buffer of the site of interest:

EO# 23 is the nearest occurrence, about 1.4 miles SSE of 1211 Camino Pablo; several were detected here in a 1989-1990 study, including gravid females.
EO# 21 is about 1.6 miles SSE; similarly, there were detections here during a 1989 study.
EO# 32 is about 1.8 miles SE; one adult male was captured, marked, and released in 1990.
EO# 22 is about 2 miles SE; one sub-adult female was captured, marked and released in 1989.
EO# 31 is about 2.3 miles E; 2 adult females were captured, marked, and released in 1990.
EO# 83 is about 2.5 miles ENE; 1 adult was detected here in 2004.
EO# 71 is about 3 miles ENE; 1 juvenile was trapped, and one young of year was detected in 2004.
EO# 84 is about 2.5 miles SSW; 1 adult was detected in 2006.
EO# 1 is right at, and little further than, 3 miles SW; this occurrence represents two specimens, one collected in 1904 & the other in 1953.

I hope this helps with your review.

Sincerely,
Brian

Brian Acord
CNDDB Zoology Lead
(916) 322-7307
Brian.acord@wildlife.ca.gov
www.dfg.ca.gov/biogeodata/cnddb/

BIOLOGICAL RESOURCES ANALYSIS REPORT

FOR THE

CAMINO PABLO PROPERTY

CONTRA COSTA COUNTY, CALIFORNIA

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MAY 2019

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ATTACHMENT 2 TABLES

Table 1	Plant and Wildlife Species Observed Within/Adjacent to the Survey Area
Table 2	Special-Status Species Occurring Within/Adjacent to the Survey Area

ATTACHMENT 3 SITE PHOTOGRAPHS

This report should be cited as: Olberding Environmental, Inc. May 2019. *Biological Resources Analysis Report for the Camino Pablo Property, Contra Costa County, California*. Prepared for Douglas Herring & Associates.

SUMMARY

On April 18, 2019, Olberding Environmental, Inc. conducted a field reconnaissance survey of the Camino Pablo Property (Property) for the purpose of identifying sensitive plant and wildlife species, sensitive habitats, and biological constraints potentially occurring on the Property. The Property surveyed is comprised of approximately 23.54 acres located in unincorporated Contra Costa County, California.

Results of the initial reconnaissance survey indicate that the Property contains wetlands/waters that might be considered jurisdictional by the U.S. Army Corps of Engineers (Corps), Regional Water Quality Control Board (RWQCB), and/or the California Department of Fish and Wildlife (CDFW). The Property contains two ephemeral drainage features, and two seasonal wetlands. The drainages are found on the western side of the Property, and one of the seasonal wetlands is immediately adjacent to the northernmost drainage. The second seasonal wetland is found in the northern part of the Property, and abuts the eastern boundary of the Property. If any project related activities are to occur within these features an Army Corps of Engineers jurisdictional delineation would be required.

A query of the California Natural Diversity Database (CNDDB) showed that three special-status plant species have a moderate potential to occur on the Property. The bent-flowered fiddleneck (*Amsinckia lunaris*), Mt. Diablo fairy lantern (*Calochortus pulchellus*), and Diablo helianthella (*Helianthella castanea*) were identified as having a potential to occur on the Property based on the presence of suitable habitat for this species and a CNDDB occurrence located within the vicinity of the Property. Suitable habitat for these plant species occurs throughout the Property within the annual grassland. The April 2019 survey was conducted by walking meandering transects across the entirety of the Property, and was timed to be concurrent with the blooming period for these three species. However, none of these species were observed and therefore, they are all presumed absent.

A total of six bird species were identified to have a moderate to high potential to occur on the Property in a foraging capacity. The red-shouldered hawk (*Buteo lineatus*), red-tailed hawk (*Buteo jamaicensis*), white-tailed kite (*Elanus leucurus*), American kestrel (*Falco sparverius*), and Cooper's hawk (*Accipiter cooperii*) all have a high potential to occur in a foraging capacity only as there are no suitable trees on the Property to allow for nesting. The loggerhead shrike (*Lanius ludovicianus*) has a moderate potential to occur in a foraging capacity. One of the five birds listed above (red-tailed hawk) was present, observed foraging on the Property. If project construction-related activities such as tree and vegetation removal or grading take place during the nesting season (February through August), preconstruction surveys for nesting passerine birds and raptors are recommended to determine if ground nesters are present.

CNDDB listed six occurrences of California red-legged frog (*Rana draytonii*) (CRLF) within a 5-mile radius of the Property. The Property does not contain suitable aquatic breeding or non-breeding habitat for CRLF because the seasonal wetlands and ephemeral drainages are too shallow and do not pond long enough to allow CRLF to complete their lifecycle. There are several aquatic features within vicinity of the Property and while the Property does contain upland grassland habitat within 1-mile from these ponds and creeks, there are no small mammal burrows or other refugia that would provide shelter and protection for CRLF. Therefore, the Property is limited to serving as dispersal habitat. The grassland, drainages, and seasonal wetlands provide accessible upland dispersal habitat considering the Property is situated between multiple potentially occupied locations within a minimum of 1 mile of each other. For these reasons, CRLF has a moderate potential to occur on the Property in a dispersal capacity only.

CNDDB has listed five occurrences of foothill yellow-legged frog (*Rana boylii*) (FYLF) within five miles of the Property. All but one of the FYLF CNDDB occurrences were historical (> 50 years) and more than 2 miles from the Property. The most recent FYLF occurrence (Occurrence #160) was from 1997 and was located approximately 4 miles from the Property. Additionally, the Property lacks suitable habitat for foothill yellow-legged frog as it does not contain shallow, rock lined streams that provide egg laying substrate and foraging opportunities. Furthermore, the drainages found within the Property are not hydrologically connected to creeks or streams with these features, making dispersal onto the Property unlikely. Therefore, the foothill yellow legged frog is presumed absent from the Property.

CNDDB listed 26 occurrences of Alameda whipsnake (*Masticophis lateralis euryxanthus*) within the 5-mile radius of the Property. The Alameda whipsnake was identified by the CNDDB as occurring in the vicinity of the Property. The primary habitat types for Alameda whipsnake, chaparral and scrub with rock crevices or other suitable refuge habitat, are absent from the Property. While the secondary habitat type, annual grassland, is present within the Property, the height of the vegetation is fairly low due to the prolonged, intense grazing regime on the Property. For these reasons, the Property is not considered to be suitable breeding or foraging habitat. Primary habitat for Alameda whipsnake is abundant just east of the Property within the Las Trampas Ridge open space, and Alameda whipsnakes occurring within fringes of the Las Trampas Ridge open space may pass through the secondary habitat found within the Property, but they are not likely to breed or forage on the Property due to the aforementioned lack of primary habitats. Therefore, there is a moderate potential for Alameda whipsnake to utilize the Property for dispersal only.

No sign of bat use was observed on the Property during the April 2019 survey; however, based on habitat suitability, it was determined that bats have a moderate potential to utilize the site in a foraging capacity only. These bat species include: pallid bat (*Antrozous pallidus*) and hoary bat

(*Lasiurus cinereus).* There are no structures on site and the only tree is a single arroyo willow (*Salix lasiolepis*) that does not provide adequate cover for foliage roosters. The absence of roosting habitat on the Property obviates the need for a pre-construction bat survey for roosting bats.

1.0 INTRODUCTION

Olberding Environmental, Inc. has conducted a biological resources analysis (biological constraints assessment) of the Camino Pablo Property, located in unincorporated Contra Costa County, California. This biological resources analysis included a review of pertinent literature on relevant background information and habitat characteristics of the site. Our review included researching existing information in the California Natural Diversity Database (CNDDB) maintained by the CDFW and the California Native Plant Society's (CNPS) *Inventory of Rare and Endangered Vascular Plants of California*. Also included was a review of information related to species of plants and animals that could potentially utilize the described habitats identified on and immediately surrounding the Property. To assist in the assessment, a field reconnaissance investigation of the Property was conducted on April 18, 2019. This report documents the methods, results, and conclusions for the reconnaissance-level survey associated with the biological resources analysis for the Property.

2.0 LOCATION

The Property is located approximately 1.67 miles southeast of downtown Moraga, at 1211 Camino Pablo, Contra Costa County, California. The Property itself lies just outside the limits of the Town of Moraga. Attachment 1, Figure 1 depicts the regional location of the Property in Contra Costa County, and illustrates the vicinity of the Property in relationship to the Town of Moraga. Attachment 1, Figure 3 identifies the location of the Property on the USGS 7.5' Quadrangle Map for Las Trampas Ridge. An aerial photograph of the Property has been included as Attachment 1, Figure 4.

Access to the Property is provided from California State Route 24 west. Take exit 13 towards Central Lafayette/Moraga and take a right onto Deerhill Road. Turn right on First Street and then turn right onto Mt. Diablo Boulevard before turning left onto Moraga Road. Travel 4.7 miles on Moraga Road and continue straight onto Canyon Road for 0.5 miles begore turning left onto Camino Pablo. Travel for approximately 1.3 miles and the he Property will be on the left-hand side of Camino Pablo.

3.0 PROPERTY DESCRIPTION

The Property encompasses approximately 23.54 acres in a roughly triangular shape bounded on the north, west, and south by residential area, and on the east by open space. Moraga Creek is present immediately west of the Property, across Sanders Ranch Road, and King Canyon Creek is present to the east of the Property. The Property supports three habitat types consisting of annual grassland, seasonal wetland, and ephemeral drainage. Characteristic vegetation includes wild oat (*Avena fatua*), Italian rye grass (*Festuca perennis*), ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), filaree (*Erodium spp.*), and creeping wildrye (*Elymus triticoides*).

Two ephemeral drainages occur on the Property. They flow from east to west across the Property through heavily eroded gullies with incised channels. Both drainages empty into a network of concrete V-ditches located on the western Property boundary that flow into a storm drain system that extends off site. The first drainage flows from the center of Property westward and contains a single arroyo willow tree. The second drainage also flows westward from the center of the Property before being interrupted by a concrete V-ditch. A seasonal wetland is immediately adjacent to the southern side of the drainage and appears to be fed by a seep. The second seasonal wetland is present at the northern tip of the Property and abuts the eastern boundary. Both wetlands are characterized by a mix of hydrophytic and upland vegetation, contained saturated soils, and featured small pools of water created by cattle hoof shear.

The topography of the Property consists of undulating hillsides that range between 555 feet above sea level near the southwestern boundary and 740 feet above sea level along the northeastern boundary.

4.0 REGULATORY SETTING

4.1 Federal Regulatory Setting

4.1.1 Plants and Wildlife

The federal Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq., as amended) prohibits federal agencies from authorizing, permitting, or funding any action that would result in biological jeopardy to a plant or animal species listed as Threatened or Endangered under the Act. Listed species are taxa for which proposed and final rules have been published in the Federal Register (U.S. Fish and Wildlife Service [USFWS] 2017a). If a proposed project may jeopardize listed species, Section 7 of the ESA requires consideration of those species through

formal consultations with the USFWS. Federal Proposed species (USFWS, 2017b) are species for which a proposed listing as Threatened or Endangered under ESA has been published in the Federal Register. If a proposed project may jeopardize proposed species, Section 7 of the ESA affords consideration of those species through informal conferences with USFWS. The USFWS defines federal Candidate species as "those taxa for which we have on file sufficient information on biological vulnerability and threats to support issuance of a proposed rule to list, but issuance of the proposed rule is precluded by other higher priority listing actions" (USFWS, 2017b). Federal Candidate species are not afforded formal protection, although USFWS encourages other federal agencies to give consideration to Candidate species in environmental planning.

4.1.2 Wetlands/Waters

The federal government, acting through the Corps and the Environmental Protection Agency (EPA), has jurisdiction over all "waters of the United States" as authorized by §404 of the Clean Water Act (CWA) and §10 of the Rivers and Harbors Act of 1899 (33 CFR Parts 320-330). Properties that cause the discharge of dredged or fill material into waters of the United States require permitting by the Corps. Actions affecting small areas of jurisdictional waters of the United States may qualify for a Nationwide Permit (NWP), provided conditions of the permit are met, such as avoiding impacts to threatened or endangered species or to important cultural sites. Properties that affect larger areas or which do not meet the conditions of an NWP require an Individual Permit. The process for obtaining an Individual Permit requires a detailed alternatives analysis and development of a comprehensive mitigation/monitoring plan. Waters of the United States are classified as wetlands, navigable waters, or other waters. Wetlands are transitional habitats between upland terrestrial areas and deeper aquatic habitats such as rivers and lakes. Under federal regulation, wetlands are defined as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal conditions do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (33 CFR Part 328.3[b]). Swamps, marshes, bogs, fens, and estuaries are all defined as wetlands, as are seasonally saturated or inundated areas such as vernal pools, alkali wetlands, seeps, and springs. In addition, portions of the riparian habitat along a river or stream may be a wetland where the riparian vegetation is at or below the ordinary high water mark and thus also meets the wetland hydrology and hydric soil criteria.

Navigable waters include all waters subject to the ebb and flow of the tides, including the open ocean, tidal bays, and tidal sloughs. Navigable waters also include some large, non-tidal rivers and lakes, which are important for transportation in commerce. The jurisdictional limit over navigable waters extends laterally to the entire water surface and bed of the waterbody landward to the limits of the mean high tide line. For non-tidal rivers or lakes, which have been designated

(by the Corps) to be navigable waters, the limit of jurisdiction along the shoreline is defined by the ordinary high water mark. “Other waters” refer to waters of the United States other than wetlands or navigable waters. Other waters include streams and ponds, which are generally open water bodies and are not vegetated. Other waters can be perennial or intermittent water bodies and waterways. The Corps regulates other waters to the outward limit of the ordinary high water mark. Streams should exhibit a defined channel, bed and banks to be delineated as other waters.

The Corps does not generally consider “non-tidal drainage and irrigation ditches excavated on dry land” to be jurisdictional waters of the United States (and such ditches would therefore not be regulated by the Corps (33 CFR Parts 320-330, November 13, 1986). Other areas generally not considered jurisdictional waters include: 1) artificially irrigated areas that would revert to upland habitat if the irrigation ceased; 2) artificial lakes and ponds created by excavating and/or diking of dry land to collect and retain water, used exclusively for such purposes as stock watering, irrigation, settling basins, or rice growing; 3) waste treatment ponds; 4) ponds formed by construction activities including borrow pits until abandoned; and 5) ponds created for aesthetic reasons such as reflecting or ornamental ponds (33 CFR Part 328.3). However, the preamble also states “the Corps reserves the right on a case-by-case basis to determine that a particular waterbody within these categories” can be regulated as jurisdictional water. The EPA also has authority to determine jurisdictional waters of the U.S. on a case-by-case basis. Riparian habitat that is above the ordinary high water mark and does not meet the three-parameter criteria for a wetland would not be regulated as jurisdictional waters of the United States.

4.1.3 Migratory Bird Treaty Act

Raptors are migratory bird species protected by international treaty under the Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. 703-711). The MBTA makes it unlawful to take, possess, buy, sell, purchase, or barter any migratory bird listed in 50 CFR. Part 10, including feathers or other parts, nests, eggs, or products, except as allowed by implementing regulations (50 CFR 21). Sections 3503, 3503.5, and 3800 of the California Fish and Game Code prohibit the take, possession, or destruction of birds, their nests or eggs. Implementation of the take provisions requires that Property-related disturbance at active nesting territories be reduced or eliminated during critical phases of the nesting cycle (generally February 1 – September 1, annually). Disturbance that causes nest abandonment and/or loss of reproductive effort (e.g., killing or abandonment of eggs or young) or the loss of habitat upon which the birds depend, is considered “taking” and is potentially punishable by fines and/or imprisonment. Such taking would also violate federal law protecting migratory birds (e.g., MBTA).

4.1.4 Federal Bald and Golden Eagle Protection Act

In addition to protection under the MBTA, both the bald eagle and the golden eagle are also protected by the Bald and Golden Eagle Protection Act of 1940 (16 U.S.C. 668-668c). The Bald and Golden Eagle Protection Act, and amended several times since being enacted in 1940, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald or golden eagles, including their parts, nests, or eggs (USFWS 2007). The Act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb" (USFWS 2007).

For purposes of these guidelines, "disturb" means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior" (USFWS 2007).

In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment (USFWS 2007).

4.2 State Regulatory Setting

4.2.1 Plants and Wildlife

Property permitting and approval requires compliance with California Environmental Quality Act (CEQA), the 1984 California Endangered Species Act (CESA), and the 1977 Native Plant Protection Act (NPPA). The CESA and NPPA authorize the California Fish and Game Commission to designate Endangered, Threatened and Rare species and to regulate the taking of these species (§§2050-2098, Fish & Game Code). The California Code of Regulations (Title 14, §670.5) lists animal species considered Endangered or Threatened by the State.

The Natural Heritage Division of the CDFW administers the state rare species program. The CDFW maintains lists of designated Endangered, Threatened, and Rare plant and animal species (CDFW 2018b and 2018c). Listed species either were designated under the NPPA or designated by the Fish and Game Commission. In addition to recognizing three levels of endangerment, the

CDFW can afford interim protection to candidate species while they are being reviewed by the Fish and Game Commission.

The CDFW also maintains a list of animal species of special concern (CDFW 2018b), most of which are species whose breeding populations in California may face extirpation. Although these species have no legal status, the CDFW recommends considering them during analysis of proposed property impacts to protect declining populations and avoid the need to list them as endangered in the future.

Under provisions of §15380(d) of the CEQA Guidelines, the CEQA lead agency and CDFW, in making a determination of significance, must treat non-listed plant and animal species as equivalent to listed species if such species satisfy the minimum biological criteria for listing. In general, the CDFW considers plant species on List 1A (Plants Presumed Extinct in California), List 1B (Plants Rare, Threatened, or Endangered in California and elsewhere), or List 2 (Plants Rare, Threatened, or Endangered in California, But More Common Elsewhere) of the CNPS *Inventory of Rare and Endangered Vascular Plants of California* (Skinner and Pavlik 1994) as qualifying for legal protection under §15380(d). Species on CNPS Lists 3 or 4 may, but generally do not, qualify for protection under this provision.

Sensitive habitats include riparian corridors, wetlands, habitats for legally protected species and CDFW Species of Special Concern, areas of high biological diversity, areas providing important wildlife habitat, and unusual or regionally restricted habitat types. Habitat types considered sensitive include those listed on the CNDDB working list of "high priority" habitats (i.e., those habitats that are rare or endangered within the borders of California) (Holland 1986).

4.2.2 Wetlands/Waters

The RWQCB regulates activities in wetlands and other waters through §401 of the Clean Water Act. Section 401 requires a state water quality certification for properties subject to 404 regulations. Requirements of the certification include mitigation for loss of wetland habitat. In the San Francisco Bay region, the RWQCB may identify additional wetland mitigation beyond the mitigation required by the Corps. California Fish and Game Code §§1600-1607 require the CDFW be notified of any activity that could affect the bank or bed of any stream that has value to fish and wildlife. Upon notification, the CDFW has the discretion to execute a Streambed Alteration Agreement. The CDFW defines a stream as follows:

> *"... a body of water that flows at least periodically...through a bed or channel having banks and supporting fish and other aquatic life. This includes watercourses having a subsurface flow that supports or has supported riparian vegetation."*

(Source: Streambed Alteration Program, California Department of Fish and Wildlife, 2016).

In practice, CDFW authority is extended to any "blue line" stream shown on a USGS topographic map, as well as unmapped channels with a definable bank and bed. Wetlands, as defined by the Corps, need not be present for CDFW to exert authority.

4.2.3 California Environmental Quality Act

According to Appendix G of the CEQA (CEQA 2018) Guidelines, a proposed project would have a significant impact on biological resources if it would:

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the CDFW and USFWS?

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the CDFW or USFWS?

c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?

5.0 METHODS OF ANALYSIS FOR GENERAL BIOLOGICAL RESOURCES

A special-status plant and wildlife species database search and review was conducted using the CNDDB and other sources. An additional search was conducted for special-status plants using CNPS *Inventory* on-line. Special-status species reports were accessed by searching the CNDDB database for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San

Leandro, Oakland East, and Briones Valley USGS 7.5-minute quadrangles which surround the Property, and by examining those species that have been identified in the vicinity of the Property. These quadrangles will be henceforth noted as surrounding quads. The database report identified special-status species known to occur in the region or those that have the potential to occur in the vicinity of the Property. The CNDDB report was used to focus special-status species analysis of the site prior to the reconnaissance surveys.

An Olberding Environmental biologist conducted a reconnaissance-level survey of the Property on April 18, 2019. The survey consisted of walking throughout the Property and evaluating the site and adjacent lands for potential biological resources. Existing conditions, observed plants and wildlife, adjacent land uses, soil types and potential biological resource constraints were recorded during the visit. Plant and wildlife species observed within and adjacent to the Property during the reconnaissance survey are listed in Attachment 2, Table 1.

The objectives of the field survey were to determine the potential presence or absence of special-status species habitat listed in the CNDDB database report and to identify any wetland areas that could be potentially regulated by the Corps, RWQCB, and/or CDFW (CNDDB 2019). In addition, the Olberding Environmental biologist looked for other potential sensitive species or habitats that may not have been obvious from background database reports or research. Surveys conducted after the growing season or conducted outside of the specific flowering period for a special-status plant cannot conclusively determine the presence or absence of such plant species; therefore, site conditions and habitat type were used to determine potential for occurrence. When suitable habitat was observed to support a special-status plant or animal species, it was noted in the discussion for that particular species. Regulatory agencies evaluate the possibility of occurrence based on habitats observed on-site and the degree of connectivity with other special-status animal habitats in the vicinity of the Property. These factors are discussed in each special-status plant or animal section. Potential for occurrence of each special-status or protected plant and animal species was evaluated using the following criteria.

- **Present**: The species has been recorded by CNDDB or other literature as occurring on the Property and/or was observed on the Property during the reconnaissance survey or protocol surveys.

- **May Occur**: The species has been recorded by CNDDB or other literature as occurring within five miles of the Property, and/or was observed within five miles of the Property, and/or suitable habitat for the species is present on the Property or its immediate vicinity.

- **Not Likely to Occur**: The species has historically occurred on or within five miles of the Property, but has no current records. The species occurs within five miles of the Property

but only marginally suitable habitat conditions are present. The Property is likely to be used only as incidental foraging habitat or as an occasional migratory corridor.

- **Presumed Absent**: The species will not occur on the Property due to the absence of suitable habitat conditions, and/or the lack of current occurrences. Alternatively, if directed or protocol-level surveys were done during the proper occurrence period and the species was not found, it is presumed absent.

Sources consulted for agency status information include USFWS (2017a) for federally listed species and CDFW (2018b) for State of California listed species. Based on information from the above sources, Olberding Environmental developed a target list of special-status plants and animals with the potential to occur within or in the vicinity of the Property (Attachment 2, Table 2).

5.1 Soils Evaluation

The soils present on a property may determine if habitat on the site is suitable for certain special-status plants and animals. The host plants of some special-status invertebrates may also require specific soil conditions. In the absence of suitable soil conditions, special-status plants or animals requiring those conditions would be presumed absent. Information regarding soil characteristics for the Property was obtained by viewing the Natural Resources Conservation Service (NRCS) Web Soil Survey report for the Property (NRCS 2017)

5.2 Plant Survey Methods

The purposes of the botanical surveys were (1) to characterize the habitat types (plant communities) of the study area; (2) to determine whether any suitable habitat for any special-status plant species occurs within the study area; and (3) to determine whether any sensitive habitat types (wetlands) occur within the study area. Site conditions and plant habitat surveys are important tools in determining the potential occurrence of plants not recorded during surveys (e.g., special-status plants) because presence cannot conclusively be determined if field surveys are conducted after the growing season or conducted outside a specific flowering period.

5.2.1 Review of Literature and Data Sources

The biologist conducted focused surveys of literature and special-status species databases in order to identify special-status plant species and sensitive habitat types with potential to occur in the study area. Sources reviewed included the CNDDB occurrence records (CNDDB 2018) and CNPS *Inventory* (Skinner and Pavlik 1994) for the surrounding quads; and standard flora

(Hickman 1993). From the above sources, a list of special-status plant species with potential to occur in the Property vicinity was developed (Attachment 2, Table 2).

5.2.2 Field Surveys

A biologist from Olberding Environmental conducted a reconnaissance-level survey to determine habitat types and the potential for special-status plants based on the observed habitat types. All vascular plant species that were identifiable at the time of the survey were recorded and identified using keys and descriptions in Hickman (1993).

The habitat types occurring on the Property were characterized according to pre-established categories. In classifying the habitat types on the site, the generalized plant community classification schemes of *A Manual of California Vegetation* (Sawyer, Keeler-Wolf, and Evens 2009) were consulted. The final classification and characterization of the habitat types of the study area were based on field observations.

5.3 Wildlife Survey Methods

The purposes of the wildlife survey were to identify special-status wildlife species and/or potential special-status wildlife habitats within the study area.

5.3.1 Review of Literature and Data Sources

A focused review of literature and data sources was conducted in order to determine which special-status wildlife species had potential to occur in the vicinity of the Property. Current agency status information was obtained from USFWS (2017a) for species listed as Threatened or Endangered, as well as Proposed and Candidate species for listing, under the federal ESA; and from CDFW (2018b, 2018c) for species listed as Threatened or Endangered by the state of California under the CESA, or listed as "species of special concern" by CDFW. From the above sources, a list of special-status wildlife species with potential to occur in the Property vicinity was developed (Attachment 2, Table 2).

5.3.2 Field Surveys

General Wildlife Survey – An Olberding Environmental biologist conducted a survey of species habitat within the entire study area, including visible portions of the adjacent properties. The purpose of the habitat survey was to evaluate wildlife habitats and the potential for any protected species to occur on or adjacent to the Property.

Reconnaissance-Level Raptor Survey – A reconnaissance-level raptor survey was conducted on the Property. Observation points were established on the periphery of the site to view raptor activity over a fifteen- to thirty-minute time period. This survey was conducted with the use of binoculars and notes were taken for each species observed. Additionally, utility poles and perch sites in the vicinity of the Property were scanned for raptor activity. All raptor activity within and adjacent to the Property was recorded during the reconnaissance-level observation period.

Reconnaissance-Level Burrowing Owl (Athene cunicularia) Survey – A reconnaissance-level burrowing owl (*Athene cunicularia*) survey was also conducted on the Property to identify potential burrow sites or burrowing owl use of on-site habitat. The general presence and density of suitable burrow sites (e.g., rodent burrows) was evaluated for the Property.

6.0 RESULTS FOR GENERAL BIOLOGICAL RESOURCES

The search and review of the CNDDB database reports revealed the occurrence of special-status plant and wildlife species that occur in the habitats found within the Property boundaries (CNDDB 2018). The CNDDB database and background data were reviewed for the surrounding quads (Attachment 2, Table 2). Those animals listed in Attachment 2, Table 2 were reviewed for their potential to occur on the Property based on general habitat types. Most of the plant and several of the animal species identified by the CNDDB require specific habitat microclimates that were not found to occur within the Property.

6.1 Soil Evaluation Results

The NRCS (2017) reports two soil types within the Property. A map of this soil type can be found in Attachment 1, Figure 8. The soil type mapped included the following:

- **LhE: Los Osos clay loam, 15 to 30 percent slopes –** The Los Osos series consists of moderately deep, well drained soils that formed in material weathered from sandstone, shale, and in some places from conglomerate. These soils are found between 100 to 3,500 feet. The composition of this soil type within the Property consists of 80 percent Los Osos and similar soils and 20 percent of minor components including Alo (5%), Millsholm (5%), Lodo (5%), and Diablo (5%).

  Typically, Los Osos soils exhibit very high runoff and slow permeability. These soils are used mostly for range, limited areas are cropped to grain and sudan grass pasture. Vegetation is mostly annual grasses and forbs with some perennial grasses, coastal sagebrush, and live oak. This series shows no frequency of ponding or flooding. Its stratified layers consist of the following:

A--0 to 14 inches; brown loam, very dark grayish brown moist; slightly hard, friable; moderately acid (pH 6.0).

Btss1--14 to 24 inches; yellowish brown clay, dark yellowish brown moist; very hard, very firm; moderately acid (pH 6.0).

Btss2--24 to 32 inches; light yellowish brown clay loam, dark yellowish brown moist; very hard, very firm; slightly acid (pH 6.5).

C--32 to 39 inches; pale yellow sandy loam, light olive brown moist; hard, friable; neutral (pH 7.0).

Cr--39 to 43 inches; yellowish brown sandstone, brown moist.

- **LhF: Los Osos clay loam, 30 to 50 percent slopes –** Information about Los Osos soil and its stratified layers can be found in the previous soil type (**LhE**).

- **CeB:** Conejo clay loam, 2 to 5 percent slopes - The Conejo series consists of very deep, well drained soils that formed in alluvium from basic igneous or sedimentary rocks. Conejo soils are on alluvial fans and stream terraces. Slopes range from 0 to 9 percent. The mean annual precipitation is about 20 inches, (508 mm) and the mean annual air temperature is about 62 degrees F. Conejo soils are on alluvial fans and stream terraces at elevations of 30 to 2,000 feet. Vegetation is annual grasses and forbs with few scattered oaks. Its stratified layers consist of the following:

  Ap--0 to 5 inches, (0 to 13 cm); dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; very hard, friable, moderately sticky and moderately plastic; many fine and medium irregular pores; slightly alkaline, pH 7.5.

  A1--5 to 19 inches, (13 to 48 cm); very dark grayish brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; very hard, friable, moderately sticky and moderately plastic; slightly alkaline, pH 7.5.

  A2--19 to 30 inches, (48 to 76 cm); very dark grayish brown (10YR 3/2) clay loam, very dark grayish brown (10YR 3/2) moist; very hard, friable, moderately sticky and moderately plastic; slightly alkaline, pH 7.5.

  Bw1--30 to 48 inches, (76 to 122 cm); dark grayish brown (10YR 4/2) clay loam, very

dark grayish brown (10YR 3/2) moist; very hard, friable, moderately sticky and moderately plastic; slightly alkaline, pH 7.5.

Bw2--48 to 70 inches, (122 to 178 cm); brown (10YR 5/3) loam, dark yellowish brown (10YR 4/4) moist; slightly hard, weakly brittle but friable, nonsticky and slightly plastic; moderately alkaline, pH 8.0.

6.2 Plant Survey Results

6.2.1 Floristic Inventory and Habitat Characterization

The Property supports three habitat types consisting of non-native annual grassland, seasonal wetland, and drainage. In classifying the habitat types on the Property, generalized plant community classification schemes were used (Sawyer, Keeler-Wolf, and Evens 2009). The final classification and characterization of the habitat type of the Property was based on field observations.

The habitat type and a description of the plant species present within the habitat type are provided below. Dominant plant species are also noted. A complete list of plant species observed on the Property can be found within Attachment 2, Table 1.

Non-native Annual Grassland

A large majority of the Property, 23.34 acres, is dominated by non-native annual grassland habitat. Dominant vegetation observed within this habitat type includes but is not limited to wild oat, ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), Mediterranean barley (*Hordeum marinum*), and Italian rye grass. Medium to large sized stands of native creeping wildrye (*Elymus triticoides*) are scattered throughout the grassland, and other native species found within this habitat include purple needlegrass (*Stipa pulchra*), lupines (*Lupinus spp.*), sun cup (*Taraxia ovata*), and common buttercup (*Ranunculus californicus*).

The grassland habitat is almost entirely void of trees and shrubs, with the exception of a few short oso berry (*Oemleria cerasiformis*), poison oak (*Toxicodendron diversilobum*), coyotebrush (*Baccharis pilularis*), and common snowberry (*Symphoricarpos albus*) bushes located on a hillside just above the northernmost drainage. The grassland vegetation throughout the Property was fairly short, likely due to the long-term grazing pressure associated with cattle rangeland.

Drainage

The Property contains two drainage features, both of which are ephemeral. Dominant vegetation within both drainages was consistent with the composition of the annual grassland, and consisted primarily of Italian rye grass, Mediterranean barley, wild oat, creeping wildrye, and ripgut brome. Other species observed include curly dock (*Rumex crispus*), milk thistle (*Silybum marianum*), filaree, and ribwort plantain (*Plantago lanceolata*). The southernmost drainage also had a single arroyo willow growing within the channel.

Seasonal Wetland

There are two seasonal wetlands found within the Property. The first seasonal wetland is immediately adjacent to the northernmost ephemeral drainage and is characterized by a mix of hydrophytic plants, such as curly dock and Italian rye grass, and upland species such as wild oats and ripgut brome. This wetland was swale-like and contained numerous small pools of water within cattle hoof shear.

The second seasonal wetland is present in the northern portion of the Property along the eastern boundary. The vegetation within the wetland was consistent with the surrounding grasslands, but several hydrophytic species such as curly dock and toad rush (*Juncus bufonicus*) were observed. Some of the larger pools also contained algae. Similar to the first wetland, small pools of water were noted within hoof shear that overflowed into one another through small streams.

Special-Status Plant Species

Special-status plant species include species listed as Rare, Threatened, or Endangered by the USFWS (2017a) or by the State of California (CDFW 2018c). Federal Proposed and Candidate species (USFWS, 2017b) are also special-status species. Special-status species also include species listed on List 1A, List 1B, or List 2 of the CNPS Inventory (Skinner and Pavlik, 1994; CNPS 2018). All species in the above categories fall under state regulatory authority under the provisions of CEQA, and may also fall under federal regulatory authority. Considered special-status species are species included on List 3 (Plants About Which We Need More Information—A Review List) or List 4 (Plants of Limited Distribution—A Watch List) of the CNPS *Inventory*. These species are considered to be of lower sensitivity and generally do not fall under specific state or federal regulatory authority. Specific mitigation considerations are not generally required for List 3 and List 4 species.

Attachment 2, Table 2 includes a list of special-status plants with the potential to occur within or in the immediate vicinity of the Property based on a review of the surrounding quads. The special-status plant species identified by the CNDDB as potentially occurring on the Property are

known to grow only from specific habitat types. The specific habitats or "micro-climate" necessary for many of the plant species to occur are not found within the boundaries of the Property. The habitats necessary for the CNDDB reported plant species consist of valley and foothill grassland, cismontane woodlands, chaparral, playas, chenopod scrub, adobe clay soils, alkaline soils, serpentine soils, sandy soils, gravelly soils, coastal prairie, coastal scrub, coastal dunes, coastal bluff scrub, coastal salt marsh, vernal pools, seeps, meadows and sinks, marshes or swamps, riparian woodlands, on slopes near drainages, closed cone coniferous forest, north coast coniferous forest, redwood forest, lower montane coniferous forest, and broad-leafed upland forest.

Occurrences of special-status plants within a five-mile radius of the point roughly representing the center of the Property are described in detail. Occurrence distance from the Property is estimated from this center point (Attachment 1, Figure 6).

Bent-Flowered Fiddleneck (*Amsinckia lunaris*). CNPS List 1B.

Bent-flowered fiddleneck is an annual of the family *Boraginaceae*. The inflorescence is spike-like and coiled at the tip with multiple small orange flowers. It is distributed throughout the inner north coast ranges of California, in the west Central Valley, and the San Francisco Bay Area. Habitat consists of coastal bluff scrub, cisomontane woodlands, and valley and foothill grasslands. The blooming period is between March and June.

The CNDDB listed ten occurrences of this bent-flowered fiddleneck within five miles of the Property. The closest occurrence (Occurrence #74) was approximately 1 mile west of the Property on the King's Canyon Loop Trail of the Upper San Leandro Reservoir. 50 plants were recorded in this location in 2010. Somewhat suitable habitat for bent-flowered fiddleneck exists within the open grassland habitat of the Property; however, no plants were present at the time of the survey. The April 2019 survey was performed within the identified blooming period of this species (March-June). For these reasons bent-flowered fiddleneck is presumed absent from the Property.

Mount Diablo Fairy-Lantern (*Calochortus pulchellus*). CNPS List 1B.

Mount Diablo fairy-lantern is a spring blooming bulb that is in flower between April and June. This species exhibits light yellow globe-shaped flowers that turn down as if nodding. The plant grows to approximately one and a half feet tall and has between one to several flowers on the stem and long, narrow, pointed leaves. This bulb specifically grows on wooded slopes in chaparral and in valley and foothill grassland habitat.

The CNDDB listed two occurrences (Occurrence #57 & 28) of Mt. Diablo fairy lantern within a 5-mile radius of the Property. The closest occurrence (Occurrence #57) is located approximately 2.75 miles southeast of the Property on the highest hill along Rifle Range Road, near the sandstone area above San Leandro Reservoir. The annual grassland habitat found within the Property is somewhat suitable for Mt. Diablo fairy lantern; however, the April reconnaissance survey was conducted during the blooming period for this species and none were observed. Therefore, Mt. Diablo fairy lantern is presumed absent from the Property.

Diablo Helianthella (*Helianthella castanea*). CNPS List 1B.

Diablo helianthella is a perennial herb that exhibits yellow sunflowers that bloom between April and June. The plant has simple broad leaves that are attached at the base of the stem and grows up to two feet in height. The Diablo helianthella is known to grow on rocky, azonal soils often in partial shade within broadleaf upland forest, chaparral, cismontane woodland, coastal scrub, riparian habitat, and valley and foothill grasslands.

The CNDDB listed 21 occurrences of Diablo helianthella within a 5-mile radius of the Property. The closest occurrence (Occurrence #115) is located approximately 1 mile northeast of the Property at the southeast end of Gudde Ridge, about 0.5 air miles south of the junction of Canyon Road and Camino Pablo. One plant was observed in 2014. The annual grassland habitat found within the Property is suitable for Diablo helianthella, especially on the hillside above the northernmost drainage where several patches of rocky substrate are adjacent to small oso berry and poison oak shrubs. However, the April 2019 survey was conducted during the blooming period for this species, and none were observed. Therefore, Diablo helianthella is presumed absent from the Property.

6.3 Wildlife Survey Results

6.3.1 General Wildlife Species and Habitats

A complete list of wildlife species observed within the Property can be found in Attachment 2, Table 1. Wildlife species commonly occurring within habitat types present on the Property are discussed below:

Non-native Annual Grassland

Due to the low vegetation height and the lack of trees and shrubs, the annual grassland habitat provides limited foraging opportunities for avian species. Passerine species observed during the survey include black phoebe (*Sayornis nigricans*), savannah sparrow (*Passerculus*

sandwichensis), American crow (*Corvus bracyrynchos*), Anna's hummingbird (*Calypte anna*), turkey vulture (*Cathartes aura*), and wild turkey (*Meleagris gallopavo*).

The red-tailed hawk (*Buteo jamaicensis*) was the only raptor species observed during the survey, however the grassland habit could potentially be utilized for foraging by other species including white-tailed kite (*Elanus leucurus*), red-shouldered hawk (*Buteo lineatus*), American kestrel (*Falco sparverius*), and Cooper's hawk (*Accipiter cooperii*).

The cover from the grassland habitat and cattle hoof shear offer suitable habitat for various reptile species. Numerous western fence lizards (*Sceloporus occidentalis*) were observed throughout the Property. Other reptile species including Pacific gopher snake (*Pituophis catenifer catenifer*) and California king snake (*Lampropeltis californiae*) may also occur.

No mammal species or signs (i.e. droppings) were seen on the Property at the time of the survey.

Seasonal Wetland

The seasonal wetlands on the Property are very shallow and only hold water in small ruts and hoof shear. Therefore, they are unsuitable for most amphibian species, such as CRLF or CTS, that require prolonged inundation to complete their lifecycle. However, Sierran tree frog larvae and one adult were observed in the northernmost wetland within the pooled water in the hoof shear.

Drainage

The ephemeral drainages offer suitable foraging and dispersal habitat for amphibian species including Sierran tree frog and western toad. During the wet months, similar species to seasonal wetlands are expected to occur in the ephemeral drainages, while similar species to the grassland habitat are expected to occur during the dry months.

One arroyo willow tree is present within the channel of the southernmost drainage. Due to its solitary nature, small stature, and lack of dense foliar cover, it is most likely not suitable nesting habitat for birds and/or raptors.

BIRDS

Red-shouldered Hawk (*Buteo lineatus*). State Protected.

The red-shouldered hawk is a medium-sized, slender *Buteo* with long legs and a long tail and is smaller than the red-tailed hawk. Upperparts are dark with pale spotting, and rusty-reddish feathers on the wing create the distinctive shoulder patch. The tail has several wide, dark bars;

the intervening narrow stripes and the tip of the tail are white, and there is variation in the number of tail bars among adults and juveniles. The habitat that the red-shouldered hawk prefers varies from bottomland hardwoods and riparian areas to upland deciduous or mixed deciduous-conifer forest, and almost always includes some form of water, such as a swamp, marsh, river, or pond. In the west, the red-shouldered hawk sometimes occurs in coniferous forests, and has been expanding its range of occupied habitats to include various woodlands, including stands of eucalyptus trees amid urban sprawl. They typically place their nests in a broad-leaved tree (occasionally in a conifer), below the forest canopy but toward the tree top, usually in the crotch of the main trunk. Nest trees are often near a pond, stream, or swamp, and can be in suburban neighborhoods or parks. These hawks eat mostly small mammals, lizards, snakes, and amphibians. They also eat toads, snakes, and crayfish. They occasionally eat birds, sometimes from bird feeders; recorded prey includes sparrows, starlings, and doves.

The CNDDB does not track red-shouldered hawk occurrences. There are no suitable nesting trees within the Property itself, but there are some large trees within the vicinity that may offer suitable nesting habitat. However, foraging opportunities occur throughout the Property in the annual grassland habitat. Given the information above the red-shouldered hawk has high potential to occur on the Property in a foraging capacity only.

Red-Tailed Hawk (*Buteo jamaicensis*). State Protected.

The red-tailed hawk is a large *Buteo* that is distinct due to the red color of its tail feathers in contrast to the brown color of its body. Not all red-tailed hawks exhibit the distinct coloration on their tail and gradations may occur especially in young birds. Red-tailed hawks hunt rodents by soaring over grassland habitat. Nest trees for red-tailed hawks are usually tall trees with a well-developed canopy that includes a strong branching structure on which to build a nest.

CNDDB does not track red-tailed hawk occurrences. However, a red-tailed hawk was observed circling above the Property during the April 2019 survey. There are no large trees present within the Property that may offer suitable nesting habitat, but foraging opportunities occur throughout the Property. Given the information above the red-tailed hawk is present in a foraging capacity only.

White-tailed Kite (*Elanus leucurus*). Federal Species of Concern, CDFW: Fully Protected.

The white-tailed kite is falcon-shaped with a long white tail. This raptor has black patches on the shoulders that are highly visible while the bird is flying or perching. White-tailed kites forage in annual grasslands, farmlands, orchards, chaparral, and at the edges of marshes and meadows. They are found nesting in trees and shrubs such as willows (*Salix sp.*), California sycamore (*Platanus racemosa*), and coast live oak (*Quercus agrifolia*) often near marshes, lakes, rivers, or

ponds. This raptor often hovers while inspecting the ground below for prey. The White-tailed Kite eats mainly small mammals, as well as some birds, lizards, and insects. Annual grasslands are considered good foraging habitat for white-tailed kites, which will forage in human-impacted areas.

CNDDB did not list the white-tailed kite as occurring within the vicinity of the Property. There are no large trees within the Property that could provide suitable nesting habitat for white-tailed kite; the single arroyo willow tree present in the southernmost drainage is too small to support a raptor nest. However, foraging opportunities occur throughout the Property in the grassland habitat. Given the information above the white-tailed kite has high potential to occur on the Property in a foraging capacity only.

Cooper's Hawk (*Accipiter cooperii*). State Protected.

Coopers' hawk is a medium to large-size raptor, reaching an average of 28-34 in wingspan. They are distinctive for the black and white horizontal banding on the elongated tail, blue gray head, back and upper wings. Additional markings include rusty red horizontal barring on a white breast, a large square head, and long yellow legs and feet.

The CNDDB listed one occurrence (Occurrence #115) of Cooper's hawk within a 5-mile radius of the Property. This occurrence is located approximately 4.25 miles southwest of the Property along Urban Chimes Creek, between Delmont Avenue and I-580 in Oakland. Two adults and four juveniles were observed in a nest in July 2006. While Cooper's hawks generally nest in riparian trees, the arroyo willow on the Property is not large enough to support a raptor nest and there are no other large trees present within the Property that could offer suitable nesting habitat. However, foraging opportunities occur throughout the grassland on Property. Given the information above, the Cooper's hawk has high potential to occur on the Property in a foraging capacity only.

American Kestrel (*Falco sparverius*). State Protected.

The American kestrel is the smallest of raptor species and is distinct due to the black barring on its face. The female kestrel is slightly larger than the male bird and is differentiated by its brown and red coloration. The male kestrel is slightly smaller than the female and has gray wing patches near the top of the wing. Kestrels favor open areas with short ground vegetation and sparse trees. You'll find them in meadows, grasslands, deserts, parks, farm fields, cities, and suburbs. Kestrels utilize cavities in trees and structures for nesting and hunt small rodents and birds.

The CNDDB did not list any occurrences of American kestrel within a 5-mile radius of the Property. The grassland habitat within the Property is suitable foraging habitat for kestrel; however, there are no trees or structures within the Property that contain cavities for potential nest sites. Therefore, the American kestrel has a high potential to occur on the Property in a foraging capacity only.

Loggerhead Shrike (*Lanius ludovicianus*). Federal Species of Special Concern, California Species of Special Concern.

The loggerhead shrike is a black and white perching bird with a black face mask that extends over the bill. A common resident and winter visitor in lowlands and foothills throughout California. It prefers open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches. It occurs only rarely in heavily urbanized areas, but is often found in open cropland. This species hunts large insects, small rodents and even small birds. Loggerhead shrikes are known for their habit of impaling their food on thorns or barb wire for future consumption. The range and habitat for the loggerhead shrike has steadily shrunk due to human development within grasslands; however, this species is often found on lands grazed by cattle that are fenced with barb wire. These birds use shrubs, dense trees, and thickets of vegetation for nesting sites.

CNDDB did not list the loggerhead shrike as occurring within the vicinity of the Property. While there are no thickets or shrubs within the Property that could offer potentially suitable nesting habitat, foraging opportunities occur across the Property within the grassland. Given the information above the loggerhead shrike has moderate potential to occur on the Property in a foraging capacity only.

MAMMALS

Special-status Bats

Bats (Order - *Chiroptera*) are the only mammals capable of "true" flight. They are nocturnal feeders and locate their prey, which consists of small to medium sized insects by echolocation. Bats consume vast amounts of insects making them very effective pest control agents. They may eat as much as their weight in insects per day. Maternity roosts comprised of only females, may be found in buildings or mine shafts with temperatures up to 40 degrees Celsius and a high percentage of humidity to ensure rapid growth in the young. Female bats give birth to only one or two young annually and roost in small or large numbers. Males may live singly or in small groups, but scientists are still unsure of the whereabouts of most males in summer.

Special-status bats with the potential to occur on the Property are listed below:

- Pallid bat (*Antrozous pallidus*)
- Hoary Bat (*Lasiurus cinereus*)

CNDDB listed 5 occurrences of the pallid bat and one occurrence of hoary bat (Occurrence #17) as occurring within the 5-mile radius of the Property. There are no structures on the Property that could provide suitable roosting habitat for pallid bat. Additionally, there are no trees within the Property that offer dense foliar cover suitable for roosting hoary bats. However, the grassland habitat, ephemeral drainages, and seasonal wetlands provide an array of insects allowing for abundant foraging opportunities. Given the above information, multiple species of bats have a moderate potential to occur on the Property in a foraging capacity only.

American Badger (*Taxidea taxus*). California Species of Special Concern.

The American badger is a California Species of Special Concern. This large member of the weasel family has a flat body with short legs ideally suited to digging burrows. They are typically found in open plains, prairies, forests and grasslands, or other areas with friable soils and low foliar cover. In California they primarily inhabit a combination of grasslands, agricultural lands, and other open space. The badger is a fossorial carnivore that feeds on ground squirrels, mice, and gophers. It is also a significant predator of snakes, including rattlesnakes. Burrows created by badgers range from about 4 feet to 10 feet in depth and 4 feet to 6 feet in width. They typically enlarge abandoned gopher or ground squirrel burrows. Female American badger may create 2 to 4 burrows within a small area, connected by tunnels in order to better conceal her young. Displaced soil from badger dens characteristically appears in front of the burrow entrance, giving the appearance of a mound-like roof. Badgers mate between July and August, but do not give birth until March.

The CNDDB listed two occurrences (Occurrence #135 & 136) of American badger within 5-miles of the Property. The closest occurrence (Occurrence #135) is located approximately 3.5 miles southwest of the Property where a male badger was collected 2 miles northeast of Mills College in 1930. The other occurrence (Occurrence #136) is nearly 5 miles away and is also historical (dated 1925). The grassland habitat found within the Property is suitable for badger considering the low vegetation height and friable soils. However, no small mammals such as ground squirrels or gophers were observed during the survey, and therefore the Property may lack an appropriate prey base to support badgers. For these reasons, the American badger has a low potential on the Property, and is not likely to occur.

AMPHIBIANS

California Red-Legged Frog (*Rana draytonii*). Federally Threatened, California Species of Special Concern.

California red-legged frog (CRLF) was listed as a Federal threatened species on May 31, 1996 (61 FR 25813) and is considered threatened throughout its range. If a proposed Property may jeopardize listed species, Section 7 of the ESA requires consideration of those species through formal consultations with the USFWS. Federal Proposed species (USFWS 2006) are species for which a proposed listing as Threatened or Endangered under the ESA has been published in the Federal Register. If a proposed Property may jeopardize proposed species, Section 7 of the ESA affords consideration of those species through informal conferences with USFWS. On April 13, 2006, USFWS designated critical habitat for the CRLF under the ESA. In total, approximately 450,288 acres fell within the boundaries of critical habitat designation. A new ruling by the USFWS on March 17, 2010, revised the designation of critical habitat for CRLF (75 FR 12815 12959). In total, approximately 1,636,609 acres of critical habitat in 27 California counties fall within the boundaries of the final revised critical habitat designation. This rule became effective on April 16, 2010.

The CRLF is a rather large frog, measuring one and a half to five inches in length. They are reddish-brown to gray in color, with many poorly defined dark specks and blotches. Dorsolateral folds are present. The underside of the CRLF is washed with red on the lower abdomen and hind legs. The CRLF has a dark mask bordered by a light stripe on the jaw, smooth eardrums, and not fully webbed toes. The male has enlarged forearms and swollen thumbs. Its vocals consist of a series of weak throaty notes, rather harsh, and lasting two to three seconds. Breeding occurs from December to March with egg masses laid in permanent bodies of water.

The CRLF is found in lowlands, foothill woodland and grasslands, near marshes, lakes, ponds or other water sources. These amphibians require dense shrubby or emergent vegetation closely associated with deep still or slow moving water. Generally these frogs favor intermittent streams with water at least two and a half feet deep and where the shoreline has relatively intact emergent or shoreline vegetation. CRLF is known from streams with relatively low gradients and those waters where introduced fish and bullfrogs are absent. CRLF are known to take refuge upland in small mammal burrows during periods of high water flow. CRLF occurs west of the Sierra Nevada-Cascade and in the Coast Ranges along the entire length of the state. Historically, they occurred throughout the Central Valley and Sierra Nevada foothills south to northern Baja California. Now they are found from Sonoma and Butte Counties south to Riverside County, but mainly in Monterey, San Luis Obispo, and Santa Barbara Counties.

CNDDB listed six occurrences of the CRLF occurring within five miles of the Property. All of these occurrences are located between 4 and 5 miles north and/or east of the Property. The lack of nearby CNDDB occurrences may be due to the remote nature of the area surrounding the Property or the inability to survey potential habitats on private lands, and does not necessarily reflect the absence of this species in the general area.

CRLF require (1) standing bodies of fresh water for aquatic breeding habitat, (2) non-breeding freshwater and wetted riparian habitat that provide shelter, forage, predator avoidance, and aquatic dispersal, (3) upland habitat such as grassland or woodland adjacent to or surrounding breeding and non-breeding aquatic and riparian habitat up to a distance of 1 mile that contain structural features and small mammal burrows that provide shelter and protection, and (4) accessible upland or riparian dispersal habitat within designated habitat units and between occupied locations within a minimum of 1 mile of each other. There are no seasonal pond, wetland, or riparian features within the Property that hold water long enough to provide suitable habitat to support CRLF aquatic breeding and non-breeding habitat; the seasonal wetlands and drainages on the Property are ephemeral and only hold a few inches of standing water within small ruts created by cattle hoof shear. Therefore, suitable aquatic breeding and non-breeding habitat is absent from the Property.

The Property does contain grassland habitat that could provide suitable upland or dispersal habitat. A review of aerial photography and USGS maps showed that Moraga Creek is immediately west of the Property, across Sander's Ranch Road, and King Canyon Creek is just east of the Property. Additionally, there are two stock ponds within the vicinity of the Property, just off of Knoll Drive; the first is approximately 0.38 miles east of the Property, and the second is approximately 0.5 miles east. While the Property does contain upland grassland habitat within 1-mile from these ponds and creeks, there are no small mammal burrows or other refugia that would provide shelter and protection for CRLF. The lack of suitable upland refugia may deter CRLF from utilizing the Property in an upland capacity, as it exposes them to predators and desiccation. Considering the absence of aquatic habitat for breeding and non-breeding, and suitable upland refugia, the Property is limited to serving as dispersal habitat. The Property provides accessible upland dispersal habitat as it is situated between potentially occupied locations (Moraga and King Canyon Creeks, and two stock ponds) within a minimum of 1 mile of each other. The wetted drainages and seasonal wetlands on the Property, while not suitable for breeding, may serve as dispersal corridors between the creeks and ponds that surround the Property. For these reasons, CRLF has a moderate potential to occur in a dispersal capacity only and may occur.

Foothill Yellow-Legged Frog (*Rana boylii*). Federal Species of Special Concern, California Species of Special Concern.

Foothill yellow-legged frogs (FHYF) are not smooth in appearance as most frogs are, but its skin is bumpier like a toad's. However, they have no warts and like all frogs are good jumpers and are found at the water's edge. These frogs rely heavily on camouflage for their survival. Dorsal colors of this frog range from brown, gray, to rust red with the bottom parts of their legs being yellow. Like their name suggests, these frogs can be found along rocky creeks in the foothills of the Cascade Mountains from south of the Willamette Valley to central California. They also occupy sunny creeks throughout southwestern Oregon. The foothill yellow-legged frog is typically found in partially shaded, shallow streams with cobble-sized rocky substrates needed for egg-laying.

The CNDDB listed five occurrences of foothill yellow-legged frog within a 5-mile radius of the Property. The closest occurrence (Occurrence #2125) is located approximately 3 miles west of the Property in the vicinity of the Canyon Community near Pinehurst Road and San Leandro Creek. Foothill yellow-legged frogs were collected from Redwood Peak in 1909, and one was collected at the community of Canyon in 1947, however it now appears that foothill yellow-legged frog is extirpated from this area. The most recent occurrence (Occurrence #160) is over 20 years old, dated to February 1997, and is located approximately 4 miles northwest of the Property. In addition to the lack of recent and nearby CNDDB occurrences, the Property lacks suitable habitat for foothill yellow-legged frog as it does not contain shallow, rock lined streams that provide egg laying substrate and foraging opportunities. Furthermore, the drainages found within the Property are not hydrologically connected to creeks or streams with these features, making dispersal onto the Property unlikely. Therefore, the foothill yellow legged frog is presumed absent from the Property.

REPTILES

Alameda Whipsnake (*Masticophis lateralis euryxanthus*). Federally Threatened, State Threatened.

The Alameda whipsnake is one of two subspecies of the California whipsnake. It is distinguished from the chaparral whipsnake (*M. l. lateralis*) by the broad orange striping on its sides. Adults reach approximately three to five feet in length and show a sooty black to dark brown back, cream colored undersides and pinkish tail. This species is typically found in chaparral, northern coastal sage scrub, and coastal sage habitats; however, annual grasslands, oak woodlands, and oak savannah serve as habitat during the breeding season. Egg-laying occurs near scrub habitat on ungrazed grasslands with scattered shrub cover. The known distribution

for Alameda whipsnake includes Sobrante Ridge, Oakland Hills, Mount Diablo, the Black Hills, and Wauhab Ridge.

Male and female snakes are active from April to November finding mates. During the breeding season from late March through mid-June, male snakes exhibit more movement throughout their home range, while female snakes remain sedentary from March until egg laying. Females lay a clutch of 6 to 11 eggs, usually in loose soil or under logs or rocks.

CNDDB listed 26 occurrences of the Alameda whipsnake within the vicinity of the Property. The eastern half of the Property is located within USFWS designated critical habitat (Unit: 2) for Alameda whipsnake (See Attachment 1 Figure 7). The closest occurrence (Occurrence #23) is located approximately 2 miles south of the Property, 0.7 miles west of Brown Ranch Road along Old Airstrip Road, just north of Kaiser Creek arm of the Upper San Leandro Reservoir. Numerous adults were captured and radio marked between 1989 and 1990. The Property does not contain chaparral, sage brush, or rock outcrops, which are the primary habitat constituents for Alameda whipsnake. These habitats provide cover for snakes during dispersal, cover from predators, and a variety of microhabitats where whipsnakes can move to regulate their body temperature. Secondary habitat for Alameda whipsnake consists of grasslands and open woodlands. These habitats provide dispersal, foraging and occasionally nesting opportunities, particularly when they are linked to chaparral/scrub. Additionally, rock crevices, talus and small mammal burrows that provide shelter, protection, egg-laying sites, and foraging opportunities are particularly important for Alameda whipsnake. The primary habitat types for Alameda whipsnake, chaparral and scrub, along with rock crevices or other suitable refuge habitat, are absent from the Property. However, the secondary habitat type, annual grassland, is present within the Property. While there is suitable secondary habitat for Alameda whipsnake found on the Property, the height of the vegetation is fairly low due to the prolonged, intense grazing regime on the Property, and therefore does not provide suitable protection and coverage from aerial predators nor does it provide shade for temperature regulation. For these reasons, the Property is not considered to be suitable breeding or foraging habitat.

Primary habitat for Alameda whipsnake is abundant just east of the Property within the Las Trampas Ridge open space. Las Trampas Ridge is home to one of five main populations of Alameda whipsnake identified within its historical range. Alameda whipsnakes occurring within fringes of the Las Trampas Ridge open space may pass through the secondary habitat found within the Property, but they are not likely to breed or forage on the Property due to the aforementioned reasons. Therefore, there is a moderate potential for Alameda whipsnake to utilize the Property for dispersal only.

7.0 CONCLUSIONS

7.1 Wetlands

Results of the biological resource analysis survey conducted by Olberding Environmental indicate that the Property contains wetlands/waters that may be considered jurisdictional by the Army Corps of Engineers, RWQCB or CDFW. The Property has two ephemeral drainages, and two seasonal wetlands. These areas showed positive indicators of wetland soils, hydrology, and vegetation. If any project related activities are to occur within these features, an Army Corps of Engineers jurisdictional delineation would be required.

7.2 Special-status Plants

Three special-status plant species, bent-flowered fiddleneck, Mt. Diablo fairy lantern, and Diablo helianthella, were determined to have a moderate potential to occur on the Property. This plants potential to occur on the Property was based on the presence of suitable habitats, soil types, and nearby and recent CNDDB occurrences. However, the April 2019 survey was conducted within the blooming period for each of these species, and none were observed. Therefore, bent-flowered fiddleneck, Mt. Diablo fairy lantern, and Diablo helianthella are presumed absent from the Property.

7.3 Special-status Wildlife

Foraging or Nesting Raptor/Passerine Species – A total of six bird species were identified as having potential to occur on the Property. Five species including red-shouldered hawk, red-tailed hawk, white-tailed kite, American kestrel and Cooper's hawk had a high potential to occur in a foraging capacity only. Loggerhead shrike had a moderate potential to occur in a foraging capacity only. The red-tailed hawk was observed foraging on the Property during the time of the survey.

Special-Status Mammals – Given the presence of suitable onsite foraging habitat; the pallid bat and hoary bat have a moderate potential to occur on the Property in a foraging capacity only. There are no trees or structures within the Property that could provide suitable roosting habitat for bats. American badger is not likely to occur on the Property.

Special-Status Amphibians – Two amphibian species, CRLF and FYLF, had multiple CNDDB occurrences recorded within the vicinity of the Property. The Property does not contain suitable aquatic breeding or non-breeding habitat for CRLF because the seasonal wetlands and ephemeral drainages are too shallow and do not pond long enough to allow CRLF to complete their

lifecycle. There are several aquatic features within vicinity of the Property and while the Property does contain upland grassland habitat within 1-mile from these ponds and creeks, there are no small mammal burrows or other refugia that would provide shelter and protection for CRLF. Therefore, the Property is limited to serving as dispersal habitat. The grassland, drainages, and seasonal wetlands provide accessible upland dispersal habitat considering the Property is situated between potentially occupied locations within a minimum of 1 mile of each other. For these reasons, CRLF has a moderate potential to occur on the Property in a dispersal capacity only.

The FYLF CNDDB occurrences were historical and at great distance from the Property. Additionally, the Property lacks suitable habitat for foothill yellow-legged frog as it does not contain shallow, rock lined streams that provide egg laying substrate and foraging opportunities. Furthermore, the drainages found within the Property are not hydrologically connected to creeks or streams with these features, making dispersal onto the Property unlikely. Therefore, the foothill yellow legged frog is presumed absent from the Property.

Special-Status Reptiles – The Alameda whipsnake was identified by the CNDDB as occurring in the vicinity of the Property. The primary habitat types for Alameda whipsnake, chaparral and scrub, along with rock crevices or other suitable refuge habitat, are absent from the Property. While the secondary habitat type, annual grassland, is present within the Property, the height of the vegetation is fairly low due to the prolonged, intense grazing regime on the Property and for these reasons, the Property is not considered to be suitable breeding or foraging habitat. Primary habitat for Alameda whipsnake is abundant just east of the Property within the Las Trampas Ridge open space, and Alameda whipsnakes occurring within fringes of the Las Trampas Ridge open space may pass through the secondary habitat found within the Property, but they are not likely to breed or forage on the Property due to the aforementioned reasons. Therefore, there is a moderate potential for Alameda whipsnake to utilize the Property for dispersal only.

8.0 RECOMMENDATIONS

- **Corps and State Regulated Wetlands/Waters** – Jurisdictional wetlands and waters potentially regulated under the authority of the Corps, RWQCB, and CDFW are present on the Property. Fill of these regulated features may require authorization under Sections 404 and 401 of the Clean Water Act (CWA) and authorization under Section 1600 of the Fish and Wildlife Code. A Corps wetland delineation should be prepared to document the actual extent of jurisdictional features if any construction activity could result in impacts to wetlands/waters. If the wetlands/waters are deemed jurisdictional and construction activities are proposed that could impact these features, permits must be obtained prior to construction. Setbacks from the wetlands/water features may be

required to protect habitat quality and to protect water quality. Permitting to allow impacts to wetlands/waters features may also require mitigation.

- **Alameda Whipsnake Survey** – Alameda whipsnake was determined to have a moderate potential to occur on the Property in a dispersal capacity only. Therefore, it is recommended that Alameda whipsnake surveys be conducted in order to adequately determine the presence or absence of this species on the Property. If surveys are not conducted to validate a negative occurrence and presence is assumed, then the developer should coordinate with CDFW and USFWS in order to seek take coverage under Section 7 or 10 of the ESA and the CESA. In this case, the agencies may require compensatory mitigation, as onsite habitat preservation or offsite habitat protection.

    - ***Survey Methodology***
      The daytime survey was conducted between March and October at 10-17 degrees C (50 - 62 degrees F) when they are active. Between March and mid-June are ideal since they are mating and they will be more obvious and less wary of observers. With the temperatures also being lower during these months, it will take longer for the snakes to warm up, so they must spend more time basking. Therefore, during these months visits are conducted during the early afternoons. During the warmer summer months, the snakes will have to spend less time basking due to the increase in temperature. Visits during this period will be conducted earlier in the day. Surveys consisted of several non-consecutive survey visits in the spring and repeated in the late summer/autumn. Ideally seven visits will work.

- **Pre-construction CRLF Protocol Survey** - A qualified biologist shall survey the project site for CRLF (and other sensitive wildlife species) preceding the commencement of construction activities to verify absence/presence of the species. Surveys should be perform using USFWS protocol. The potential for CRLF to occur on the Property is limited to a dispersal capacity, therefore surveys performed during the breeding season to identify eggs and larvae will not be required.

    - ***Surveys Performed during the non-breeding season (July 1- September 30)***
      One day and one night survey would be required during the non-breeding season. At least one survey must be completed between January 1 and August 15. If CRLF are identified at any time during the course of surveys, no additional surveys are needed. Day surveys should be conducted between one hour after sunrise and one hour before sunset. Night surveys are used to identify and locate

adult and metamorphosed frogs and are to take place no earlier than one hour after sunset.

If surveys are not conducted to validate a negative occurrence and presence is assumed, then the developer should coordinate with CDFW and USFWS in order to seek coverage under Section 7 or 10 of the ESA and the CESA. In this case, the agencies may require compensatory mitigation, as onsite habitat preservation or offsite habitat protection.

- **Erosion Control –** Grading and excavation activities could expose soil to increased rates of erosion during construction periods. During construction, runoff from the Property could adversely affect aquatic life within the adjacent water features. Surface water runoff could remove particles of fill or excavated soil from the site, or could erode soil down-gradient, if the flow were not controlled. Deposition of eroded material in adjacent water features could increase turbidity, thereby endangering aquatic life, and reducing wildlife habitat. Implementation of appropriate mitigation measures would ensure that impacts to aquatic organisms would be avoided or minimized. Mitigation measures may include best management practices (BMP's) such as hay bales, silt fencing, placement of straw mulch and hydro seeding of exposed soils after construction as identified in the Storm Water Pollution Prevention Plan (SWPPP).

9.0 LITERATURE CITED

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ATTACHMENTS

ATTACHMENT 1
FIGURES

Figure 1	**Regional Map**
Figure 2	**Vicinity Map**
Figure 3	**USGS Quadrangle Map**
Figure 4	**Aerial Photograph**
Figure 5	**CNDDB Map of Special Status Wildlife**
Figure 6	**CNDDB Map of Special Status Plants**
Figure 7	**USFWS Designated Critical Habitat**
Figure 8	**Soils Map**
Figure 9	**Photo Location Map**
Figure 10	**Habitat Map**

Figure 1
Regional Map

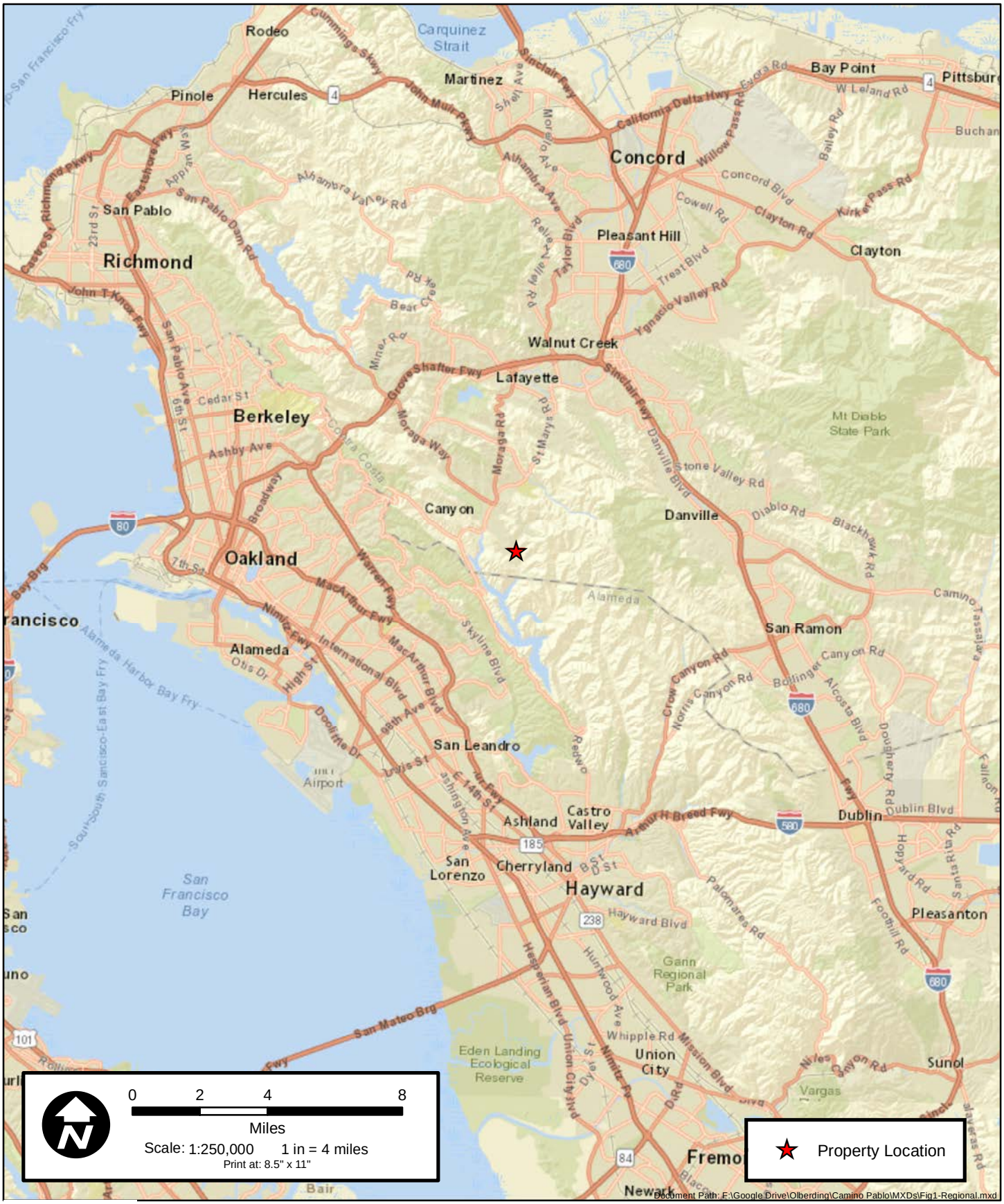

Figure 1: Regional Map
Camino Pablo Property
Contra Costa County, California

OLBERDING ENVIRONMENTAL
193 Blue Ravine Road, Ste. 165
Folsom, CA 95630
Phone: (916) 985-1188

Map Revision Date: 4/22/2019

Figure 2
Vicinity Map

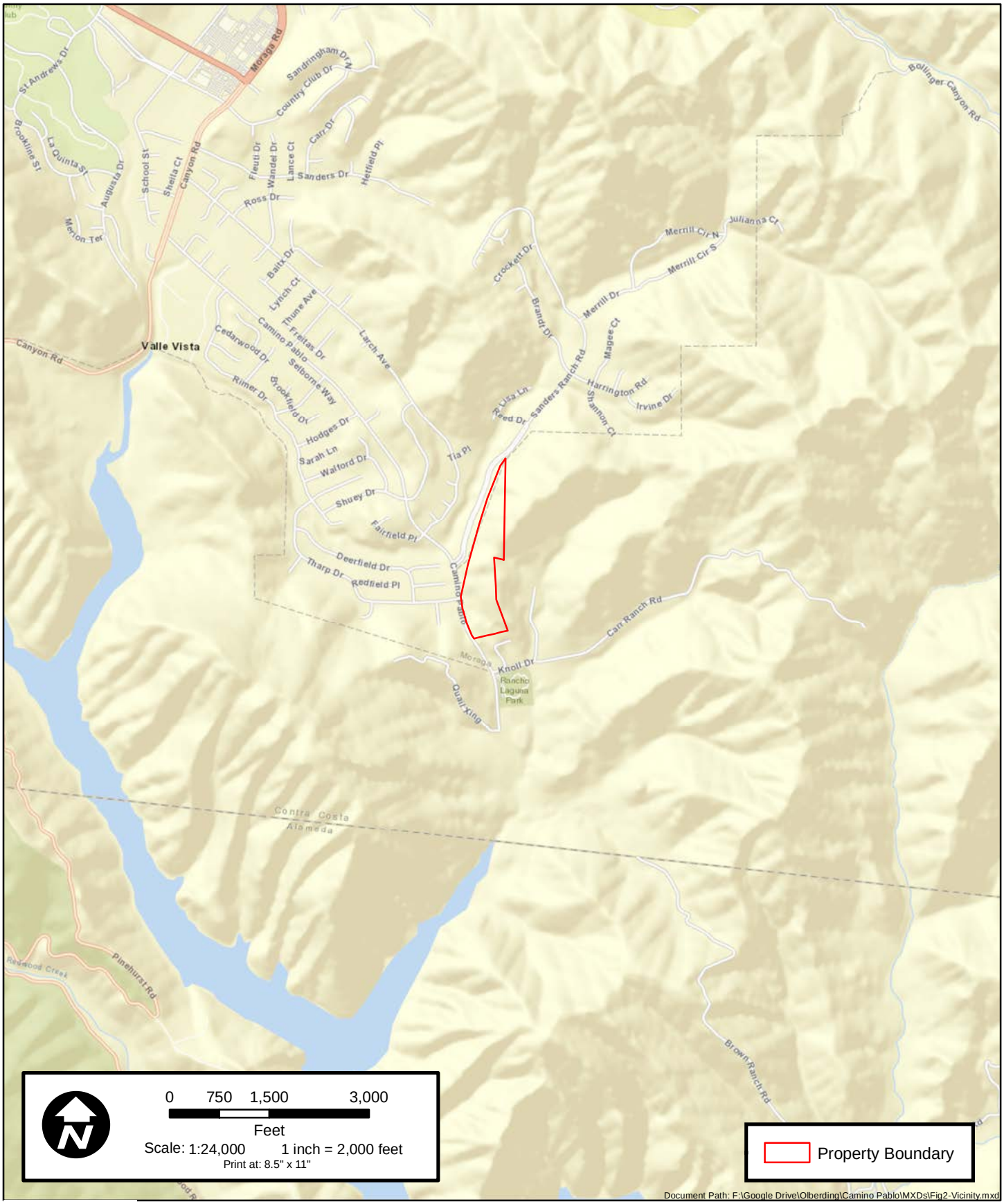

Figure 2: Vicinity Map
Camino Pablo Property
Contra Costa County, California

OLBERDING ENVIRONMENTAL
193 Blue Ravine Road, Ste. 165
Folsom, CA 95630
Phone: (916) 985-1188

Map Revision Date: 4/22/2019

Figure 3
USGS Quadrangle Map

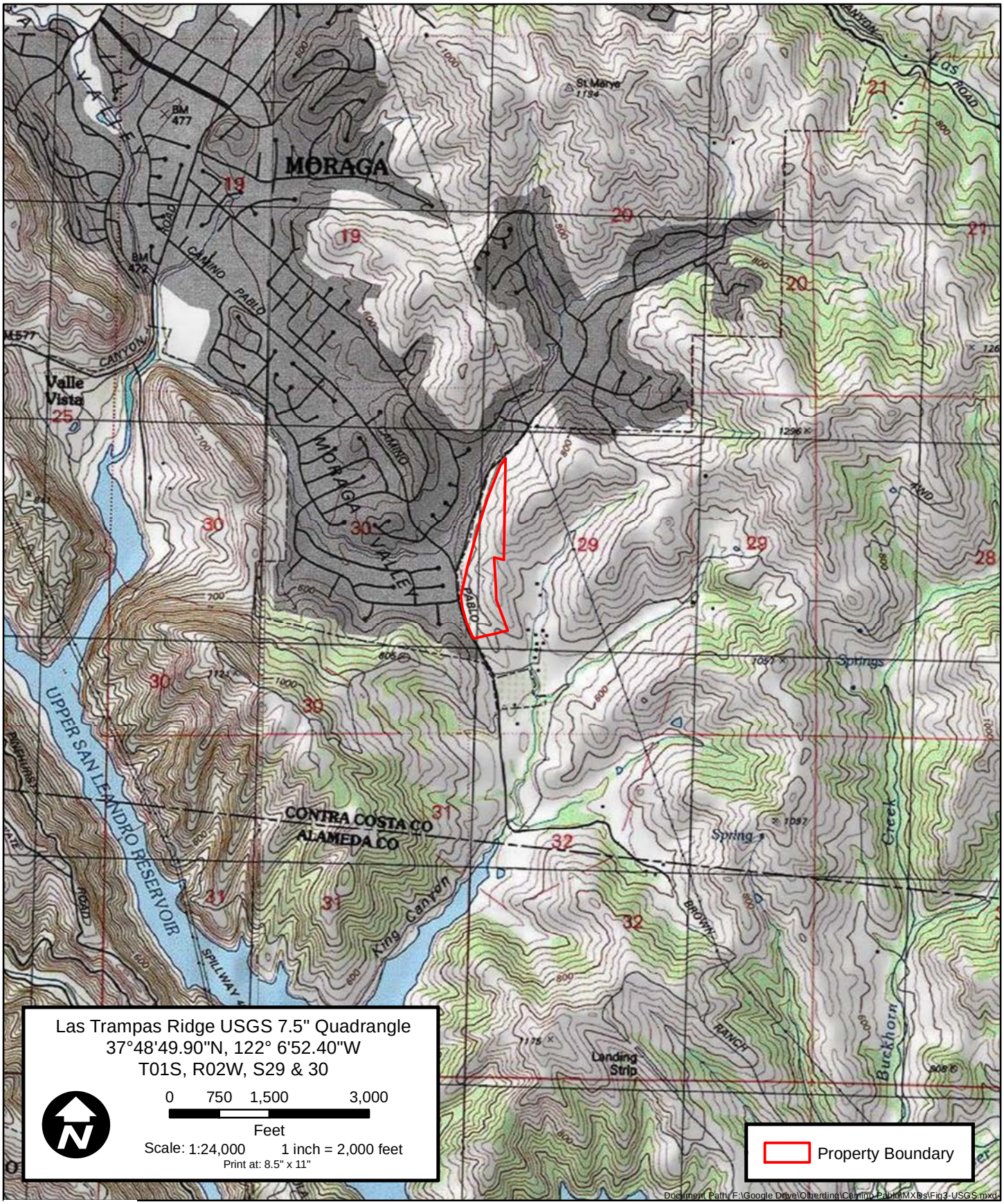

Figure 3: USGS Topographic Map
Camino Pablo Property
Contra Costa County, California

OLBERDING ENVIRONMENTAL
193 Blue Ravine Road, Ste. 165
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Map Revision Date: 4/22/2019

Figure 4
Aerial Photograph

Figure 4: Aerial Map
Camino Pablo Property
Contra Costa County, California

OLBERDING ENVIRONMENTAL
193 Blue Ravine Road, Ste. 165
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Map Revision Date: 4/22/2019

Figure 5
CNDDB Map of Special Status Wildlife

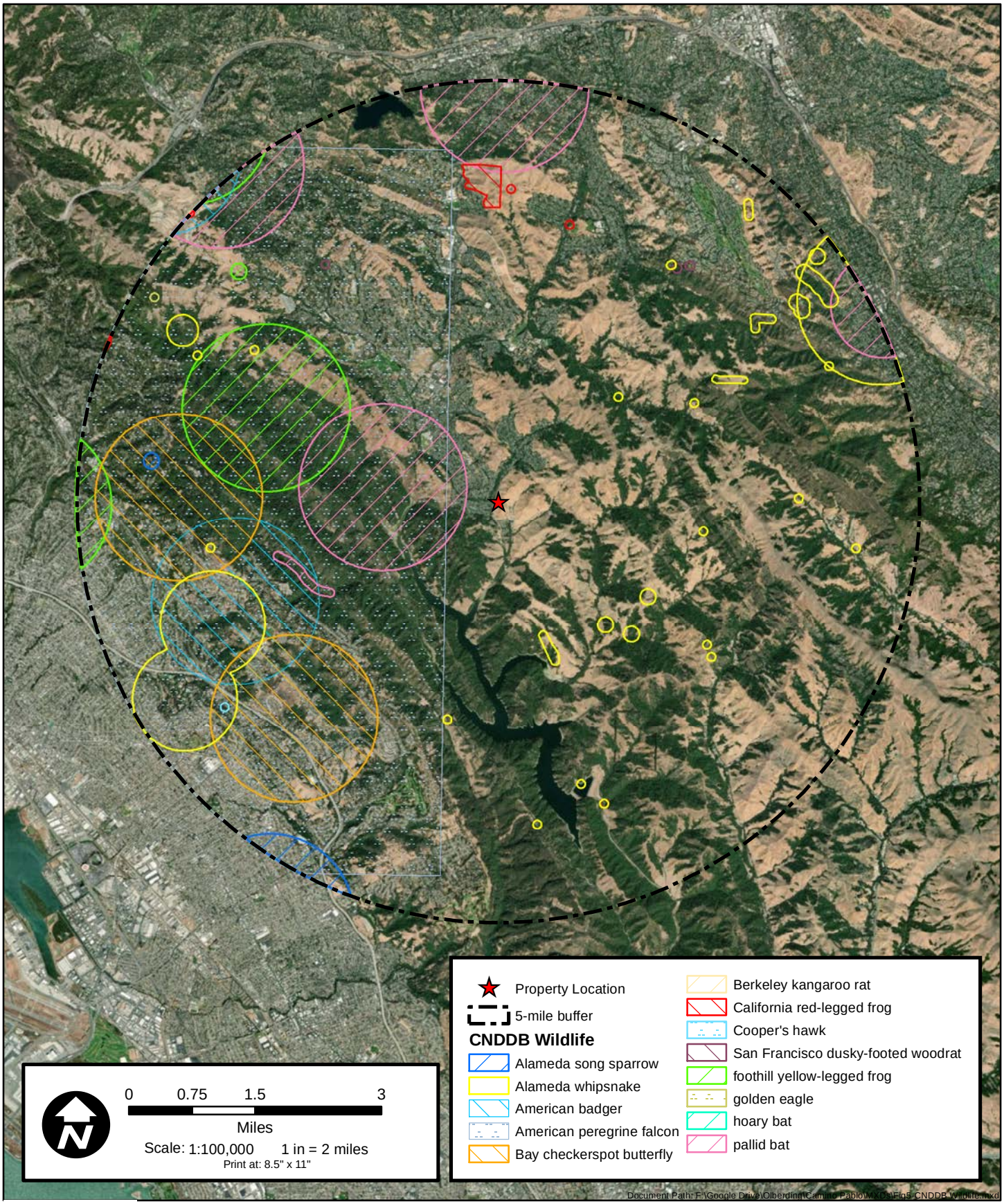

Figure 5: CNDDB Wildlife Map
Camino Pablo Property
Contra Costa County, California

OLBERDING ENVIRONMENTAL
193 Blue Ravine Road, Ste. 165
Folsom, CA 95630
Phone: (916) 985-1188

Map Revision Date: 4/22/2019

Figure 6
CNDDB Map of Special Status Plants

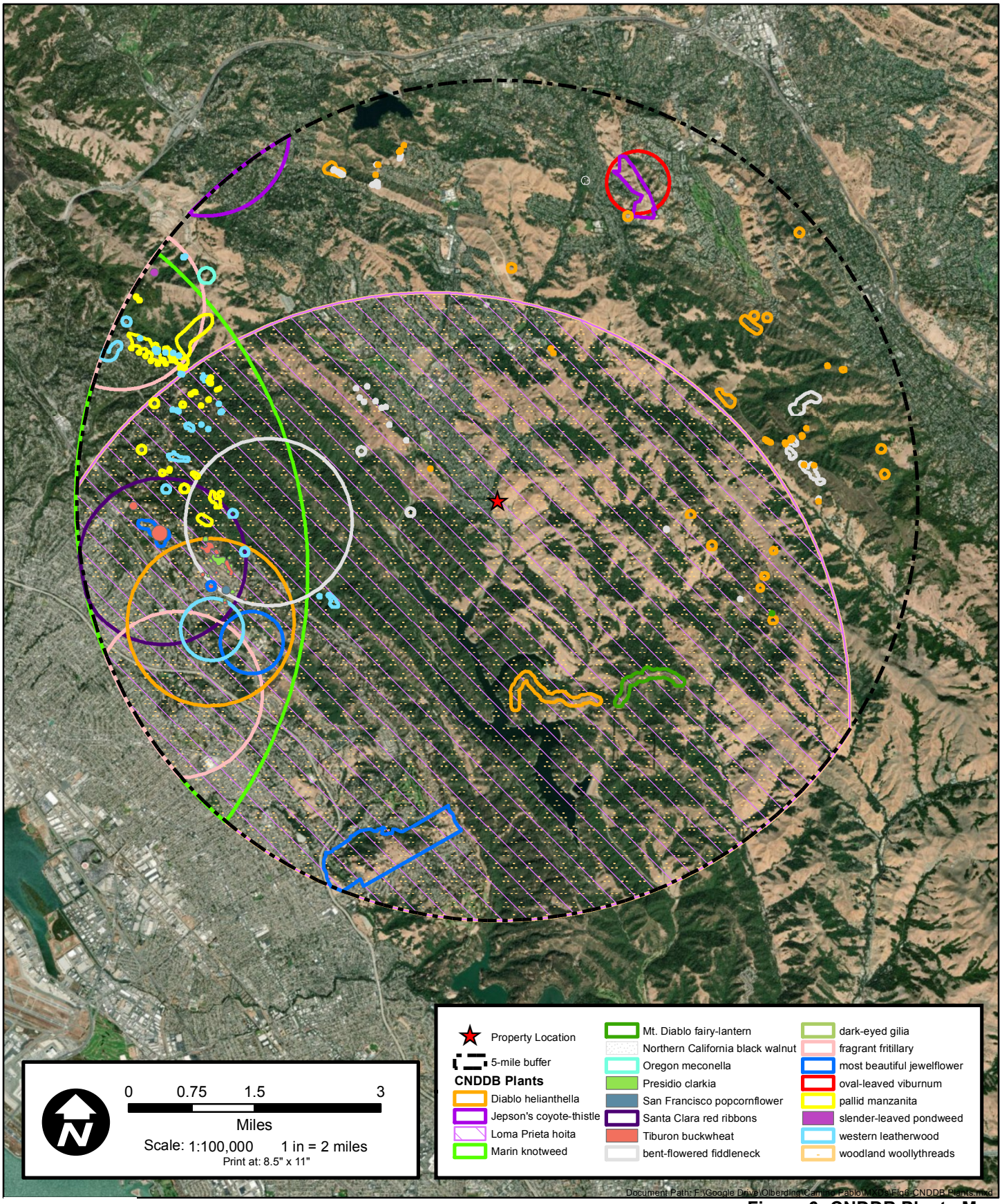

Figure 6: CNDDB Plants Map
Camino Pablo Property
Contra Costa County, California

OLBERDING ENVIRONMENTAL
193 Blue Ravine Road, Ste. 165
Folsom, CA 95630
Phone: (916) 985-1188

Map Revision Date: 4/22/2019

Figure 7
USFWS Designated Critical Habitat

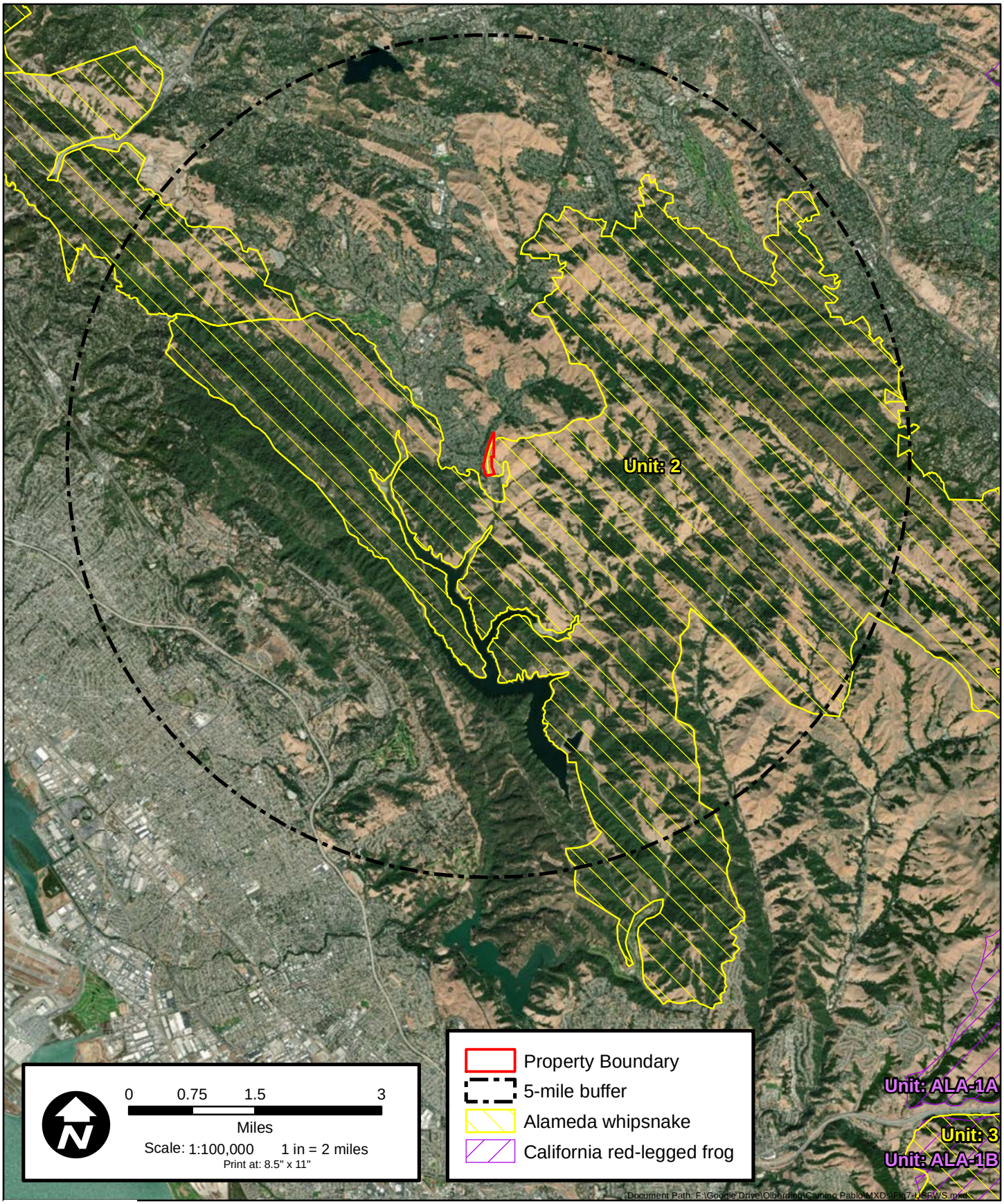

Figure 7: USFWS Designated Critical Habitat Map
Camino Pablo Property
Contra Costa County, California

OLBERDING
-ENVIRONMENTAL-

193 Blue Ravine Road, Ste. 165
Folsom, CA 95630
Phone: (916) 985-1188

Map Revision Date: 4/22/2019

Figure 8
Soils Map

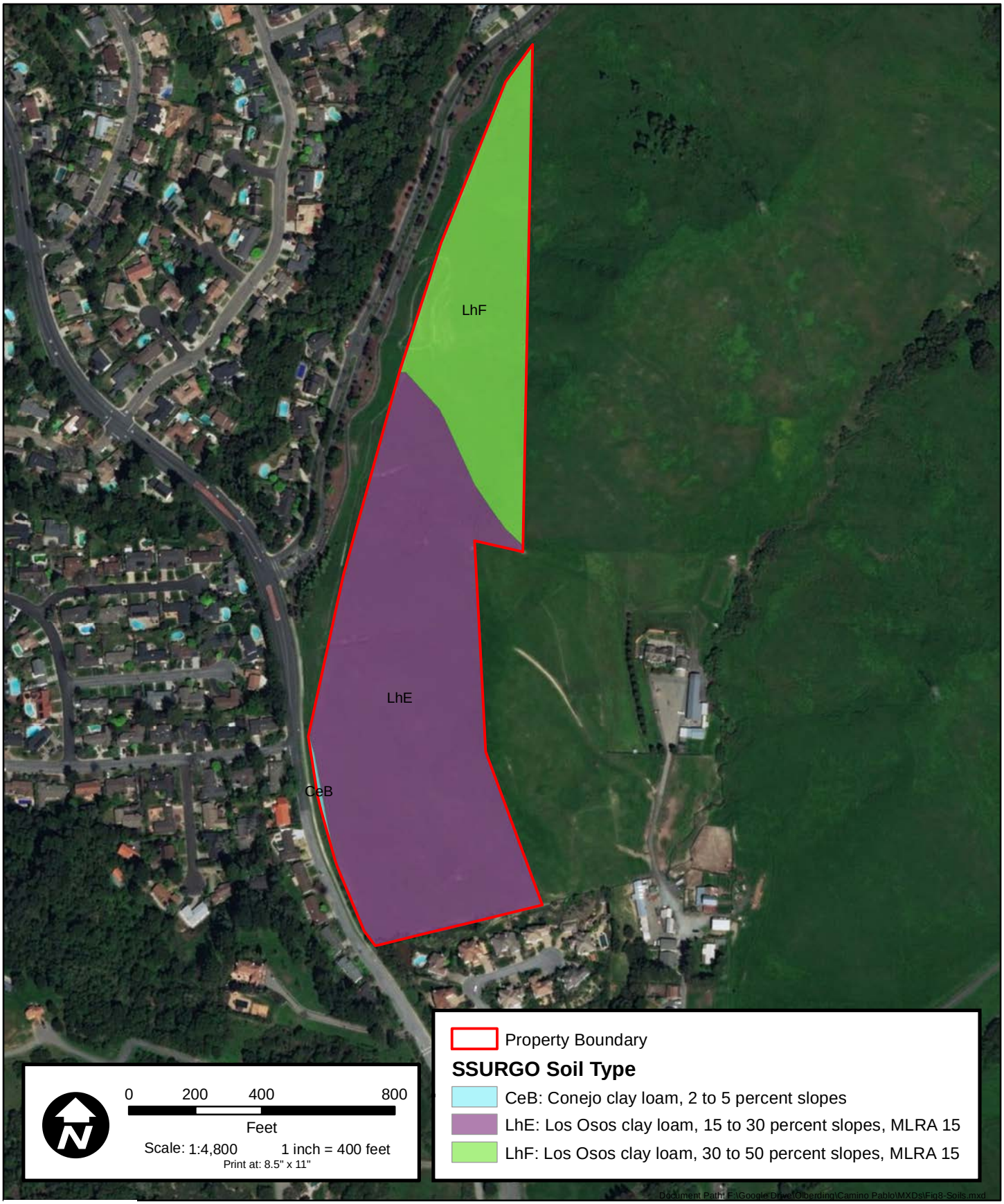

Figure 8: Soils Map
Camino Pablo Property
Contra Costa County, California

OLBERDING ENVIRONMENTAL
193 Blue Ravine Road, Ste. 165
Folsom, CA 95630
Phone: (916) 985-1188

Map Revision Date: 4/22/2019

Figure 9
Photo Location Map

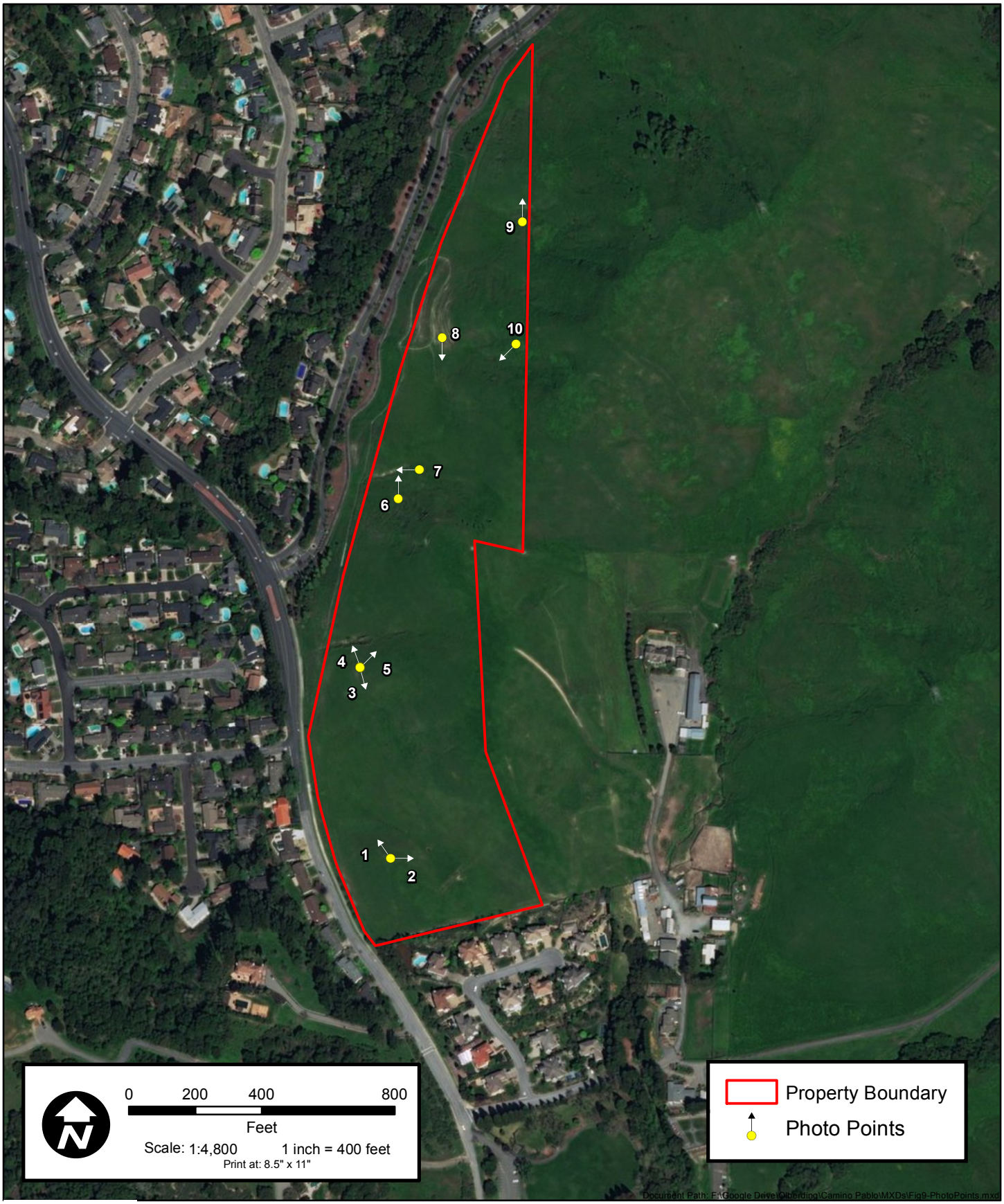

Figure 9: Photo Points Map
Camino Pablo Property
Contra Costa County, California

OLBERDING
ENVIRONMENTAL
193 Blue Ravine Road, Ste. 165
Folsom, CA 95630
Phone: (916) 985-1188

Map Revision Date: 4/23/2019

Figure 10
Habitat Map

Figure 10: Habitat Map
Camino Pablo Property
Contra Costa County, California

OLBERDING
ENVIRONMENTAL

193 Blue Ravine Road, Ste. 165
Folsom, CA 95630
Phone: (916) 985-1188

Map Revision Date: 4/22/2019

ATTACHMENT 2

TABLES

Table 1

Plant and Wildlife Species Observed

Within/Adjacent to the Survey Area

Table 1 Wildlife Species Observed Within/Adjacent to the Survey Area	
Scientific Name	**Common Name**
Plant Species Observed	
Achillea millefolium	Yarrow
Aira caryophylla	Silver hairgrass
Anagallis arvensis	Scarlet pimpernel
Avena fatua	Wild oat
Baccharis pilularis	Coyote brush
Bellardia trixago	Mediterranean lineseed
Brassica nigra	Black mustard
Briza minor	Little rattlesnake grass
Bromus diandrus	Ripgut brome
Bromus hordeaceus	Soft chess
Calystegia subacaulis ssp. subacaulis	Stemless glory
Carduus pycnocephalus	Italian thistle
Centaureae solstitialis	Yellow star thistle
Cholorogalum pomeridianum	Soap plant
Cirsium vulgare	Bull thistle
Convolvulus arvensis	Field bindweed
Elymus triticoides	Creeping wildrye
Erodium brachycarpum	White-stem filaree
Erodium cicutarium	Heron’s bill filaree
Festuca perennis	Italian rye grass
Geranium dissectum	Cut leaf
Geranium molle	Cranes bill geranium
Helminthotheca echioides	Bristly oxtongue
Hirschfelia incana	Shortpod mustard
Hordeum marinum	Mediterranean barley
Lactuca serriola	Prickly lettuce
Lithophragma affine	Common woodland star
Lupinus spp.	Lupine
Lythrum hyssopifolia	Hyssop loosestrife
Juncus bufonicus	Toad rush
Medicago polymorpha	Bur clover
Oemleria cerasiformis	Oso berry

Plantago lanceolata	Ribwort plantain
Ranunculus californicus	Common buttercup
Rumes acetosella	Sheep's sorrel
Rumex crispus	Curly dock
Salix lasiolepis	Arroyo willow
Sanicula bipinnatifida	Purple sanicle
Scandix pecten-veneris	Shepard's needle
Sherardia arvensis	Blue fieldmadder
Silybum marianum	Milk thistle
Sonchus arvensis	Field sow thistle
Stipa pulchra	Purple needlegrass
Symphoricarpos albus	Common snowberry
Taraxia ovata	Sun cup
Toxicodendron diversilobum	Poison oak
Trifolium hirtum	Rose clover
Vicia villosa	Hairy vetch
Xanthium spinosum	Spiny cocklebur
Animal Species Observed	
Birds	
Aphelocoma californica	Western scrub jay
Buteo jamaicensis	Red-tailed hawk
Calypte anna	Anna's hummingbird
Corvus brachyrhynchos	American crow
Meleagris gallopavo	Wild turkey
Melodia melospiza	Song sparrow
Passerculus sandwichensis	Savannah sparrow
Sayornis nigricans	Black phoebe
Reptiles	
Sceloporus occidentalis	Western fence lizard
Amphibians	
Pseudacris sierra	Sierran tree frog

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, and Briones Valley 7.5 Minute Quadrangle Maps

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
PLANTS					
Bent-flower Fiddleneck (*Amsinckia lunaris*)	-/-/1B	March – June	Coastal bluff scrub, cismontane woodland, and valley and foothill grassland	Moderate Suitable habitat present	Presumed absent Surveyed during blooming period
California Androsace (*Androsace elongate ssp. acuta)*	-/-/4.2	March – June	Chaparral, cismontane woodland, coastal scrub, meadows and seeps, pinyon and juniper woodland, valley and foothill grassland	Low No suitable habitat present	Presumed absent
Slender Silver Moss (*Anomobryum julaceum*)	-/-/4.2	N/A	Damp rock and soil on outcrops, usually on roadcuts. Broadleaf upland forest, lower montane coniferous forest, north coast coniferous forest.	Low No suitable habitat present	Presumed absent
Coast Rockcress (*Arabis blepharophylla*)	-/-/4.3	February – May	Coastal prairie, mixed evergreen forest, northern coastal scrub.	Low No suitable habitat present	Presumed absent
Mt. Diablo Manzanita (*Arctostaphylos auriculata*)	-/-/1B	January – March	Chaparral and cismontane woodland with sandstone substrate.	Low No suitable habitat present	Presumed absent
Contra Costa Manzanita (*Arctostaphylos manzanita ssp. laevigata*)	-/-/1B	January – March	Chaparral and cismontane woodland with sandstone substrate.	Low No suitable habitat present	Presumed absent
Pallid Manzanita (*Arctostaphylos pallida*)	T/E/1B	December – March	Siliceous shale, sandy or gravelly soils in broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland and coastal scrub.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Alkali Milk-Vetch (*Astragalus tener* var. *tener*)	-/-/1B	March – June	Playas, valley and foothill, and vernal pools in alkaline soils. Micro habitat consists of low ground, alkali flats, and flooded lands	Low No suitable habitat present	Presumed absent
Big-Scale Balsamroot (*Balsamorhiza macrolepis* var. *macrolepis*)	-/-/1B	March – June	Chaparral, cismontane woodland, and valley and foothills grasslands, sometimes in serpentinite outcrops.	Low No suitable habitat present	Presumed absent
Big tarplant (*Blepharizonia plumosa)*	-/-/1	July - October	Valley grassland, foothill woodland, chaparral.	Low Suitable habitat present	Presumed absent
Mount Diablo Fairy-Lantern (*Calochortus pulchellus*)	-/-/1B	April – June	Chaparral, cismontane woodland, riparian woodland, and valley and foothill grassland; on wooded and brushy slopes.	Moderate Suitable habitat present	Presumed absent Surveyed during blooming period
Oakland Star Tulip (*Calochortus umbellatus*)	-/-/4.2	March – May	Broadleaf upland forest, chaparral, cismontane woodland, lower montane coniferous forest, valley and foothill grassland. Often serpentine.	Low No suitable habitat present	Presumed absent
Chaparral Harebell (*Campanula exigua*)	-/-/1B	May – June	Chaparral, in rocky, usually serpentine soils.	Low No suitable habitat present	Presumed absent
Johnny-Nip (*Castilleja ambigua var. ambigua*)	-/-/4.2	March – August	Coastal bluff scrub, coastal prairie, coastal scrub, marshes and swamps, valley and foothill grassland, vernal pools.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Congdon's Tarplant (*Centromadia parryi* ssp. *congdonii*)	-/-/1B	May – October	Valley and foothill grasslands in alkaline soils.	Low Suitable habitat present	Presumed absent
Point Reyes Salty Bird's-Beak *(Chloropyron maritimum ssp. palustre)*	-/-/1B	June – October	Annual herb occurring in coastal salt marshes and swamps.	Low No suitable habitat present	Presumed absent
Robust Spineflower (*Chorizanthe cuspidata var. robusta*)	E/-/1B	April – September	Sandy or gravelly substrate in maritime chaparral, cismontane woodland openings, coastal dunes and coastal scrub.	Low No suitable habitat present	Presumed absent
Bolander's Water-Hemlock (*Cicuta maculata var. bolanderi*)	-/-/2B	July – September	Coastal, salt marsh and wetland riparian.	Low No suitable habitat present	Presumed absent
Franciscan Thistle (*Cirsium andrewsii*)	-/-/1B	March – July	Grassy and riparian areas in seeps, wet areas, watercourse edges. Typically along coastlines.	Low Suitable habitat present	Not likely to occur
Santa Clara Red Ribbons (*Clarkia concinna* ssp. a*utomixa*)	-/-/4	May – June	Cismontane woodland, chaparral, on slopes and near drainages.	Low Suitable habitat present	Not likely to occur

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Presidio Clarkia (*Clarkia franciscana)*	E/E/1B	May – July	Coastal scrub and valley and foothill grassland.	Low Suitable habitat present	Not likely to occur
Hospital Canyon Larkspur (*Delphinium californicum ssp. interius*)	-/-/1B	April – June	Openings in chaparral, mesic cismontane woodland, coastal scrub.	Low No suitable habitat present	Presumed absent
Western Leatherwood (*Dirca occidentalis*)	-/-/1B	January – March	Mesic areas of broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, north coast coniferous forest, riparian forest and riparian woodland.	Low No suitable habitat present	Presumed absent
Tiburon Buckwheat (*Eriogonum luteolum var. caninum*)	-/-/1B	June – September	Serpentine soils in chaparral, coastal prairie, valley and foothill grassland.	Low No suitable habitat present	Presumed absent
Mount Diablo Buckwheat (*Eriogonum truncatum*)	-/-/1B	April – November	Chaparral, coastal scrub, and valley and foothill grasslands in sandy soils.	Low No suitable habitat present	Presumed absent
Bay Buckwheat (*Eriogonum umbellatum var. bahiiforme*)	-/-/4.2	July – September	Cismontane woodland, lower montane coniferous forest. Rocky areas, often serpentine.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Jepson's Woolly Sunflower (*Eriophyllum jepsonii*)	-/-/4.3	April – June	Chaparral, foothill woodland, northern coastal scrub, coastal sage scrub. Serpentine soils.	Low No suitable habitat present	Presumed absent
Jepson's Coyote-Thistle (*Eryngium jepsonii*)	-/-/1B	April − August	Clay soils. Valley and foothill grasslands. Vernal pools.	Low Suitable habitat present	Not likely to occur
Cut-Leaved Monkeyflower (*Erythranthe laciniata*)	-/-/1B	April – July	Mesic, granitic areas in chaparral, and, upper and lower montane coniferous forest.	Low No suitable habitat present	Presumed absent
San Joaquin spearscale (*Extriplex joaquiniana)*	-/-/1B	April – October	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland in seasonal alkali wetlands or alkali sink scrub with *Distichlis spicata*, *Frankenia*, etc.	Low No suitable habitat present	Presumed absent
Minute Pocket Moss (*Fissidens pauperculus*)	-/-/1B	-	North Coast coniferous forest in damp coastal soil.	Low No suitable habitat present	Presumed absent
Stinkbells (*Fritillaria agrestis*)	-/-/4.2	February – April	Cismontane woodland, chaparral, valley and foothill grassland. Sometimes on serpentine soil. Mostly found on non-native grassland or in grassy openings in clay soil.	Low Suitable habitat present	Not likely to occur

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Fragrant Fritillary (*Fritillaria liliacea*)	-/-/1B	February – April	Cismontane woodland, coastal prairie, coastal scrub, and valley and foothill grasslands, often in serpentine soils.	Low Suitable habitat present	Not likely to occur
Phlox-Leaf Serpentine Bedstraw (*Galium andrewsii ssp. gatense)*	-/-/4.2	April – June	Serpentine, rocky environments. Chaparral, cismontane woodland, lower montane coniferous forest.	Low No suitable habitat present	Presumed absent
Dark-Eyed Gilia (*Gilia millefoliata*)	-/-/1B	April – July	Coastal dunes.	Low No suitable habitat present	Presumed absent
Diablo Helianthella (*Helianthella castanea*)	-/-/1B	March – June	Broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, valley and foothill grassland. Usually in chaparral/oak woodland interface in rocky, azonal soils, often in partial shade.	Moderate Suitable habitat present	Presumed absent Surveyed during blooming period
Hogwallow Starfish (*Hesperevax caulescens*)	-/-/4.2	March – June	Valley and foothill grasslands with mesic, clay soils. Shallow vernal pools. Sometimes in alkaline environments.	Low Suitable habitat present	Not likely to occur
Brewer's Western Flax (*Hesperolinon breweri*)	-/-/1B	May – July	Chaparral, cismontane woodland, valley and foothill grassland. Often in rocky serpentine soils.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Loma Prieta Hoita (*Hoita strobilina*)	-/-/1B	May – October	Chaparral, cismontane woodland, riparian woodland, usually in mesic, serpentine soils.	Low No suitable habitat present	Presumed absent
Santa Cruz Tarplant (*Holocarpha macradenia*)	T/E/1B	June – October	Coastal prairie, coastal scrub, and valley and foothill grasslands, often with clay, sandy soils; often with non-natives.	Low No suitable habitat present	Presumed absent
Kellogg's Horkelia (*Horkelia cuneata var.sericea*)	-/-/1B	April – September	Sandy or gravelly substrate in openings of closed-cone coniferous forest, maritime chaparral, coastal dunes and coastal scrub.	Low No suitable habitat present	Presumed absent
Coast Iris (*Iris longipetala)*	-/-/4.2	March – May	Mesic environments. Coastal prairie, lower montane coniferous forest, meadows and seeps.	Low Suitable habitat present	Not likely to occur
Carquinez Goldenbush (*Isocoma arguta*)	-/-/1B	August – December	Alkaline valley and foothill grassland.	Low No suitable habitat present	Presumed absent
Contra Costa Goldfields (*Lasthenia conjugens*)	E/-/1B	March – June	Valley and foothill grassland, cismontane woodland, and vernal pools, swales, and low depressions in open grassy areas.	Low Suitable habitat present	Not likely to occur

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Bristly Leptosiphon (*Leptosiphon acicularis)*	-/-/4.2	April – July	Chaparral, cismontane woodland, coastal prairie, valley and foothill grassland	Low Suitable habitat present	Not likely to occur
Serpentine Leptosiphon (*Leptosiphon ambiguus)*	-/-/4.2	March - June	Usually serpentine. Cismontane woodland, coastal scrub, valley and foothill grassland.	Low No suitable habitat present	Presumed absent
Hall's Bush-Mallow (*Malacothamnus hallii)*	-/-/1B	May – September	Chaparral, coastal scrub	Low No suitable habitat present	Presumed absent
Oregon Meconella (*Meconella oregana*)	-/-/1B	March – April	Coastal prairie, coastal scrub.	Low No suitable habitat present	Presumed absent
Woodland Woolythreads (*Monolopia gracilens*)	-/-/1B	February – July	Found in serpentine, broadleafed upland forest (openings), chaparral (openings), cismontane woodland, north coast coniferous forest (openings), valley and foothill grassland.	Low No suitable habitat present	Presumed absent
Antioch Dunes Evening Primrose (*Oenothera deltoides ssp. howellii*)	E/E/1B	March – September	Inland dunes.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Mount Diablo Phacelia (*Phacelia phacelioides*)	-/-/1B	April – May	Chaparral, cismontane woodland; adjacent to trails, on rock outcrops and talus slopes; sometimes on serpentine.	Low No suitable habitat present	Presumed absent
San Francisco Popcornflower (*Plagiobothrys diffusus*)	-/-/1B	March – June	Coastal prairie and valley and foothill grassland.	Low No suitable habitat present	Presumed absent
Hairless Popcorn-Flower (*Plagiobothrys glaber*)	-/-/1A	March – May	Meadows and seeps, marshes and swamps, coastal salt marshes and alkaline meadows.	Low No suitable habitat present	Presumed absent
Oregon Polemonium (*Polemonium carneum*)	-/-/2	April – September	Coastal prairie, coastal scrub, and lower montane coniferous forest from 0-1830 meters in elevation.	Low No suitable habitat present	Presumed absent
Marin Knotweed (*Polygonum marinense*)	-/-/3	(April) May – August (October) Months in parentheses are uncommon	Coastal salt and brackish marshes and swamps.	Low No suitable habitat present	Presumed absent
Lobb's Aquatic Buttercup (*Ranunculus lobbii*)	-/-/4.2	February – May	Mesic areas in cismontane woodland, North Coast coniferous forest, valley and foothill grassland, vernal pools.	Low Suitable habitat present	Not likely to occur

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Adobe Sanicle (*Sanicula maritima*)	-/R/1B	February – May	Clay, serpentine substrate in chaparral, coastal prairie, meadows and seeps, and valley and foothill grassland.	Low No suitable habitat present	Presumed absent
Chaparral Ragwort (*Senecio aphanactis*)	-/-/2	January – April	Cismontane woodland, coastal scrub, drying alkaline flats, chaparral.	Low No suitable habitat present	Presumed absent
Long-Styled Sand Spurrey (*Spergularia macrotheca longistyla*)	-/-/1B	February – May	Alkaline meadows and seeps, marshes and swamps.	Low No suitable habitat present	Presumed absent
Most Beautiful Jewel-Flower (*Streptanthus albidus* ssp. *peramoenus*)	-/-/1B	April – June	Chaparral, cismontane woodland, and valley and foothill grasslands in serpentine soils on ridges and slopes.	Low No suitable habitat present	Presumed absent
Slender-Leaved Pondweed (*Stuckenia filiformis subsp. alpina*)	-/-/2	May – July	Assorted freshwater marshes and swamps. Shallow, clear water of lakes and drainage channels.	Low No suitable habitat present	Presumed absent
California Seablite (*Suaeda californica*)	E/-/1B	July – October	Marshes and swamps, margins of coastal salt marshes.	Low No suitable habitat present	Presumed absent
Saline Clover (*Trifolium hydrophilum*)	-/-/1B	April – June	Marshes and swamps, valley and foothill grasslands with mesic, alkaline soils, and vernal pools.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Coastal Triquetrella (*Triquetrella california*)	-/-/1B	-	Coastal bluff scrub and coastal scrub.	Low No suitable habitat present	Presumed absent
Caper-Fruited Tropidocarpum (*Tropidocarpum capparideum*)	-/-/1B	March – April	Valley and foothill grasslands on alkaline hills.	Low Suitable habitat present	Not likely to occur
Oval-Leaved Viburnum (*Viburnum ellipticum*)	-/-/2B	May – June	Chaparral, cismontane woodland, lower montane coniferous forest.	Low No suitable habitat present	Presumed absent
BIRDS					
Cooper's Hawk (*Accipiter cooperii*)	-/CP/-	February – August	Oak woodlands, coniferous forests, riparian corridors. Often hunts on edges between habitats.	Moderate Suitable foraging habitat present	May occur Foraging capacity only
Sharp-Shinned Hawk (*Accipiter striatus*)	-/CP/-	February – August	Oak woodlands, coniferous forests, riparian corridors. Often hunts on edges between habitats. (Nesting) Ponderosa pine, black oak, riparian deciduous, mixed conifer, and Jeffrey pine habitats. Prefers riparian areas. North-facing slopes with plucking perches are critical requirements. Nests usually within 275 feet of water.	Moderate Suitable foraging habitat present	May occur Foraging capacity only

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Tricolored Blackbird (*Agelaius tricolor*)	SOC/-/SSC	February – August	Nesting within seasonal wetland marshes, blackberry brambles or other protected substrates. Forages in annual grassland and wetland habitats.	Low No suitable habitat present	Presumed absent
Grasshopper Sparrow (*Ammodramus savannarum*)	-/-/SSC	February – August	Open grasslands and prairies with patches of bare ground.	Low Suitable habitat present	Not likely to occur
Golden Eagle (*Aquila chrysaetos*)	FP/CP/-	February – August	Nests in cliff-walled canyons and tall trees in open areas. (Nesting and wintering) Rolling foothills mountain areas, sage-juniper flats, and desert.	Moderate Suitable foraging habitat present	May occur Foraging capacity only
Great Egret (*Ardea alba*) ROOKERIES	-/-/-	February – August	Freshwater, brackish and marine wetlands. Form breeding colonies on lakes, ponds, marshes, estuaries or islands. Forage in marshes, swamps, streams rivers, ponds, tidal flats, canals and flooded fam fields.	Low No suitable habitat present	Presumed absent
Great Blue Heron (*Ardea herodias*) ROOKERIES	-/-/-	February – August	Saltwater and freshwater habitats from open coasts, marshes, sloughs, riverbanks, and lakes to small ponds. Also forage in grasslands and agricultural fields.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Short-Eared Owl (*Asio flammeus*)	-/-/SSC	February - August	Open areas with low vegetation, including prairie and coastal grasslands, meadows, savannah, tundra, marshes, dunes and agricultural areas.	Low Suitable habitat present	Not likely to occur
Burrowing Owl (*Athene cunicularia*)	SOC/-/SC	February – August	Dry open annual or perennial grassland, desert and scrubland. Uses abandoned mammal burrows for nesting.	Low No suitable habitat present	Presumed absent
Oak Titmouse (*Baeolophus inornatus*)	-/-/SSC	February – August	Dry, open oak or oak-pine woodlands, or scrub oaks and brush lands close to woodlands. Prefer to nest in natural cavities but will nest in ones made by woodpeckers or excavate themselves.	Low No suitable habitat present	Presumed absent
Red-tailed Hawk (*Buteo jamaicensis*)	-/CP/-	February – August	Various grassland habitats, urban land, oak woodlands with grassland for foraging.	High Suitable foraging habitat present	Present Foraging capacity only
Red-shouldered Hawk (*Buteo lineatus*)	-/CP/-	February – August	Forages in variety of semi-developed habitats including orchards. Forages in woodlands and riparian areas. Nests in riparian habitat but also eucalyptus groves.	High Suitable foraging habitat present	May occur Foraging capacity only

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Ferruginous Hawk (*Buteo regalis*)	-/CP/-	Late Fall – Winter	Open country such as semiarid grasslands with few trees, rocky outcrops, and open valleys. Also along streams or in agricultural areas during migration.	Low Suitable habitat present	Not likely to occur
Swainson's Hawk (*Buteo swainsonii)*	-/T/-	February – October	Nests in riparian areas and in oak savannah near foraging areas. Forages in alfalfa and grain fields with rodent populations.	Low No suitable habitat present	Presumed absent
Western Snowy Plover (*Charadrius alexandrinus nivosus*)	T/-/SSC	February – August	Sandy beaches, salt pond levees, shores of large alkali lakes. Requires sandy, gravelly, or friable soils for nesting.	Low No suitable habitat present	Presumed absent
Northern Harrier (*Circus hudsonius*)	-/-/SSC	February – August	Nests in grasslands and marshlands, ground nesting bird. (Nesting) Coastal salt and freshwater marsh. Nest and forage in grasslands, from salt grass in desert sink to mountain cienagas. Nests on ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks	Low Suitable habitat present	Not Likely to Occur
Yellow Rail (*Coturnicops noveboracensis)*	-/-/SSC	February - August	Salt or brackish marshes or wet meadows. Prefers habitats with tall, dense vegetation such as sedges or cattails.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Snowy Egret (*Egretta thula*) ROOKERIES	-/-/-	February - August	Found along the coast but breed in inland wetlands. Nest on thick vegetation in barrier islands, saltmarsh islands, swamps or marshes.	Low No suitable habitat present	Presumed absent
White-tailed Kite (*Elanus leucurus*)	SOC/CP/FP	February – August	Various grassland habitats, urban land, oak woodlands with grassland for foraging.	High Suitable foraging habitat present	May occur Foraging capacity only
California Horned Lark (*Eremophila alpestris actia*)	-/-/SSC	February – August	Short-grass prairie, bald hills, mountain meadows, open coastal plains, fallow grain fields, and alkali flats. Prefer open terrain where they construct nests on the ground, often in sparsely vegetated areas.	Low Suitable habitat present	Not likely to occur
Merlin (*Falco columbarius*)	-/-/WL	February – August	Breed in open and semiopen areas such as forested openings or fragmented woodlots near rivers, lakes, or bogs, and on lake islands. Often nest in coastal areas and along rivers.	Low No suitable habitat present	Presumed absent
Prairie Falcon (*Falco mexicanus*)	-/CP/-	February – August	Nests on cliffs in dry open terrain either in level or hilly habitats. Forages in scrub, grassland, desert or agricultural fields.	Low Suitable foraging habitat present	Not likely to occur

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
American Peregrine Falcon (*Falco peregrinus anatum)*	-/-/FP	February - August	Nests near wetlands, lakes, rivers, or other water. On cliffs, banks, dunes, mounds, and human-made structures.	Low Suitable foraging habitat present	Not likely to occur
American Kestrel (*Falco sparverius)*	-/CP/-	February – August	Various grassland habitats, urban land, oak woodlands with grassland for foraging.	High Suitable foraging habitat present	May occur Foraging capacity only
Saltmarsh Common Yellowthroat (*Geothlypis trichas sinuosa*)	SOC/-/SSC	February – August	Fresh and saltwater marshes of the San Francisco Bay area. Forages in thick, continuous vegetation down to water surface. Nests in tall grasses, tule patches, and willows.	Low No suitable habitat present	Presumed absent
Bald Eagle (*Haliaeetus leucocephalus)*	-/E/FP	January – July	Wetland habitats such as coasts, rivers, lakes or marshes. Uses large mature conifers or hardwood trees for nesting.	Low Suitable foraging habitat present	Not likely to occur
Loggerhead Shrike (*Lanius ludovicianus*)	SOC/-/SSC	February – August	Open grassland habitats, grazed grasslands. Uses shrubs for nesting.	Moderate Suitable foraging habitat present	May occur Foraging capacity only
California Black Rail (*Laterallus jamaicensis coturniculus)*	-/T/FP	February – July	Inhabits shallow salt and freshwater marshes. Nests in upland areas of salt marshes, shallow freshwater marshes, wet meadows and flooded grassy vegetation.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Suisun Song Sparrow (*Melospiza melodia maxillaris)*	-/-/SC	February – August	Inhabits tidal salt marshes, needs vegetation for nesting sites.	Low No suitable habitat present	Presumed absent
Alameda Song Sparrow (*Melospiza melodia pusillula*)	-/-/SSC	February – August	Resident of salt marshes bordering south arm of San Francisco Bay, inhabits *Salicornia* marshes, nests low in *Grindelia* bushes (high enough to escape high tides) and in *Salicornia*.	Low No suitable habitat present	Presumed absent
Black-Crowned Night Heron (*Nycticorax nycticorax*) ROOKERIES	-/-/-	February – August	Inhabits wetlands including saltmarshes, freshwater marshes, swamps, streams, rivers, lakes, canals and tidal mudflats.	Low No suitable habitat present	Presumed absent
Osprey (*Pandion halietus*)	-/-/WL	February - August	Inhabit areas near bodies of water such as saltmarshes, rivers, ponds, reservoirs and estuaries. Large nests are places on open poles, channel markers, or dead trees and are often over water.	Low No suitable habitat present	Presumed absent
Bryant's Savannah Sparrow (*Passerculus sandwichensis alaudinus*)	-/-/SSC	February – August	Low, tidally influenced habitats, ruderal areas, moist grasslands within and just above the fog belt. Bayshore habitats include pickleweed marsh and adjacent grassland.	Low No suitable habitat present	Presumed absent
California Ridgeway's Rail (*Rallus obsoletus obsoletus*)	E/E/-	February – August	Salt to brackish-water marshes with tidal sloughs in San Francisco Bay area. Found in dense pickleweed.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Black Skimmer (*Rynchops niger*)	-/-/SSC	February - August	Inhabits open sandy beaches, gravel or shell bars with sparse vegetation, or on mats of debris in saltmarshes. Colonial nesters.	Low No suitable habitat present	Presumed absent
Yellow Warbler (*Setophaga petechia*)	-/-/SSC	February – August	(Nesting) Riparian plant associations, prefers willows, cottonwoods, aspens, sycamores, and alders for nesting and foraging. Also nests in montane shrubbery in open conifer forests.	Low No suitable habitat present	Presumed absent
California Least Tern (*Sternula antillarum browni*)	E/E/FP	May – June	Forages in shallow estuaries and lagoons. Nests are situated on barren to sparsely vegetated places near water, such as salt flats, on sandy or gravelly substrates.	Low No suitable habitat present	Presumed absent
MAMMALS					
Pallid Bat (*Antrozous pallidus*)	-/SC/-	N/A	Forages in grasslands, shrublands, deserts, forests, and woodlands. Most common in open, dry habitats. Roosts in rock crevices, caves, tree hollows, and buildings. Roosts must protect bats from high temperatures; very sensitive to disturbance of roosting sites.	Moderate Suitable foraging habitat present	May occur Foraging capacity only
Townsend's Big-Eared Bat (*Corynorhinus townsendii*)	-/SSC/-	Resident	Throughout California in a wide variety of habitats; roosts in the open, hanging from walls and ceilings. Needs sites free from human disturbance. Most common in mesic sites.	Low Suitable habitat present	Not likely to occur

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Berkeley Kangaroo Rat (*Dipodomys heermanni berkeleyensis*)	-/-/-	Resident	Open grassy hilltops and open spaces in chaparral and blue oak/digger pine woodlands; needs fine, deep, well-drained soil for burrowing.	Low No suitable habitat present	Presumed absent
Western Mastiff Bat (*Eumops perotis californicus*)	-/-/SSC	Resident	Many open, semi-arid to arid habitats, including conifer and deciduous woodlands, coastal scrub, grasslands, chaparral, etc. Roosts in crevices in cliff faces, high buildings, trees, and tunnels.	Low Suitable habitat present	Not likely to occur
Hoary Bat (*Lasiurus cinereus*)	-/-/-	Resident	Prefers open habitats or habitat mosaics with access to trees for cover and open areas or habitat edges for feeding. Roosts in dense foliage of medium to large trees near water. Feeds mainly on moths.	Moderate Suitable foraging habitat present	May occur
Yuma Myotis (*Myotis yumanensis*)	-/-/-	Resident	Optimal habitats are open forests and woodlands with sources of water over which to feed. Maternal colonies occur in caves, mines, buildings or crevices.	Low Suitable habitat present	Presumed absent
San Francisco Dusky-Footed Woodrat (*Neotoma fuscipes annectens*)	-/SC/-	Resident	Forest habitats of moderate canopy and moderate to dense understory, may prefer chaparral and redwood habitats. Nests constructed of grass, leaves, sticks, feathers, etc. Population may be limited by availability of nest materials.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Big Free-Tailed Bat (*Nyctinomops macrotis*)	-/-/SSC	Resident	Inhabits rocky or canyon country where it roosts in crevices. Arid landscapes such as desert shrub, woodlands and evergreen forests.	Low No suitable habitat present	Presumed absent
San Joaquin Pocket Mouse (*Perognathus inornatus*)	-/-/-	Resident	Inhabits grassland, semi-desert or desert environments with loose, sandy soils.	Low No suitable habitat present	Presumed absent
Salt Marsh Harvest Mouse (*Reithrodontomys raviventris)*	E/E/FP	Resident	Salt marshes with dense stands of pickleweed and other dense wetland vegetation such as cattails or bullrush.	Low No suitable habitat present	Presumed absent
American Badger (*Taxidea taxus*)	-/-/SSC	Resident	Shrub, forest, and herbaceous habitats with friable soils to dig burrows. Need open, uncultivated ground. Prey on fossorial mammals.	Low Suitable habitat present	Not likely to occur
San Joaquin Kit Fox (*Vulpes macrotis mutica*)	E/T/-	Resident	Annual grasslands or grassy stages with scattered shrubby vegetation. Needs loose soils for burrowing.	Low No suitable habitat present	Presumed absent
AMPHIBIAN					
California Red-Legged Frog (*Rana draytonii*)	T/-/SC	May 1 – November 1	Lowlands and foothills in or near permanent deep water with dense, shrubby or emergent riparian habitat. Requires 11-20 weeks of permanent water for breeding and larval development. Must have access to aestivation habitat.	Moderate Suitable dispersal habitat present	May occur Dispersal capacity only

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
California Tiger Salamander (*Ambystoma californiense*)	T/T/-	Aquatic Surveys - Once each in March, April, and May with at least 10 days between surveys. Upland Surveys - 20 nights of surveying under proper conditions beginning October 15 and ending March 15.	Vernal pools, swales and depressions for breeding, needs underground refugia.	Low No suitable habitat present	Presumed absent
Foothill Yellow-Legged Frog (*Rana boylii*)	SOC/-/SC	Year-round resident	Partially-shaded, shallow streams and riffles with a rocky substrate in a variety of habitats. Need cobble for egg-laying.	Low No suitable habitat present	Presumed absent
Coast Range Newt (*Taricha torosa)*	-/-/SSC	Year-round resident	Found in wet forests, oak forests, chaparral, and rolling grasslands	Low Suitable habitat present	Not likely to occur
REPTILE					
Northern California Legless Lizard (*Anniella pulchra)*	-/-/SSC	Year-round resident	Occurs in moist warm loose soil with plant cover. Moisture is essential. Occurs in sparsely vegetated areas of beach dunes, chaparral, pine-oak woodlands, desert scrub, sandy washes, and stream terraces with sycamores, cottonwoods, or oaks.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**
Western Pond Turtle (*Emys marmorata*)	-/-/SC	March – October	Aquatic turtle needs permanent water in ponds, streams, irrigation ditches. Nests on sandy banks or grassy fields.	Low No suitable habitat present	Presumed absent
Alameda Whipsnake (*Masticophis lateralis euryxanthus*)	T/T/-	Year-round resident	Valley-foothill hardwood habitat of the coast ranges between Monterey and north San Francisco Bay areas. Inhabits south-facing slopes and ravines where shrubs form a vegetative mosaic with oak trees and grasses.	Moderate Suitable dispersal habitat present	May occur Dispersal capacity only
Coast Horned Lizard (*Phrynosoma blainvillii*)	-/SSC/-	Year-round resident	Frequents a wide variety of habitats, most common in lowlands along sandy washes with scattered low bushes; requires open areas for sunning, bushes for cover, patches of loose soil for burial, and abundant supply of ants and other insects.	Low No suitable habitat present	Presumed absent

Table 2

Special-Status Species for the Las Trampas Ridge, Walnut Creek, Clayton, Diablo, Dublin, Hayward, San Leandro, Oakland East, Briones Valley 7.5 Minute Quadrangle Maps[1]

Common Name/Scientific Name	Status (Fed/State/ CNPS)[2]	Blooming or Survey Period	Habitats of Occurrence	Potential on Site	Status on Site**

1. Special-status plants and animals as reported by the California Natural Diversity Data Base, California Native Plant Society, and other background research October 2017
2. Order of Codes for Plants - Fed/State/CNPS

Order of Codes for Animals - Fed/State/CDFW

Codes:

SOC - Federal Species of Concern

SC - California Species of Special Concern

E - Federally/State Listed as an Endangered Species

T - Federally/State Listed as a Threatened Species

C - Species listed as a Candidate for Federal Threatened or Endangered Status

R - Rare

D - Delisted

CP- California protected

FP - State Fully Protected

DFG: SC California Special Concern species

1B - California Native Plant Society considers the plant Rare, Threatened, or Endangered in California and elsewhere.

1A - CNPS Plants presumed extinct in California.

2 - CNPS Plants Rare, Threatened or Endangered in California, but more common elsewhere.

3 - CNPS Plants on a review list to find more information about a particular species.

4 - CNPS Plants of limited distribution - a watch list.

ATTACHMENT 3

SITE PHOTOGRAPHS

1. Facing northwest, photo shows the annual grassland habitat that dominates the Property. Residences along Camino Pablo can be seen in the background.

2. Facing east, photo shows the rolling hillsides and annual grassland that characterizes the Property.

3. Facing south, photo shows the annual grassland found within the Property. The vegetation height was fairly low due to grazing pressure, but patches of taller grasses can be seen scattered throughout the grassland.

4. Facing north, photo shows the southernmost drainage on the Property. This drainage featured a defined bed and bank, and a clearly incised channel that contained a single arroyo willow tree. A few inches of water was noted in the channel at the time of the survey.

5. Facing northeast, photo shows the start of the southernmost ephemeral drainage. Erosional slumps associated with the channel can be seen.

6. Facing north, photo shows the second ephemeral drainage and the seasonal wetland adjacent to it. The seasonal wetland is characterized by a mix of upland and hydrophytic vegetation, and contained saturated soils and small pools of water in cattle hoof shear at the time of the survey.

7. Facing west, photo shows the second ephemeral drainage channel in the northern portion of the Property. The channel contained a few inches of water at the time of the survey.

8. Facing south, photo shows one of the concrete v-ditches present in the northwestern portion of the Property.

9. Photo shows the second seasonal wetland present in the northern portion of the Property along the eastern Property boundary. Water has collected in small ruts created by cattle hoof shear, and some of the deeper pools contained Sierran tree frog tadpoles.

10. Facing southwest, photo shows an overview of the rolling hillsides and annual grassland found within the Property.

Camino Pablo Project

Alameda Whipsnake (*Masticophis lateralis euryxanthus*) Surveys

Project No.:
1004

Zentner Planning and Ecology

Oakland

Prepared for:
JBT Property Management Company Inc.

Issued:
October 2019

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I. Introduction

A. Purpose

Zentner Planning and Ecology completed a series of surveys for the Alameda whipsnake (*Masticophis lateralis euryxanthus*; AWS) at the Camino Pablo Project site in the Town of Moraga in Contra Costa County, CA. The site and its ability to support this species were also evaluated during these surveys. This report provides the results of the field surveys with an evaluation of the site features and their ability to support AWS.

The surveys were completed to determine the presence or absence of AWS at the project site as recommended by Olberding Environmental, Inc. in their Biological Resource Analysis Report for the Camino Pablo Property, which was prepared as part of the Town of Moraga's environmental review process for a proposed residential development. In that report, Olberding recommended a total of seven AWS surveys to determine presence/absence of the species. The first three surveys were completed by Jill Grant of Baercat Compliance, who is an expert field herpetologist (**Appendix A**). Zentner Planning and Ecology, who have extensive experience surveying for amphibians and reptiles, including AWS, completed the remaining four surveys. The Baercat Compliance Survey Report is provided as **Appendix B** to this report.

B. Location

The Camino Pablo Project site (project site) is approximately 24 acres and is the westernmost portion of the Carr Ranch. The Camino Pablo site lies in south-central Contra Costa on the southern edge of the Town of Moraga adjacent to the Sanders Ranch, Tharpe and Sky view subdivisions (**Figure 1**). Camino Pablo and Sanders Ranch form the site's western and northern border. The southern border abuts the Moraga Highlands (Sky View) subdivision, while the eastern border is undeveloped open space; parts of which are owned by East Bay Municipal Utility District (EBMUD) and by the Carr Ranch. The Site's APN is 258-290-023 and the street address is 1211 Camino Pablo.

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Planning & Ecology

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Camino Pablo

Moraga
California

FIGURE 1

LOCATION MAP

N

BY: **JPE**

PROJECT: **1004**

BASE MAP:
© 2018 GOOGLE MAPS

FILE: D:\Graphic Designer\My Documents\PROJECTS\1100-1199\1112\Adobe\ZinfandelLocation.pdf

DATE: **9/19/2019**

Photo 1: View looking north along the northwest side of the project site. Grazing cattle are visible in the center of the photo and the adjacent Sanders Ranch development is visible on the left of the photo. August 2019.

Regionally, the site is on the southern edge of the Lamorinda development area, a generally suburban residential complex situated between Oakland and Walnut Creek. The great majority of the developed lands are to the north, however, south of the site, lands are generally public open space and include EBMUD reservoirs and East Bay Regional Park District (EBRPD) open space and parks.

C. Site Description

The roughly triangular shaped Camino Pablo property is located in central, far western Contra Costa County, very close to the northwestern tip of Alameda County. The property itself is the western piece of the greater Carr Ranch land that includes homes, barns and other ranch outbuildings, stock pens, and grazing land. The Carrs have lived and run cattle on the property since 1916.

The watershed of the site consists of primarily of ephemeral waterways in the drainages of the slopes. Water on the west side of the property is intercepted at roadside drainages along Camino Pablo Blvd. Existent concrete v-ditches run northeast to southwest along Sanders Ranch Rd. There are approximately 2,180 linear feet of v-ditch adjacent to the property, with 483 linear feet actually within the property. From the site, the drains connect with Moraga Creek and become part of the greater San Leandro watershed. Moraga Creek flows into the Upper San Leandro Reservoir, and then into San Leandro Creek, which exits to the bay at Arrowhead Marsh, between the Oakland Airport and Alameda.

The project site contains approximately 24 acres of grazed grassland on primarily the western-facing slope of a relatively steep, north-south trending ridge. The grasslands now appear to be relatively moderately grazed, however, they are dominated by non-native, annual grasses, which is often indicative of past heavy grazing. Two gullies run down the steep ridge toward Camino Pablo Blvd. and are picked up by one of the v-ditches. The site contains a good number of slides and slumps and a number of cement v-ditches run along the northern portion of the site to catch and drain water.

Photo 2: View looking south along the western edge of the site. Annual grassland dominates the site. A small, spring-fed wetland can be identified on the right side of the photo as the green area amidst the brown annual grasses. August 2019.

Erosion, which is prevalent across the site due to the presence of annual vegetation and the history of grazing, is apparent by the minor slumps and slides that make up the jurisdictional waterways onsite. Small seasonal wetlands occur in only a couple of locations on the property; at the base of the largest jurisdictional waterway, at the base of a wide slump at a higher elevation, and along a seep adjacent to one of the gullies.

D. Plant Communities and Associated Wildlife Habitat

As noted above, the project site is dominated by grassland and non-native annual grassland vegetation (**Figure 2**). The site also contains a few small pockets of ruderal vegetation. A few

LEGEND

PROPERTY BOUNDARIES

STUDY AREA

VEGETATION TYPES

GRASSLAND

RUDERAL VEGETATION

SEASONAL WETLAND

OTHER WATERS

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CAMINO PABLO

Moraga, California

FIGURE 2

VEGETATION MAP

N

BY: EMM

PROJECT: 1004

BASE MAP: Google 2015

DATE: 10/12/2015 - update 9/19

FILE: D:\PROJECTS\1004\adobe\1004vegetation map

very small seasonal wetlands are also associated with seeps or gullies on the northern portion of the property.

Nomenclature used for plant names follows *The Jepson Manual*, Second Edition (Baldwin et. al. 2012) and changes made to this manual as published on the Jepson Interchange Project website (http://ucjeps.berkeley.edu/interchange/index.html). Nomenclature for wildlife follows the CDFW's *Complete list of Amphibian, Reptile, Bird, and Mammal Species in California* (2008) and any changes made to species nomenclature as published in scientific journals since the publication of CDFW's list.

1. Annual Grassland Vegetation

Grassland characterized by non-native annual grasses and forbs dominate the site. These non-native grasslands are primarily composed of wild oats (*Avena fatua*), ryegrass (*Festuca perennis*), soft chess brome (*Bromus hordeaceus*), ripgut brome (*Bromus diandrus*), with areas of bindweed (*Convolvulus arvensis*), red-stem filaree (*Erodium cicutarium*), and rose clover (*Trifolium hirtum*).

This grassland composition is characteristic of most of the grasslands in the region, the majority of which have been subjected to relatively heavy grazing since the Spanish first brought cattle into the area in the 1700's and have had a wide variety of grazing regimes since that period. Once established, these non-native grasses are very difficult to remove and their establishment has some broad ramifications to the habitat in general. One of the primary effects of annual grassland is on soil structure. Annual grasslands have dense, shallow roots that dry the upper soil zones, whereas the native perennial grasses have long, deep roots. While these deep roots helped hold the soils on California's steep slopes, the shallow-rooted annual grasses leave the soils, especially the upper layers vulnerable. This often leads to erosion, particularly slumps and gully erosion as is found on the site, especially on the very steep west-facing slopes of the property.

However, a couple of slumps on the northern portion of the site contain small pockets of relatively steep north or northwest facing slopes. These older slump areas contain a scattering of native vegetation including primarily purple needlegrass (*Stipa pulchra*), creeping wildrye (*Elymus triticoides*), buttercup (*Ranunculus californicus*), common fiddleneck (*Amsinckia intermedia*), soap plant (*Chlorogalum pomeridianum*), and sun cup (*Taraxia ovate*).

In addition, a strip of creeping wildrye is present on the property between the sidewalk that lies adjacent to Camino Pablo Blvd and an existing fence-line that runs parallel to the road. This strip is approximately 20 feet wide and runs about 75 feet long.

2. Ruderal Vegetation

A few small pockets of ruderal vegetation are found on the project site. These primarily include areas that have been relatively heavily disturbed by more recent slump or slide activity and areas where cattle tend to congregate, such as ridge tops. The ruderal vegetation found in the

slide and slump areas tends to be found in the uppermost portion of these areas, especially near adjacent property where the land use management is different than the project site.

The ruderal vegetation is dominated by black mustard (*Brassica nigra*). Other vegetation includes ryegrass, ripgut, wild oats, bristly ox-tongue (*Helminthotheca echioides*), Italian thistle (*Carduus pycnochephalus*), spring vetch (*Vicia sativa*), and summer mustard (*Hirschfeldia incana*). This assemblage also includes invasive exotics--those non-native species that can invade and dominate habitats containing native species.

3. Seasonal Wetland

Seasonal wetland vegetation is found in four small areas on the project site including a seep near the northeastern border of the site, a seep adjacent to the northern gully, and within two portions of the gullies along the western edge of the site adjacent of Camino Pablo Blvd. These areas remain saturated for a prolonged period of time, but don't really pond water.

The vegetation in the seasonal wetlands is characterized by mildly hydrophytic vegetation reflecting the saturated conditions that drain and dry relatively quickly. The majority of the vegetation is facultative (FAC) meaning that these are plants that occur between 33% to 67% of the time in wetlands, rather than obligate (OBL) vegetation which is nearly always (greater the 99%) associated with ponded conditions. The only obligate vegetation in the wetlands is relatively sparse, iris-leaved rush (*Juncus xiphioides*). Other vegetation observed in these areas includes ryegrass (FAC), soft chess brome (*Bromus hordeaceus*; FACU), Mediterranean barley (*Hordeum marinum*; FAC), and white sweet clover (*Trifolium repens*, FACU). FACU plants occur less than 33% of the time in wetlands.

E. Wildlife

Wildlife at the project site appears limited to common suburban/rural species. Mammals would include coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and lagomorphs (rabbits) such as black-tailed jackrabbit (*Lepus californicus*). The coyotes and other predators, such as red-tailed hawk (*Buteo jamaicensis*) and red-shouldered hawk (*Buteo lineatus*), prey on the small mammals that appear to be common on-site, including California vole (*Microtus californicus*) and deer mouse (*Peromyscus maniculatus*). Other birds commonly found in this type of grassland habitat include mourning dove (*Zenaida macroura*), western meadowlark (*Sturnella neglecta*), turkey vulture (*Cathartes aura*), killdeer (*Charadrius vociferous*), and American kestrel (*Falco sparverius*). While there is no nesting habitat for most birds, including raptors, the grasslands do provide good foraging habitat for raptors such as white-tailed kite (*Elanus leucurus*), American Kestrel and, especially, red-tailed hawk. Common reptiles likely present include western fence lizard (*Sceloperus occidentalis*), southern alligator lizard (*Gerrhonotus multicarinatus*), gopher snake (*Pituophis melanoleucus*), and western rattle snake (*Crotalus viridis*).

II. Alameda Whipsnake Ecology

A. Range and Ecology

The Alameda whipsnake (*Masticophis lateralis euryxanthus*) is a medium-sized whipsnake that can be up to 60 inches (152 centimeters) in length. The species is slender with a narrow neck, broad head, and large eyes. They are dark brown to black with a wide yellow-orange stripe on each side extending down the length of the body. The underside is cream and tapers to orange or pinkish toward the tail.

AWS mate from March through mid-June and hatchlings usually appear in August through November; females have an average clutch size of approximately seven. These snakes are fast moving and generally hunt with their head held up. Western fence lizard (*Sceloporus occidentalis*) is an important prey item, as well as frogs, snakes and birds.

The historical distribution is difficult to determine, but AWS likely inhabited suitable habitat in Alameda and Contra Costa County, as well as western San Joaquin and northern Santa Clara Counties (USFWS, 2002). Currently, the whipsnake is known generally from five populations in Alameda and Contra Costa Counties. The five populations are located as follows: Sobrante Ridge, Tilden/Wildcat Regional Parks to the Briones Hills, in Contra Costa County (Tilden-Briones population); Oakland Hills, Anthony Chabot area to Las Trampas Ridge, in Contra Costa County (Oakland-Las Trampas population); Hayward Hills, Palomares area to Pleasanton Ridge, in Alameda County (Hayward-Pleasanton Ridge population); Mount Diablo vicinity and the Black Hills, in Contra Costa County (Mount Diablo-Black Hills population); and Wauhab Ridge, Del Valle area to the Cedar Mountain Ridge (Sunol-Cedar Mountain population). They are found in chaparral and northern and coastal sage scrub as well as approximately 500 feet into adjacent grassland, oak savanna and oak-bay woodland. They seek shelter in rock outcrops or piles or in small mammal burrows.

Critical habitat for the AWS was designated in 2006 and includes 154,834 acres throughout Alameda, Contra Costa, Santa Clara, and San Joaquin Counties. Critical habitat has been determined to contain features essential to the conservation of the AWS and may include areas that are not currently occupied by the species.

Core habitat, habitat with elements essential for the survival and reproduction of a species, for AWS is generally found in open-canopied shrub communities, including coastal scrub and chaparral, often with rock outcroppings on south-, southeast-, east-, and southwest-facing slopes (Swaim 1994). Rock outcrops are an important element of its habitat, as they provide AWS with protection from predators and habitat for western fence lizards and other prey species (Swaim 1994) and are typically found within approximately 0.5 miles of occupied habitat (Swaim 1994). AWS may also be found less frequently in oak woodland/savanna and grassland areas adjoining core habitats, especially where these areas are used as movement corridors between core habitats (Swaim 2003). Typical plant species within occupied habitats of scrub and chaparral communities include California sage, coyote brush, poison oak - and

sticky monkey flower. Canopy cover within these habitats is typically open (<75% cover of total area) with little to no herbaceous understory (Swaim 1994). Therefore, habitat associations for AWS should include those that co-occur in the general chaparral/scrub habitat mosaic (Alvarez 2005).

B. Local Distribution

The California Natural Diversity Database (CNDDB) lists 26 occurrences of AWS within 5 miles of the project site (**Figure 3**); there are no occurrences within 1 mile of the project site. The closest CNDDB record of AWS is located approximately 1.6 mile south of the project site (record #23). This record describes the results of a 1989 capture study and a 1990 telemetry home range study of a male and female AWS. During the capture study approximately 10 AWS were captured in habitat described as "hillside patches of diablan sage scrub on steep SW face…bordered by grassland and (California bay forest) riparian). The next closest record is located approximately 1.7 miles south of the project site (record #21). This record describes a specimen collected in 1989 on Buckhorn Road northeast of upper San Leandro Reservoir.

There are 2 more records within 2 miles of the project site. One of these records describes an adult male captured 3 miles southeast of Moraga in 1990 (record #32). The other describes an adult found in 2012 along Bollinger Canyon Road as recent roadkill (record #172). There are 6 records within 3 miles of the project site and 16 records between 3 and 5 miles of the project site. The majority of these records describe observations within scrub or chaparral communities, though there are a few that describe locations, such as a paved corporation yard (record #171) or parking lot (record #144), that are regions containing scrub or chaparral communities.

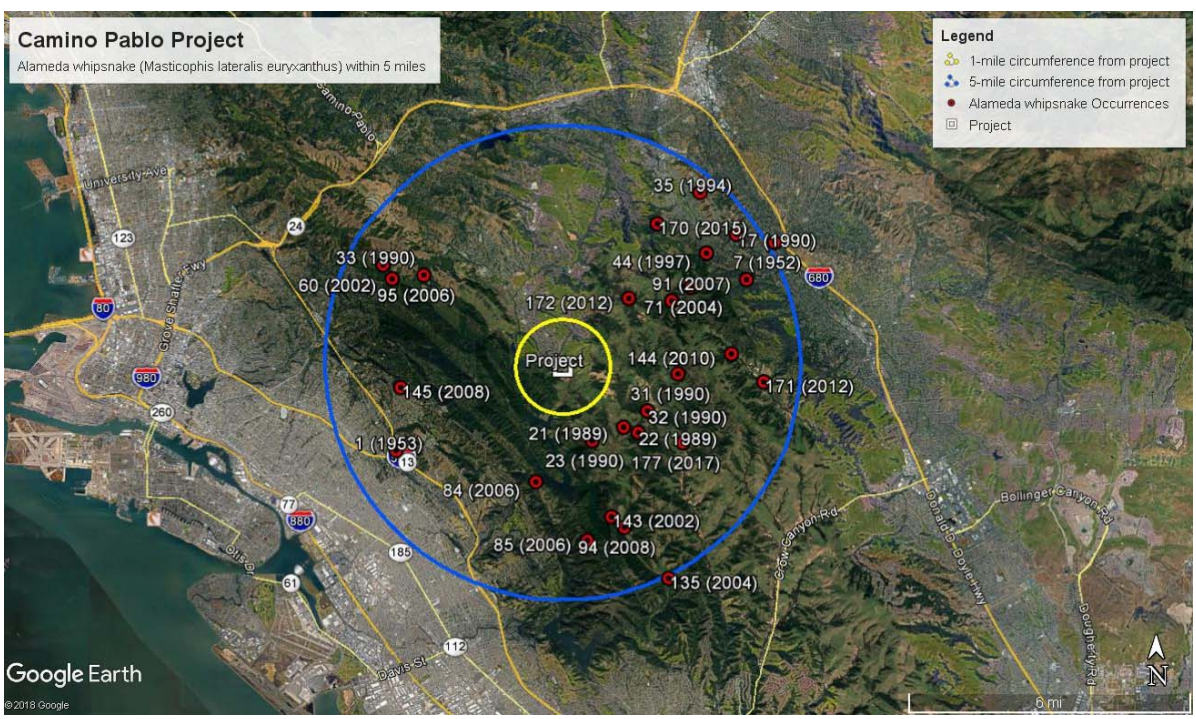

Figure 3: AWS Regional Distribution (Taken from Baercat, 2019)

III. Survey Results

A. Methods

Zentner Planning and Ecology conducted a literature review of the local CNDDB records with attention to the habitat preferences and life stage of sightings. Previously completed survey reports and Biological Assessments for the project site were also reviewed to gain insight into site conditions.

Surveys were completed by Sean Micallef, Emily Mathews, and Julia Evered, all biologists with Zentner Planning and Ecology, who worked in pairs to complete four surveys of the project site. The surveys were completed by walking transects across the entire property allowing for complete visual coverage of all habitat features. Binoculars were used when necessary to maximize AWS detection.

B. Results

No AWS or signs of AWS were identified on the project site during any of the surveys. Details on the surveys are provided in **Table 1** below. As well, no habitat that would be favorable to the AWS was identified on site.

Table 1: Survey Results

Date	Temperature/Weather	Surveyors	Notes	AWS Observed
8/15/19	• Cool 60 – 75 degrees Fahrenheit	SM & EM	• One king snake skeleton (*Lampropeltis californiae*) with small amount of skin on head and tail observed in thickly vegetated western slope. • Two gopher snake (*Pituophis catenifer catenifer*) skeletons with no skin or other easily identifiable features present. Skeletons unlikely to be AWS due to size and length.	No
8/20/19	• Cool 63 – 72 degrees Fahrenheit	EM & JE	• One gopher snake (*Pituophis catenifer catenifer*) head, no body parts present, observed on	No

	• Light mist/precipitation at beginning of survey.		densely vegetated NW slope. • One snake skin seen on site. Skin too large to be from AWS. Observed on densely vegetated SW slope.	
8/21/19	• 66-75 degrees Fahrenheit • Partially cloudy at beginning of survey, but cleared by middle	EM & JE	• No snakes or signs of snakes observed during survey.	No
8/28/19	• Cool 59 – 63 degrees Fahrenheit	SM & EM	• No snakes or signs of snakes observed during survey.	No

Wildlife detected during field surveys included the following species:

Red-tailed hawk (*Buteo jamaicensis*)
Crow (*Corvus brachyrhynchos*)
Western bluebird (*Sialia mexicana*)
Finch sp. (*Haemorhous sp.*)
Mule deer (*Odocoileus hemionus*)
Pigeon (*Columba liva*)
Hummingbird (*Calypte sp*)
Fence lizard (*Sceloporus occidentalis*)
Barn Swallow (*Hirundo rustica*)
White tailed kite (*Elanus leucurus*)

As well, coyote (*Canis latrans*) feces were seen on site as was evidence of gophers (*Thomomys bottae*) and field mice. The owners three large bulls were also present on site grazing.

IV. Conclusions

The project site lies along the north-central edge of the Unite 2 section of AWS Critical Habitat in Contra Costa County; the Critical Habitat border in the area is Camino Pablo Blvd. However, core habitat is not present within or near the project site. The project site is predominately tall grassland habitat that would be it difficult to AWS to visually hunt prey and there is little habitat for AWS to retreat from aerial predators as there is no chaparral or scrub cover, few burrows, and deep cracks, and only one tree on the project site.

As well, it is not likely that the site provides movement habitat for AWS due to the impediments created by adjacent developments.

The closest record of the AWS is more than 1.5 miles from the project site and this record, as well as others recorded within 5 miles of the project site have contained much more suitable matrix of habitats.

LSA (2008) completed an assessment for the adjacent Sanders ranch and determined that even the scrub habitat here was unsuitable for Alameda whipsnake. The site itself contains no rock outcrops, no chaparral, scrub or even individual shrubs. As noted above, telemetry data indicate that Alameda whipsnakes venture up to 500 feet into adjacent habitats from their home ranges, which are centered on chaparral/scrub communities (USFWS 2005). The closest Core habitat of this type is located approximately 1 mile to the east of the project site within Critical Habitat or about 0.5 miles southwest of the site across Camino Pablo Road outside of Critical Habitat. Because the site does not contain any elements of core habitat and is on the very edge of critical habitat located adjacent to residential developments on three sides that block whipsnake movement, the site is not likely movement habitat for this species. Accordingly, Alameda whipsnake are not likely to occur on this site despite its inclusion in Critical Habitat.

AWS are unlikely to occur on the project site for a number of reasons including: an abundance of predators, a low prey base and inadequate refugia. As the Olberding report states, the site does not contain any primary AWS habitat, though grasslands are generally considered secondary AWS habitat. However, as the Olberding report also states, the grassland vegetation on the site is regularly and relatively intensely grazed. The resulting low vegetation does not provide suitable cover for snakes to avoid predators or regulate their body temperature. During each of the AWS surveys of the site, numerous raptors that are predators of AWS were observed foraging over the site. As well, during our surveys the skeletons of several snakes that had been consuming, likely by raptors were observed including gopher snake and king snake. These snakes were likely captured by raptors from nearby areas and brought to the site to be consumed, leaving only the skeleton behind.

The Olberding report states there is a moderate potential for AWS to utilize the property for dispersal only. However, the site has been degraded and provides little value for dispersal or as a migration corridor because of the busy roadways, adjacent residential developments, roaming livestock, and lack of suitable cover. The property is at the edge of the open space area, with development to the north, west and east. Relatively small areas of flatter topography are located up against these adjacent developments with a tall, steep hill and the Carr Ranch between these areas and the open space. The site is also located in an area of annual grassland without burrows or rockcropping and is several hundred feet from suitable scrub or chaparral habitats, which is further than AWS typically travel. The Baercat AWS survey report came to similar conclusions regarding the lack of suitability of the site to support AWS in any capacity (**Appendix B**). Their report documents that the site does not provide a sufficient prey, contains difficult foraging habitat, provides a detrimental climate, and goes on to detail numerous threats to AWS at the site. Therefore, for all of the reasons noted above, AWS are unlikely to utilize the property in any capacity, including as dispersal. AWS would be unlikely to survive on the site given the lack of cover and abundance of predators and there is no connecting habitat for them to disperse to through the site.

The Olberding report recommended that seven surveys be completed to determine absence/presence of AWS of this species on the property. The seven surveys were completed by both Baercat Compliance and by Zentner Planning and Ecology with negative results. Therefore, absence of AWS dispersal use of the site has been confirmed.

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Appendix A

Jill Grant Bio

Jill Grant
Senior Biologist & Project Manager
Bay Area Environmental Resources Compliance And Training (Baercat)

Ms. Grant has over 20 years of experience in environmental construction compliance beginning as a field herpetologist under the tutelage of Dr. Samuel McGinnis to trap and provide safe harbor to the elusive, fully protected, state and federally endangered San Francisco garter snake during construction of BART to SFO. In her career, she has conducted numerous site assessments for California reptiles and amphibians with focused surveys, trapping, and relocation for a variety of special status species including Alameda whipsnake, Pacific pond turtle, California tiger salamander, and California red-legged frog according to regulatory guidelines. She also has extensive survey experience with nesting migratory birds, San Francisco dusky-footed woodrat, and roosting bats. Ms. Grant is also experienced with construction practices including large scale grading and excavation, tunnel and bridge construction, construction plan and design drawings, and standard OSHA safety requirements. As an Environmental Manager and Qualified SWPPP Developer/Practitioner (QSD/QSP), she has produced permit compliance documents including annual and ad-hoc reports for the Water Boards, monthly and quarterly environmental compliance reports for the State Revolving Fund, and project close-out reports for USACE, CDFW, and USFWS.

Appendix B

Baercat AWS Survey Report

Alameda Whipsnake Survey

South Camino Pablo Annexation Project Subdivision #9396
Town of Moraga, California

Submitted to:

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August 2019

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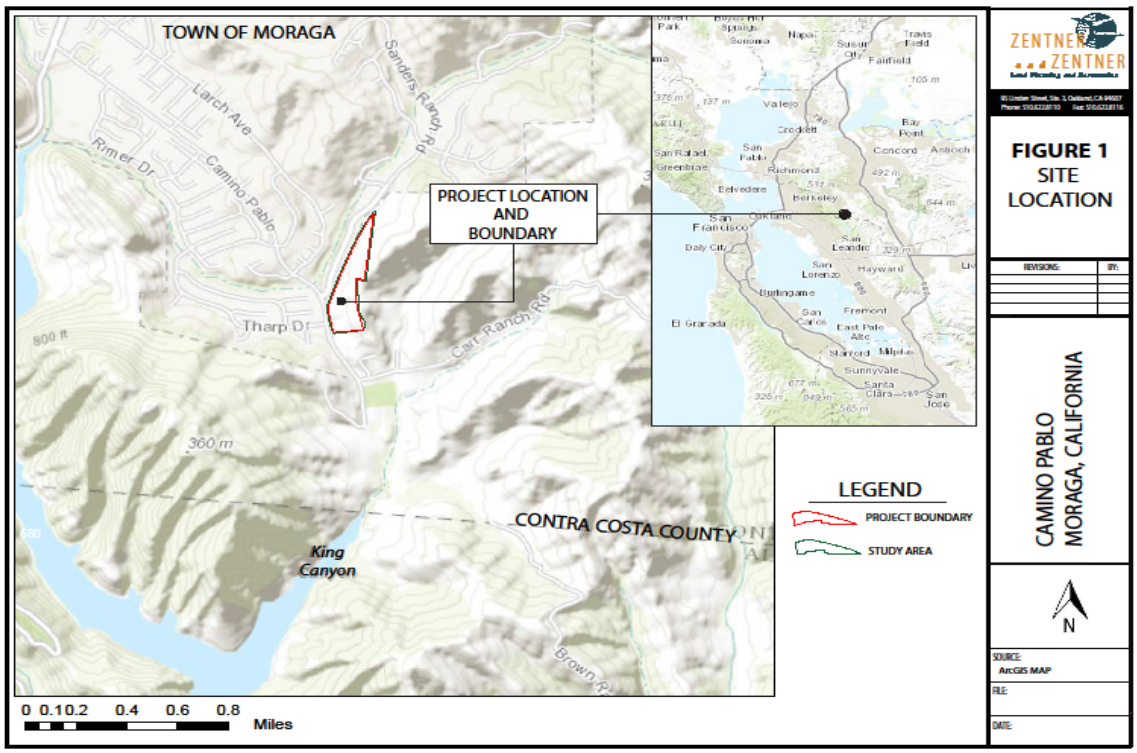
Introduction

At the request of Zentner and Zentner Land Planner and Restoration, BAERCAT conducted a reconnaissance survey for Alameda whipsnake (AWS; *Masticophis lateralis euryxanthus;* =Alameda striped racer; *Coluber lateralis euryxanthus*) in July and August of 2019 on a 24-acre property (project) where a proposed subdivision will be located in Moraga, California (Figure 1). The project will be limited to 9 acres at the southwest corner of the property and will result in the preservation of approximately 15-acres of open space which will be protected from future development. This report presents the results of field surveys for Alameda whipsnake with an evaluation of the habitat for features that would benefit this special status species.

The project site is located less than one mile east of the Upper San Lorenzo Reservoir and approximately ten miles east of the San Francisco Bay on the western edge yet within U.S. Fish and Wildlife Service designated AWS Critical Habitat (Federal Register, Vol. 71, No 190/ 58210) where it abuts a private subdivision (Sanders Ranch) to the north, the Moraga Highlands subdivision to the south, a 2-lane road and recreational trail to the west, and mostly undeveloped open space to the east, parts of which are owned by East Bay Municipal Utility District (EBMUD). Two sparsely vegetated and severely eroded drainages carry ephemeral runoff from the western hillsides into an existing concrete ditch running northeast to southwest along Sanders Ranch Road to drain into two large concrete inlets that connect with Moraga Creek to flow into the Upper San Leandro Reservoir (delineation Zentner 2015). The project APN is 258-290-023 and street address is 1211 Camino Pablo.



Regulatory Setting

The Alameda whipsnake was listed as threatened on June 27, 1971 by the state of California and was one of the first species protected by the California Endangered Species Act (CESA), enacted in 1970, which prohibits the unauthorized take of State-listed threatened or endangered species. This species was listed as federally threatened on December 5, 1997 (USFWS 1997) with additional protection through a recovery plan issued on December 2002 (Draft Recovery Plan for Chaparral and Scrub Community Species East of San Francisco Bay) along with designated critical habitat finalized on October 2, 2006 (USFWS 2006). This snake faces a medium degree of threat mainly from economic development but has a high potential for recovery (USFWS 2011).

Alameda Whipsnake Ecology

The Alameda whipsnake is a subspecies of the California whipsnake (*Masticophis lateralis*) and occurs in small areas of San Joaquin and Santa Clara counties, most of Alameda County and throughout Contra Costa County (Stebbins 2003, USFWS 2005). Core habitat consists of south-facing slopes and ravines, with features of rock outcrops, deep crevices or abundant rodent burrows where shrubs form a vegetative mosaic with oak trees and grasses (Swaim 1994, CNDDB 2019).

The Alameda whipsnake has a high preferred body temperature, a long, slender build and unusually large eyes, characteristics which aid in pursuing fast-moving prey (Shine 1980), primarily western fence lizards (*Sceloporus occidentalis*), which they hunt with their heads held high above the ground to peer over or around obstacles prior to striking and swallowing whole without constriction. AWS may also feed on frogs, birds, and other snakes (Stebbins and McGinnis 2012).

The annual cycle of the Alameda whipsnake is as such. They emerge from brumation (winter cooling) in late-March from an overwintering shelter called a hibernaculum. This could be a deep burrow, rock crevice or other similar refuge. The snake will immediately begin to search for food and for reproduction opportunities. Males will travel their entire home range to court and mate with the females who tend to remain close to their hibernaculum. They are oviparous but little is known about their egg-laying sites. One oviposit event occurred within in an ungrazed grassland community adjacent to a chaparral community (U.S. Fish & Wildlife Service 2005). Another suspected egg-laying event occurred in a patch of grassland within 3-6 meters of coastal scrub in the Berkeley Hills ((USFWS 2011). Reptiles in general choose a sheltered site for egg-laying to avoid predation. The site must have substrate that will provide warmth and suitable water moisture to successfully incubate their clutch. Typical reptilian egg-laying sites include loose soil or sand, underground retreats, leaf piles, or hollow wood. Like many of our California reptiles, AWS hatch in the late summer and the young follow the adult's annual cycle of entering a hibernaculum in late November.

All life stages of AWS are vulnerable to predators. As ground dwellers, they are exposed to foraging raccoons, skunks, opossums, foxes, and coyotes. In suburban areas, domestic dogs and cats can significantly reduce the snake population. Other predators include raptors that launch their stealthy attack from above, and king snakes that prey upon AWS from below. AWS avoid predation by outmaneuvering other wildlife using high bursts of speed, or their excellent climbing ability. They also can squeeze into deep rock or soil crevices where a larger animal cannot follow.

Methods

BAERCAT conducted a search of the California Natural Diversity Database (CNDDB) maintained by the California Department of Fish and Wildlife (CDFW) for records of Alameda whipsnake within 5 miles of the project site. Each of these records was scrutinized for habitat preference and life stage of sighting.

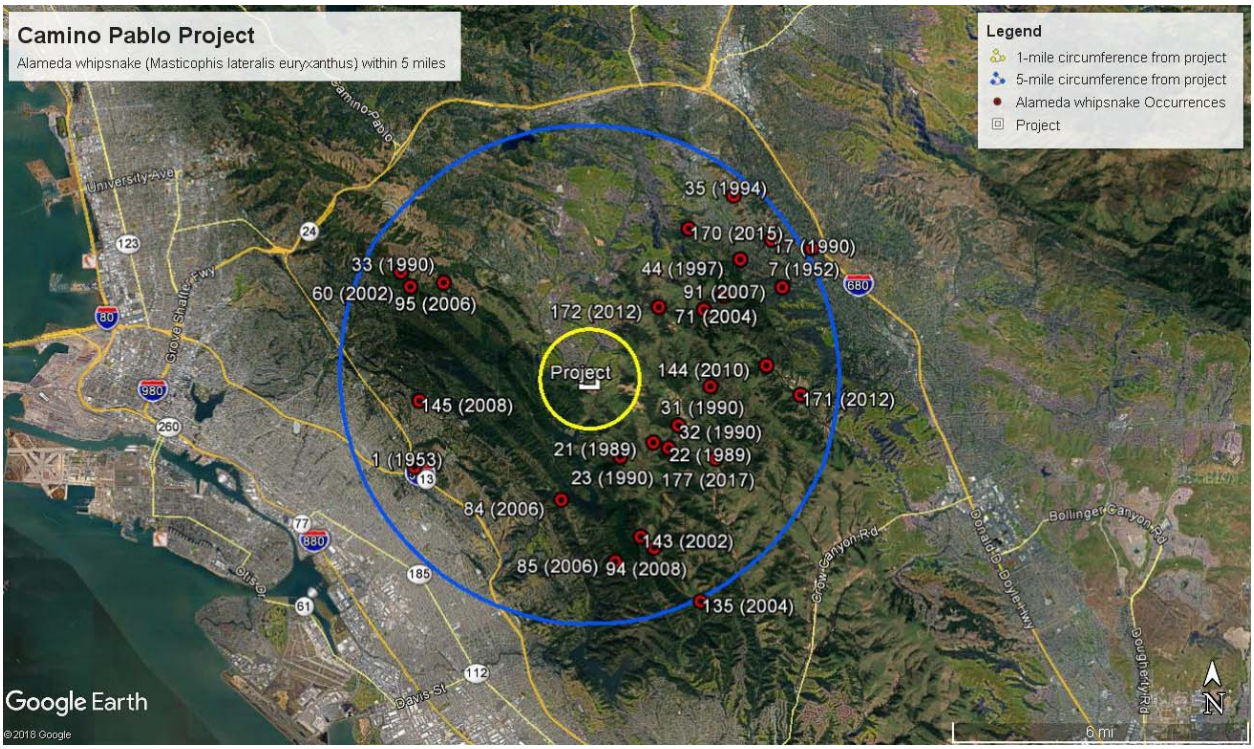
Pedestrian transects were conducted by biologist Jill Grant on the project site, which consists mainly of a north-south trending ridge and westerly slopes that rise steeply from 574 to 702 feet above sea level (Zentner 2015). The initial site survey on July 27, 2019 was spent assessing habitat features as weather conditions were cool (67-74 degrees Fahrenheit) with light precipitation (mist) and not conducive for AWS surveys. A dense morning fog traveling through a valley from the Upper San Lorenzo Reservoir blanketed all areas of the project except for the top of the ridgeline. However, the following survey dates of July 31, August 1, and August 2, were conducive to survey for reptiles with warm temperatures (74-86 degrees Fahrenheit), clear skies, little to no wind, and no precipitation.

Pedestrian transects of the entire property allowed complete visual coverage of all habitat features. However the northern portion could only be surveyed from the western fence line using Pentax 8x40 PCF WP binoculars, and a Sony alpha 6000 camera with 55- 210 mm lens, as this was an area where the owner's four large bulls (*Bos taurus*) preferred to graze, roll in the dirt, and run up and down the hillside. The surveyor had been warned by the property owner to stay clear of the cattle bulls as they weighed over 2,000 pounds and could be dangerous. Access to the northern portion was also limited by refusal by the gate guard to access the private Sanders Ranch community. Pedestrian transects were repeated on August 1, and 2 with a focus on habitat features that would support the occurrence of reptiles (sites of basking and foraging). These were observed first from a distance using Pentax 8x40 PCF WP binoculars, and a Sony alpha 6000 camera with 55- 210 mm lens prior to closer inspection to maximize detection of AWS.

Results

The California Natural Diversity Database (CNDDB) lists 25 element occurrences (EO) of Alameda whipsnake within 5 miles of the project with no sightings within 1 mile of the project.

The closest occurrence (OE#23), was approximately 1.6 miles southeast of the project where 35 AWS were captured during a 1989-1990 trapping study including one gravid female. Two of these snakes were then used in a telemetry study to measure home range. This study site was located on the upper arm of San Leandro Reservoir in scrub habitat bordered by grassland and riparian bay forest. The Diablan sage scrub vegetation of this occurrence (California sage, sticky monkey flower, coyote brush, and poison oak) was the habitat of the many sightings (EO#21, 22, 31, 32, and 83) within 2.5 miles of the project. The remainder of the sightings within 5 miles of the project was located in chaparral or scrub habitat with the exception of two reports. OE#172 was a road kill in riparian oak/bay woodland adjacent grassland habitat and OE#85 was an adult male found in grassland and eucalyptus near the entrance to Lake Chabot Regional Park.



The 24-acre project site consists of non-native grassland dominated by oat hay (*Avena sativa*) interspaced with minor invasions of non-native bull thistle (*Cirsium vulgare*), and spiny cocklebur (*Xanthium spinosum*), which are mostly found in deeply tilled firebreaks and other areas of human travel. Native plants consist of summer lupine (*Lupinus formosus*) and one willow in the central drainage with scattered coyote bush in the northern portion and a small patch in the ruderal vegetation along the concrete canal that lies east of Sanders Ranch.

Adjacent properties include landscaping of redwood trees (*Sequoia sempervirens*), tall pines (*Pinus* spps.), ornamental shrubs, and patches of lawn for the homes along the southern firebreak boundary. The western boundary consists of a hedgerow of ornamental shrubs with a small patch of California blackberry (*Rubus ursinus*) outside the firebreak and along the Camino Pablo recreational trail. This paved trail allows pedestrians to travel from the large private Sanders

Ranch community north of the project to an off-lease dog park south of the project. Scrub habitat exists on a residential lot that abuts the southwest corner of the project where a few coast live oak trees occur in an understory of coyote bush which inadvertently provides the best afternoon shade on the project and was used by the cattle as a resting site.

No rock outcroppings were detected, only a cluster of three, smooth, hardpan clay "stones" approximately 14 cm across and 20 cm in height. These stones were near an eroded side of the hillside where cattle were observed rubbing. No burrows were observed but there was evidence of rodent nesting (feces, seed heads, dried grass weaved together) in a few of the numerous depressions that the biologist stumbled upon while transecting the dry drainages. Minor slumping of the clay soils formed these depressions approximately 25 cm in depth and 60 cm in diameter, many of which had deep soil cracks and all were virtually undetectable visually within the tall grass.

Wildlife detected during field surveys included two western fence lizards (one adult male was basking in the willow drainage and one juvenile was basking on the clay stones). The biologist also observed wild turkey (*Meleagris gallopavo*), northern mockingbird (*Mimus polyglottos*), scrub jay (*Aphelocoma californica*), red-tailed hawk (*Buteo jamaicensis*), white-tailed kites (*Elanus leucurus*), red-shouldered hawk (*Buteo lineatus*) and an American kestrel (*Falco sparverius*). Mounds of earth from movements of Botta's pocket gopher (*Thomomys bottae*) were observed along the recreational trail to the west where Audubon's cottontails (*Sylvilagus audubonii*) sprinted across the busy Camino Pablo roadway. Mule deer (*Odocoileus hemionus*) droppings, coyote (*Canis latrans*) feces, and cow-pies were also observed on the property.

Discussion

The California Natural Diversity Database (CNDDB) lists 26 element occurrences of Alameda whipsnake within 5 miles of the project. All were found in scrub or chaparral communities with the exception of two reports. One road kill snake was found adjacent grassland and riparian oak/bay woodland and one adult male was detected in grassland near eucalyptus trees at Lake Chabot Regional Park. Although this sighting did not mention chaparral, this habitat type is found near where this occurrence was reported.

No core habitat of coastal scrub or chaparral was found on the project. Marginal oak scrub habitat exists in the residential landscaping along the southern boundary, but this small area (~0.10 acre) is surrounded by urbanization - houses, a wide firebreak, and the Camino Pablo recreational trail where a parade of dog-walkers travel to and from the off-lease dog park. However, the adjacent project area is denuded of vegetation from tilling and from cattle that frequently rest in the shade of the oak trees on hot afternoons. Marginal quality coyote bush scrub occurs along the concrete culvert above Sanders Ranch. Urban wildlife feces, raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and opossum (*Didelphis virginianus*), was observed in this culvert providing evidence of use as a corridor and making the cover provided by this coyote bush scrub unusable for AWS.

There is not a sufficient prey base or optimal foraging and cover habitat for AWS. Only two lizards were observed during pedestrian field surveys. Although widespread abundance of western fence lizards does not necessarily correlate to the presence of Alameda whipsnake (Swaim 1994) low numbers of lizards and other prey items do point to the absence of AWS. There also were no burrows detected on the project. Lack of burrows would limit populations of frogs and rodents. No ground nesting birds (with the exception of turkeys which are too large for AWS to feed upon) were observed or nests detected during pedestrian surveys. They may be deterred from this site due to the presence of large roaming livestock that would damage or destroy ground nests.

Alameda whipsnakes would have difficulty foraging in the project as they would not be able to visually hunt prey in the tall forage crop grassland. They also would not be able to retreat from aerial predators as there is no cover of chaparral or coastal scrub, no burrows, few deep cracks, and only one tree. The vegetated hedgerow on the western boundary and the coast live oak and coyote bush understory at the southwest corner of the project provide marginal habitat conducive for prey items (bird nesting and foraging lizards in the leaf litter), cover for AWS and protection from the cattle that rest at that corner. Potential egg-laying sites could be found in the deep cracks of the drainage depressions but little is known about AWS ovipositor events and the adjacent firebreak on the project edge is deeply tilled in the spring of each year coinciding with AWS mating season where the males roam their entire home range in their search for females.

The project climate is not beneficial for AWS. Westerly aspects of the projects hillsides and the site proximity to the San Francisco Bay (within 10 miles) and the Upper San Leandro Reservoir (within 1 mile) produce a fog influenced climate that will not generate the warmer temperatures needed for early morning emergence and maximum foraging activity (USFWS 2011). The landscaped edges of the northern and southern boundary would be detrimental to this species especially the redwood trees as they form a closed canopy with uniformly cool conditions which would not allow the Alameda whipsnake to reach their preferred internal temperature range, higher than other snake species (Hammerson 1979), needed for hunting and digestion.

There are numerous threats to AWS on the project. It is bordered on the west by a busy roadway (Camino Pablo) and a well-traveled recreational trail. Both offer superior basking sites but could lead to a snake's demise by car or bicycle impact or predation from off-leash domestic animals. Daily basking through open exposure to direct solar radiation or surface radiation is required to achieve the high internal temperature to successfully forage on fast-moving prey. However, basking sites must also have retreat opportunities to minimize threats of harm. Each field survey detected foraging raptors above the project and perched in tall trees along the southern boundary but few AWS retreats were found in the project grasslands.

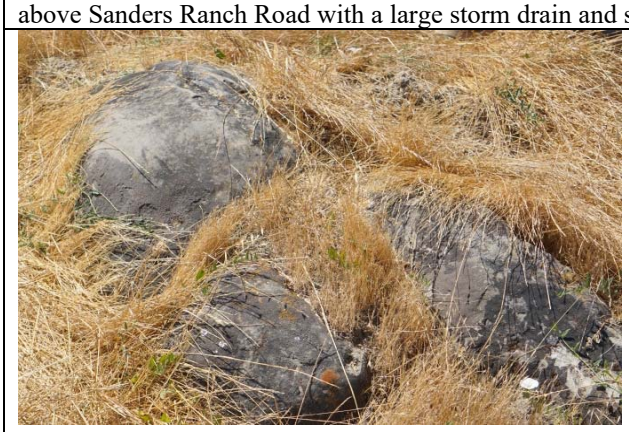
A substantial threat comes from human disturbance. One of the primarily uses of AWS habitat in East Bay counties is cattle grazing. This activity reduces vegetative cover of trees, chaparral and coastal scrub, and can promote tall dense nonnative plant communities where AWS cannot visually spot their prey and pursue quickly. High ground disturbance through grazing and tilling will collapse burrows systems of fossorial animals which may reduce potential egg-laying sites

for AWS. These wide, unvegetated firebreaks also prevent dispersal of AWS as there is not sufficient cover from predators.

Alameda whipsnake are unlikely to use the project area due to a high number of predators, low prey base, inadequate refugia, and dense vegetative thatch which make it difficult for a snake to pursue prey. The land is degraded with little value as a migration corridor or for overland dispersal because of busy roadways, concrete canals used by predatory wildlife, roaming livestock, and lack of appropriate cover. The site is also located several hundred feet from appropriate scrub or chaparral in monoculture grassland without burrows or rock outcroppings.

Project Photographs

Panoramic view south of project (left of fenceline) from the adjacent concrete stormwater canal that lies directly above Sanders Ranch Road with a large storm drain and small area of coyote bush scrub in the background.

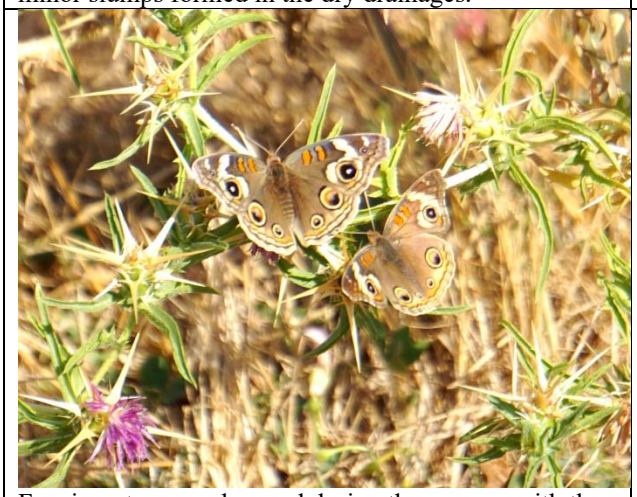


The three clay boulders less than 1-foot in diameter found on the project.

One of four Angus bulls roaming the project during field surveys.

Rodent feces and nesting material were observed in minor slumps formed in the dry drainages.

One of many avian predators observed hunting at the project.



Few insects were observed during the surveys with the exception of common buckeye (*Junonia coenia*) butterflies on invasive aster plants.

One of many cattle rubbing and rolling locations on the project.

Panoramic view south from steep hillside to firebreak and Camino Pablo road.

The northern portion of the project will be preserved as-is. This area was surveyed from the western fenceline to minimize harm to the surveyor from the four 2,000 pound bulls roaming the property.

Facing north, view of the storm drain above Sanders Ranch Road and the project drainage with the one willow.

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Camino Pablo Project

California Red-Legged Frog (*Rana draytonii)*
Non-Breeding Season Surveys

Project No.:
1004

Zentner Planning and Ecology

Oakland

Prepared for:
JBT Property Management Company Inc.

Issued:
October 2019

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I. Introduction

A. Purpose

Zentner Planning and Ecology completed reconnaissance level surveys for the California red-legged frog (*Rana draytonii*; CRLF) at the Camino Pablo Project site in the Town of Moraga in Contra Costa County, CA. The site and its ability to support this species were also evaluated during these surveys. This report provides the results of the field surveys with an evaluation of the site features and their ability to support CRLF.

The surveys were completed to determine the presence or absence of CRLF at the project site as recommended by Olberding Environmental, Inc. in their Biological Resource Analysis Report for the Camino Pablo Property, which was prepared as part of the Town of Moraga's environmental review process for a proposed residential development. In that report, Olberding recommended that two non-breeding surveys be completed to determine presence/absence of the species on the site as dispersal habitat.

B. Location

The Camino Pablo Project site (project site) is approximately 24 acres and is the westernmost portion of the Carr Ranch. The Camino Pablo site lies in south-central Contra Costa on the southern edge of the Town of Moraga adjacent to the Sanders Ranch, Tharpe and Sky view subdivisions (**Figure 1**). Camino Pablo and Sanders Ranch form the site's western and northern border. The southern border abuts the Moraga Highlands (Sky View) subdivision, while the eastern border is undeveloped open space; parts of which are owned by East Bay Municipal Utility District (EBMUD) and by the Carr Ranch. The Site's APN is 258-290-023 and the street address is 1211 Camino Pablo.

ZENTNER
Planning & Ecology

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Camino Pablo

Moraga
California

FIGURE 1

LOCATION MAP

N

BY: **JPE**

PROJECT: **1004**

BASE MAP:
© 2018 GOOGLE MAPS

FILE: D:\Graphic Designer\My Documents\PROJECTS\1100-1199\1112\Adobe\ZinfandelLocation.pdf

DATE: **9/19/2019**

Photo 1: View looking north along the northwest side of the project site. Grazing cattle are visible in the center of the photo and the adjacent Sanders Ranch development is visible on the left of the photo. August 2019.

Regionally, the site is on the southern edge of the Lamorinda development area, a generally suburban residential complex situated between Oakland and Walnut Creek. The great majority of the developed lands are to the north, however, south of the site, lands are generally public open space and include EBMUD reservoirs and East Bay Regional Park District (EBRPD) open space and parks.

C. Site Description

The roughly triangular shaped Camino Pablo property is located in central, far western Contra Costa County, very close to the northwestern tip of Alameda County. The property itself is the western piece of the greater Carr Ranch land that includes homes, barns and other ranch outbuildings, stock pens, and grazing land. The Carrs have lived and run cattle on the property since 1916.

The watershed of the site consists of primarily of ephemeral waterways in the drainages of the slopes. Water on the west side of the property is intercepted at roadside drainages along Camino Pablo Blvd. Existent concrete v-ditches run northeast to southwest along Sanders Ranch Rd. There are approximately 2,180 linear feet of v-ditch adjacent to the property, with 483 linear feet actually within the property. From the site, the drains connect with Moraga Creek and become part of the greater San Leandro watershed. Moraga Creek flows into the Upper San Leandro Reservoir, and then into San Leandro Creek, which exits to the bay at Arrowhead Marsh, between the Oakland Airport and Alameda.

The project site contains approximately 24 acres of grazed grassland on primarily the western-facing slope of a relatively steep, north-south trending ridge. The grasslands now appear to be relatively moderately grazed, however, they are dominated by non-native, annual grasses, which is often indicative of past heavy grazing. Two gullies run down the steep ridge toward Camino Pablo Blvd. and are picked up by one of the v-ditches. The site contains a good number of slides and slumps and a number of cement v-ditches run along the northern portion of the site to catch and drain water.

Photo 2: View looking south along the western edge of the site. Annual grassland dominates the site. A small, spring-fed wetland can be identified on the right side of the photo as the green area amidst the brown annual grasses. August 2019.

Erosion, which is prevalent across the site due to the presence of annual vegetation and the history of grazing, is apparent by the minor slumps and slides that make up the jurisdictional waterways onsite. Small seasonal wetlands occur in only a couple of locations on the property; at the base of the largest jurisdictional waterway, at the base of a wide slump at a higher elevation, and along a seep adjacent to one of the gullies.

D. Plant Communities and Associated Wildlife Habitat

As noted above, the project site is dominated by grassland and non-native annual grassland vegetation (**Figure 2**). The site also contains a few small pockets of ruderal vegetation. A few

LEGEND

PROPERTY BOUNDARIES

STUDY AREA

VEGETATION TYPES

GRASSLAND

RUDERAL VEGETATION

SEASONAL WETLAND

OTHER WATERS

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CAMINO PABLO

Moraga, California

FIGURE 2

VEGETATION MAP

N

BY: EMM

PROJECT: 1004

BASE MAP: Google 2015

DATE: 10/12/2015 - update 9/19

FILE: D:\PROJECTS\1004\adobe\1004vegetation map

very small seasonal wetlands are also associated with seeps or gullies on the northern portion of the property.

Nomenclature used for plant names follows *The Jepson Manual*, Second Edition (Baldwin et. al. 2012) and changes made to this manual as published on the Jepson Interchange Project website (http://ucjeps.berkeley.edu/interchange/index.html). Nomenclature for wildlife follows the CDFW's *Complete list of Amphibian, Reptile, Bird, and Mammal Species in California* (2008) and any changes made to species nomenclature as published in scientific journals since the publication of CDFW's list.

1. Annual Grassland Vegetation

Grassland characterized by non-native annual grasses and forbs dominate the site. These non-native grasslands are primarily composed of wild oats (*Avena fatua*), ryegrass (*Festuca perennis*), soft chess brome (*Bromus hordeaceus*), ripgut brome (*Bromus diandrus*), with areas of bindweed (*Convolvulus arvensis*), red-stem filaree (*Erodium cicutarium*), and rose clover (*Trifolium hirtum*).

This grassland composition is characteristic of most of the grasslands in the region, the majority of which have been subjected to relatively heavy grazing since the Spanish first brought cattle into the area in the 1700's and have had a wide variety of grazing regimes since that period. Once established, these non-native grasses are very difficult to remove and their establishment has some broad ramifications to the habitat in general. One of the primary effects of annual grassland is on soil structure. Annual grasslands have dense, shallow roots that dry the upper soil zones, whereas the native perennial grasses have long, deep roots. While these deep roots helped hold the soils on California's steep slopes, the shallow-rooted annual grasses leave the soils, especially the upper layers vulnerable. This often leads to erosion, particularly slumps and gully erosion as is found on the site, especially on the very steep west-facing slopes of the property.

However, a couple of slumps on the northern portion of the site contain small pockets of relatively steep north or northwest facing slopes. These older slump areas contain a scattering of native vegetation including primarily purple needlegrass (*Stipa pulchra*), creeping wildrye (*Elymus triticoides*), buttercup (*Ranunculus californicus*), common fiddleneck (*Amsinckia intermedia*), soap plant (*Chlorogalum pomeridianum*), and sun cup (*Taraxia ovate*).

In addition, a strip of creeping wildrye is present on the property between the sidewalk that lies adjacent to Camino Pablo Blvd and an existing fence-line that runs parallel to the road. This strip is approximately 20 feet wide and runs about 75 feet long.

2. Ruderal Vegetation

A few small pockets of ruderal vegetation are found on the project site. These primarily include areas that have been relatively heavily disturbed by more recent slump or slide activity and areas where cattle tend to congregate, such as ridge tops. The ruderal vegetation found in the

slide and slump areas tends to be found in the uppermost portion of these areas, especially near adjacent property where the land use management is different than the project site.

The ruderal vegetation is dominated by black mustard (*Brassica nigra*). Other vegetation includes ryegrass, ripgut, wild oats, bristly ox-tongue (*Helminthotheca echioides*), Italian thistle (*Carduus pycnochephalus*), spring vetch (*Vicia sativa*), and summer mustard (*Hirschfeldia incana*). This assemblage also includes invasive exotics--those non-native species that can invade and dominate habitats containing native species.

3. Seasonal Wetland

Seasonal wetland vegetation is found in four small areas on the project site including a seep near the northeastern border of the site, a seep adjacent to the northern gully, and within two portions of the gullies along the western edge of the site adjacent of Camino Pablo Blvd. These areas remain saturated for a prolonged period of time, but don't really pond water.

The vegetation in the seasonal wetlands is characterized by mildly hydrophytic vegetation reflecting the saturated conditions that drain and dry relatively quickly. The majority of the vegetation is facultative (FAC) meaning that these are plants that occur between 33% to 67% of the time in wetlands, rather than obligate (OBL) vegetation which is nearly always (greater the 99%) associated with ponded conditions. The only obligate vegetation in the wetlands is relatively sparse, iris-leaved rush (*Juncus xiphioides*). Other vegetation observed in these areas includes ryegrass (FAC), soft chess brome (*Bromus hordeaceus*; FACU), Mediterranean barley (*Hordeum marinum*; FAC), and white sweet clover (*Trifolium repens*, FACU). FACU plants occur less than 33% of the time in wetlands.

E. Wildlife

Wildlife at the project site appears limited to common suburban/rural species. Mammals would include coyote (*Canis latrans*), mule deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), and lagomorphs (rabbits) such as black-tailed jackrabbit (*Lepus californicus*). The coyotes and other predators, such as red-tailed hawk (*Buteo jamaicensis*) and red-shouldered hawk (*Buteo lineatus*), prey on the small mammals that appear to be common on-site, including California vole (*Microtus californicus*) and deer mouse (*Peromyscus maniculatus*). Other birds commonly found in this type of grassland habitat include mourning dove (*Zenaida macroura*), western meadowlark (*Sturnella neglecta*), turkey vulture (*Cathartes aura*), killdeer (*Charadrius vociferous*), and American kestrel (*Falco sparverius*). While there is no nesting habitat for most birds, including raptors, the grasslands do provide good foraging habitat for raptors such as white-tailed kite (*Elanus leucurus*), American Kestrel and, especially, red-tailed hawk.Common reptiles likely present include western fence lizard (*Sceloperus occidentalis*), southern alligator lizard (*Gerrhonotus multicarinatus*), gopher snake (*Pituophis melanoleucus*), and western rattle snake (*Crotalus viridis*).

II. California Red Legged Frog

A. Range and Ecology

The California red-legged frog (CRLF) historically ranged from Redding and Marin County, south to northern Baja California (Jennings and Hayes 1994). Due to the loss and modification of habitat, predation by the non-native bullfrog, and impacted water quality, its range has been reduced to isolated drainages within coastal ranges and near-coastal foothills. The United States Fish and Wildlife Service (USFWS) notes that the CRLF once occupied 46 counties, but is now found in only 22 with the greatest concentrations in Monterey, San Luis Obispo and Santa Barbara Counties (USFWS 2002).

The CRLF is a relatively large, spade-shaped species at 1.7 to 5.1 inches in length. They vary in color, and may be brown, grey, olive, or reddish in color with black spots and irregular blotches. The lower abdomen and undersides of the legs are often, but not always, red. They have a dark mask above the upper jaw. The species is characterized by its prominent dorsolateral fold which extends on the body from eye to hip. The tadpoles are brown and marked with small, dark spots. The lower body is creamy white and also flecked with small spots.

From late-November to late-April, adult CRLF are typically found in or near breeding habitat, which consists of perennial or near-perennial, deep (greater than 2 foot) ponds, pools or similar habitats associated with dense riparian or marsh vegetation (Hayes and Jennings 1989, 1994, Jennings 1988). Breeding takes place in streams, deep pools, backwaters within streams and creeks, ponds, marshes, and stock ponds. CRLF can occur in ephemeral ponds or permanent streams and ponds; however, populations probably cannot persist in ephemeral streams (Jennings and Hayes 1985). Habitats with the highest densities of CRLF are deep-water ponds with dense stands of overhanging willows and a fringe of cattails (Jennings 1988; Rathbun et al. 1993).

During rainy nights during this time, however, they may also be found 200 to 300 feet away from the aquatic habitat (Zeiner et al 1988). From late-spring through fall, CRLF will stay near aquatic habitat, but during the end of this period they may move away from the breeding locale into nearby moist locations.

CRLF breeds during the winter and early spring, from as early as late November through April and May. Larvae (tadpoles) remain in breeding ponds until metamorphosis in the summer months. Mortality rates are high, with less than 1 percent of eggs laid reaching metamorphosis (Jennings et al. 1992). Males reach sexual maturity about 2 years after metamorphosis, while females require 3 years to attain sexual maturity (Jennings and Hayes 1985). Individuals of this species may live up to 10 years (Jennings et al. 1992). Young CRLF (eggs, larvae, and tadpoles) are found almost exclusively in ponds (such as stockponds) or slow moving water in creeks, ditches, or similar habitat. Typically, these ponds or creeks are well-vegetated (Zeiner et al 1988) but habitat may also consist of well-grazed stockponds with little marsh vegetation (USFWS

2002). Young CRLF generally do not occur in aquatic habitats which also contain bullfrogs (Jennings and Hayes 1989).

Determining the location of CRLF habitat is complicated by CRLF movement away from relatively easily identified riparian and wetland habitats. Much of the movement ecology of CRLF is still poorly understood (Jennings and Hayes 1994), but they appear to move significant distances at two times during a year. First, adults move between winter oviposition sites and spring and summer foraging habitat (Jennings and Hayes 1989). Frogs observed in upland habitat at night during winter rains may represent such movement, but new aquatic habitat may also be found and colonized during such periods of reduced water stress. Movement into upland riparian habitat at such time may also protect frogs from catastrophic injury and transport by floodwaters (Jennings and Hayes 1994). Second, CRLF move into the shelter of riparian thickets during fall, when stream habitat is often much reduced (Rathbun et al. 1993). Such behavior appears to resemble estivation of amphibians like California tiger salamanders and spadefoots (Jameson 1981), however, the CRLF, especially the coastal populations, does not experience seasonal dormancy.

B. Local Distribution

The closest potentially suitable aquatic breeding habitat or non-breeding habitat for CRLF is located less than 1 mile west of the project site within the Sanders Ranch residential subdivision which contains a portion of Moraga Creek and its tributaries. However, Zentner Planning and Ecology has worked on a number of creek projects within the subdivision and completed protocol level CRLF surveys in 2015 and 2016 with negative results. The resulting CRLF report concluded that there is no CRLF breeding habitat within the development, nor is the development likely to support non-breeding or other refugial use by CRLF (Sanders Ranch California Red-Legged Frog Survey Report, 2016). A number of other CRLF surveys have been completed within the Sanders Ranch development including a 2008 survey by LSA and a 2013 survey by Mosaic Associates. These surveys each came to similar conclusions stating that the development does not contain suitable CRLF breeding habitat and that the development is unlikely to provide other refugial habitat.

The California Natural Diversity Database (CNDDB) lists six occurrences of CRLF within five miles of the project site. The closest record is located over three miles north of the project site (record #120). This record describes an adult and an egg cluster observed in 1994 within the perennial Las Trampas Creek. The next closest record is located approximately 3.5 miles north of the project site and described as adult observed in 1999 and again in 2000 in habitat described as "several bermed-drainage stockponds, surrounded by non-native grasslands" (record #374). Two additional records are located less than 4 miles from the project site. One of these describes a 1999 observation of CRLF in a stockpond and in the plunge pool below the pond berm (record # 373) and the other describes adult CRLF observed in 2008 in the spillway basin of Upper San Leandro reservoir (record #1071).

There are an additional two CNDDB records between 4 and 5 miles from the project site. One describes a 1996 observation of two adults on the bank of a culvert outlet below a siltation pond in Brookside Creek (record #226). The other describes a 1931 observation of CRLF eggs in Thornhill Pond, near Berkeley (record #8).

Photo 3: View of a wetland on the project site with obvious cattle ruts. Seep or spring-fed wetlands with no water ponding except in cattle ruts is typical of the site. August 15, 2019

III. Survey Results

A. Methods

Zentner Planning and Ecology conducted a literature review of the local CNDDB records with attention to the habitat preferences and life stage of sightings. Previously completed survey reports and Biological Assessments for the project site and adjacent Sanders Ranch Development were also reviewed to gain insight into site and regional conditions.

Surveys were completed by Sean Micallef and Emily Mathews, biologists with Zentner Planning and Ecology that have experience identifying the species and conducting CRLF surveys. The surveys were completed on August 15, 2019 (day) and September 17, 2019 (night). The day survey began at least one hour after sunrise and the night survey began at least one hour after sunset. Surveys were completed when skies were clear to partly cloudy and the site had maximum visibility; no fog, rain, etc. Both surveys were conducted in periods of time with consistent weather conditions, with temperatures above 50 degrees Fahrenheit, and with wind less than five miles per hour.

Both surveys were conducted following the same survey protocol. Immediately upon arriving at the survey site, surveyors checked and assembled their gear then began listening for calling frogs. Upon completing the listening component, surveyors conducted visual-encounter surveys and walked transects across the entire property scanning for frogs. Both surveys utilized binoculars and the streamlight ProTac HL USB flashlights were used on its lowest light setting during the nighttime surveys.

B. Results

No CRL or signs of CRLF were identified on the project site during either of the surveys. Details on the surveys are provided in **Table 1** below as well as the survey data sheets provided in Appendix A. As well, no habitat that would be favorable to the CRLF was identified on site.

Table 1: Survey Results

Date	Temperature/Weather	Surveyors	Notes	CRLF Observed
8/15/19 Day survey	• Cool 60 – 75 degrees Fahrenheit	SM & EM	• Racoon prints and coyote scat noted (CRLF predators)	No
9/17/19 Night survey	63 – 59 degrees F	SM & EM	• House cat noted hunting on site	No

Wildlife detected during field surveys included the following species:

Red-tailed hawk (*Buteo jamaicensis*)	Pigeon (*Columba liva*)
Crow (*Corvus brachyrhynchos*)	Hummingbird (*Calypte sp*)
Western bluebird (*Sialia mexicana*)	Fence lizard (*Sceloporus occidentalis*)
Finch sp. (Haemorhous sp.)	Barn Swallow (*Hirundo rustica*)
Mule deer (*Odocoileus hemionus*)	White tailed kite (*Elanus leucurus*)

As well, coyote (*Canis latrans*) feces and racoon (*Procyon lotor*) prints and a house cat (*Felis catus*) were observed on site as was evidence of gophers (*Thomomys bottae*) and field mice. The owners three large bulls were also present on site grazing.

IV. Conclusions

Now CRLF or signs of CRLF were observed during the surveys.

The site does not provide habitat for the CRLF. As the Olberding report noted, there are no aquatic habitats on the site that provide breeding habitat for the CRLF. In fact, the wetlands on the site do not really pond water, except in small, shallow ruts created by cattle hoof prints. The remainder of the jurisdictional areas remain saturated for much of the rainy season, but do not pond water. Therefore, the site does not provide breeding or non-breeding aquatic habitat for the CRLF. The Olberding report concurs with this.

The Olberding report also noted that there are no small mammal burrows or other refugia that would provide shelter and protection for CRLF. Further, the Olberding report notes that the "lack of suitable upland refugia may deter the CRLF from utilizing the property in an *upland capacity* (emphasis added), as it exposes them to predators and desiccation". Therefore, the site does not provide upland refugia habitat for the CRLF.

The Olbderding report does state that the property may serve as dispersal habitat. However, the property is unlikely to serve as dispersal habitat for a number of reasons. As noted above, the property lacks upland refugia and exposed frogs to predators and desiccation. This fact alone would greatly discourage CRLF use of the habitat as a site for upland dispersal. The Olberding reports states that the wetted drainages and seasonal wetlands on the property could serve as dispersal corridors. However, it is now known that CRLF do not use creeks and drainages as was once thought, for dispersal.

The closest recorded observation of a CRLF is more than 3 miles from the project site with numerous significant barriers (roads, housing, commercial development, etc.) separating the two. The Olberding report noted that Moraga and King Canyon Creeks as well as two stock ponds are noted within a mile of each other near the site. However, there are no known CRLF observations from those areas. Zentner Planning and Ecology completed protocol level CRLF surveys in Moraga Creek and several tributaries in 2015 and 2016 in the adjacent Sanders Ranch subdivision with negative results. It is likely that if CRLF were using those creeks, especially as breeding habitat, that it would be well known. CRLF use of the stock ponds might be less likely to be known. However, a review of GoogleEarth photography over the last 10 years indicates that neither of the stockponds hold water long enough or deep enough to provide adequate breeding habitat for the frog. As well, neither of the ponds provide any type of emergent vegetation or other cover that is characteristic of CRLF breeding habitat.

CRLF are not likely to occur on the site as there is no breeding habitat on or near the site and CRLF are not likely to move through or towards the site seeking summer habitat as there is no nearby breeding habitat and the site does not provide upland refugia habitat. Further, movement corridors to the north, west, and south are blocked by adjacent residential development and therefore, there is no habitat or other factors that would draw the CRLF to

move in the direction of the site. For all of the reasons discussed above, the species is unlikely to disperse, pass through, or other ways occur on the project site.

The Olberding report recommended that a day and night survey be completed to determine absence/presence of CRLF upland dispersal. The CRLF surveys were completed with negative results. Therefore, absence of CRLF dispersal use of the site has been confirmed.

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Appendix A

CRLF Survey Data Sheets

Appendix E.
California Red-legged Frog Survey Data Sheet

Survey results reviewed by _____ _____ _____
(FWS Field Office) (date) (biologist)

Date of Survey: 08/15/2019 (mm/dd/yyyy) **Survey Biologist:** Micallef Sean (Last name) (first name)
Survey Biologist: Mathews Emily (Last name) (first name)

Site Location: Contra Costa, Camino Pablo,
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: Camino Pablo
Brief description of proposed action:
Residential Development

Type of Survey (circle one): **DAY** **NIGHT** **BREEDING** **NON-BREEDING**

Survey number (circle one): **1** **2** **3** **4** **5** **6** **7** **8**

Begin Time: 7am **End Time:** 8:45 AM

Cloud cover: 2% **Precipitation:** NO

Air Temperature: 60°F – 75°F **Water Temperature:** NA

Wind Speed: 1-4 mph **Visibility Conditions:** Good

Moon phase: Full Moon **Humidity:** 46%

Description of weather conditions: Warm, Clear, with occasional light breeze

Brand name and model of light used to conduct surveys: NA (Day Survey)

Were binoculars used for the surveys (circle one)? **YES** **NO**
Brand, model, and power of binoculars: Wingspan Phoenix HD 8x42
Nikon Prostaff 7S 10x30

Appendix E.
California Red-legged Frog Survey Data Sheet

AMPHIBIAN OBSERVATIONS

Species	# of indiv.	Observed (O) Heard (H)	Life Stages	Size Class	Certainty of Identification
None					

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: Raccoon prints visible w/in moist area w/ cattle hoof prints

Other observation: Red tail hawk, wt kite, Am crow, blue bird pidgeon, Hummingbird, vole, w. fence lizard

Other notes, observations, comments, *etc.*

No ponded water occurs within site except within cattle hoof prints. Only mosquito larvae visible w/in these areas.

No breeding/non-breeding or foraging habitat

Necessary Attachments:

4. All field notes and other supporting documents
5. Site photographs
6. Maps with important habitat features and species locations

Appendix E.
California Red-legged Frog Survey Data Sheet

Survey results reviewed by _____ _____ _____
(FWS Field Office) (date) (biologist)

Date of Survey: 09/17/2019 (mm/dd/yyyy) **Survey Biologist:** Micallef (Last name) Sean (first name)
Survey Biologist: Mathews (Last name) Emily (first name)

Site Location: Contra Costa, Camino Pablo
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: Camino Pablo
Brief description of proposed action:
Residential Development

Type of Survey (circle one): **DAY** **NIGHT** **BREEDING** **NON-BREEDING**

Survey number (circle one): 1 2 3 4 5 6 7 8

Begin Time: 7:45 pm **End Time:** 9:45 pm

Cloud cover: 0% **Precipitation:** NO

Air Temperature: 63°F – 59° F **Water Temperature:** NA

Wind Speed: 0-2 mph **Visibility Conditions:** Good

Moon phase: Waning Gibbous 90% **Humidity:** 81%

Description of weather conditions: Mild, Clear, little to No breeze

Brand name and model of light used to conduct surveys: Streamlight ProTac

Were binoculars used for the surveys (circle one)? **YES** **NO**
Brand, model, and power of binoculars: Wingspan Phoenix HD 8x42
Nikon Prostaff 7S 10x30

Appendix E.
California Red-legged Frog Survey Data Sheet

AMPHIBIAN OBSERVATIONS

Species	# of indiv.	Observed (O) Heard (H)	Life Stages	Size Class	Certainty of Identification
None,					

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: house cat observed

other wildlife observation: Barn owl, Great horned owl (calling) Killdeer, Deer, W. fence lizard

Other notes, observations, comments, *etc.*

Only mosquito larvae available in small, shallow (approx 1-3 inch) depressions within a small area with cattle hoof prints — All areas outside this are dry.

Necessary Attachments:

4. All field notes and other supporting documents
5. Site photographs
6. Maps with important habitat features and species locations

Appendix C

Cultural Resources Evaluation

PHASE I CULTURAL RESOURCES REPORT FOR THE CAMINO PABLO SUBDIVISION PROJECT, TOWN OF MORAGA, CONTRA COSTA COUNTY, CALIFORNIA

Submitted to:

Douglas Herring
Douglas Herring & Associates
1331 Linda Vista Drive
El Cerrito, California 94530

Submitted by:

Archeo-Tec Inc.
5283 Broadway
Oakland, CA 94618

February 2016

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Rancho Period (1833-1846) 6
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Conclusions and Recommendations 9

Summary of Findings

This report presents the findings of a Phase I Cultural Resource Evaluation for the Camino Pablo Subdivision Project, an approximately 24-acre parcel of land located in the town of Moraga, Contra Costa County, California (Figures 1 and 2). The evaluation consisted of an archival literature review, Native American consultation, and a surface survey.

Current plans entail the construction of 13 single-family homes situated within the southwest portion of the subject property, coupled with the preservation of the upper hillslope and the northern part of the subject property as permanent open space. The southwest portion is divided into Parcels B, C, and D, and the northern portion is designated Parcel A (Figure 3). The subject parcel is currently used for grazing. No structures exist within the borders of the project area.

A preliminary archival literature review conducted by the staff of the Northwest Information Center, located at Sonoma State University in Rohnert Park, concluded that there was "a high potential of identifying Native American archaeological resources" within the borders of the project area. Conversely, a low probability for the discovery of historic period cultural resources was noted. Given the findings made during the preliminary archival literature review, the staff of the Northwest Information Center recommended the implementation of additional exploratory archaeological procedures.

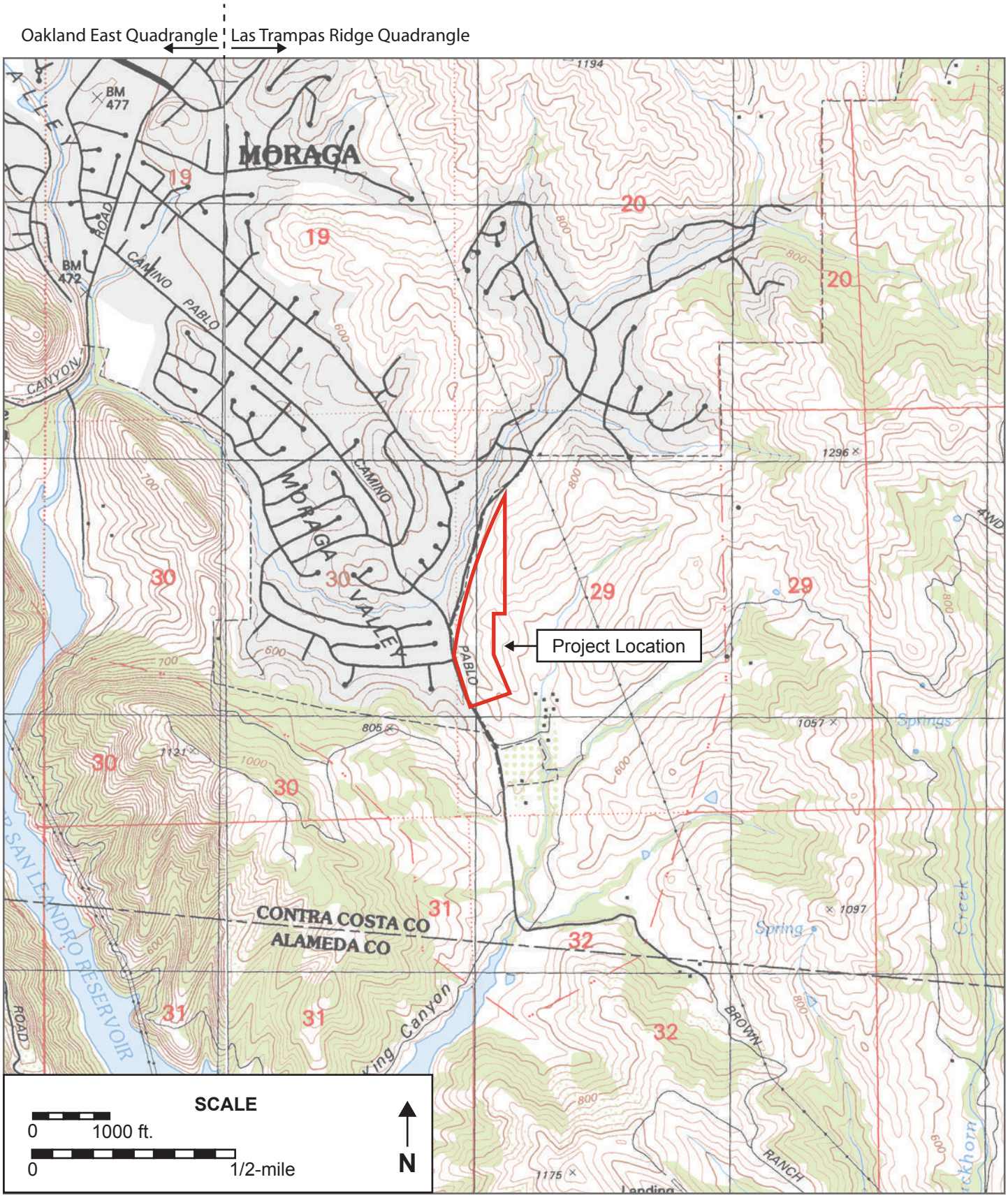
Background

Ethnography

The project site is situated in what has historically been the territory of the Bay Miwok, who occupied the interior valleys of the East Bay (Milliken 1995:24). The Bay Miwok were divided into five autonomous tribelets: Saclan, Chupcan, Volvon, Julpun, and Tatcan (Milliken 1997:9). The present project site was within Saclan territory, although the Moraga area was probably also influenced by the Julpun and Tatcan tribelets (Milliken 1995:229).

The Bay Miwok language is part of the larger Utian language family in California and linguistic evidence suggests that the ancestors of the Bay Miwok occupied the San Ramon Valley region from as long as 1,500 years ago to as recently as 400 years ago (Milliken 1995). The largest unit of political organization for the Miwok was the tribelet. Each tribelet was an "independent and sovereign nation" and within each tribelet were several permanent settlements and many seasonally occupied camps (Levy 1978:398). The size of most tribelet populations ranged between 200 and 400 people (Milliken 1997:32).

Settlements were often located adjacent to water sources, whether permanent or seasonal (Banet et al. 1991). According to Milliken, the Saclans had two villages, Jussent and Gequigmu, which



1993 USGS "Oakland East, CA" and "Las Trampas Ridge, CA", 7.5-minute Topographic Maps

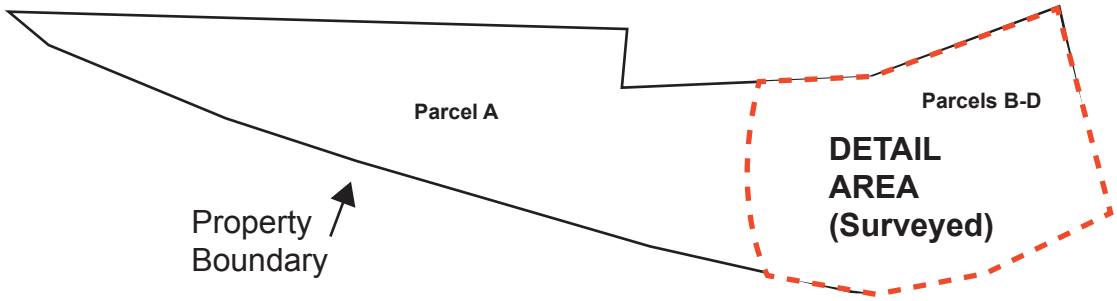
Figure 1. Project Location Map

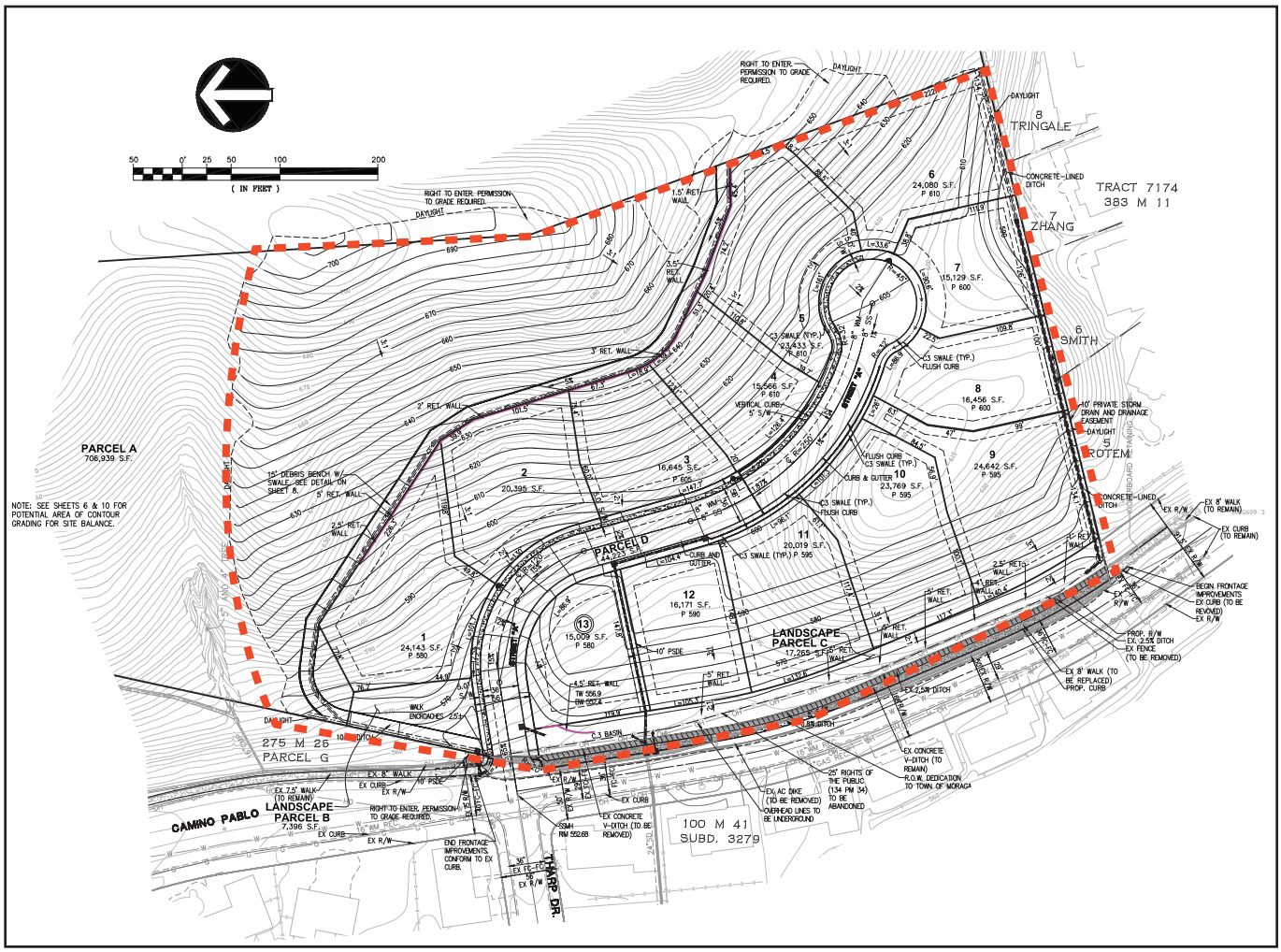
Camino Pablo Subdivision Project

Source: Douglas Herring & Associates

Figure 2. Aerial View of Site

Camino Pablo Subdivision Project





Source: Douglas Herring & Assocates, dk Consulting

Figure 3. Preliminary Project Plans

Camino Pablo Subdivision Project

were "within a few miles of each other in the East Bay hills" (Milliken 1995:21). Early Spanish explorers occasionally identified male village or tribal leaders; these men had obligations to the community, such as feeding visitors and taking care of those who could not help themselves (Milliken 1997:32). The degree of power and authority these men held, however, is unknown, and existing data from the contact period is contradictory (Milliken 1997:33).

The primary means of subsistence for the Bay Miwok were the collection of wild plants and the hunting of large mammals, such as deer, antelope, and tule elk (Levy 1978:402). Their subsistence ranges were seldom larger than 10 miles square (Milliken 1997:35). The gathering of wild plants took place on a seasonal basis, with acorns being the preeminent autumn crop. Other plant foods included seeds (such as wild oats, balsam root, ripgut grass, redmaids, and buttercup), nuts (buckeye, laurel, hazelnut, and pine), roots, and greens (Levy 1978:402). Women were the exclusive collectors of these food sources (Milliken 1997:35).

Shelters at the time of contact were also constructed out of these grasses and boats were constructed out of harvested tules. Men contributed to the food supply by hunting and fishing for game. Larger animals were hunted with bows and obsidian-tipped arrows, and traps and snares were set for smaller mammals (Milliken 1997:36).

Mission Period (1769—1833)

The first European expedition into the East Bay occurred in 1772 when Pedro Fages and his party explored the San Francisco Bay and Carquinez Strait, including the Diablo and Livermore Valleys near Concord. In the spring of 1776, Captain Juan Bautista de Anza established the San Francisco Presidio and by April 1, de Anza's men had traveled through San Francisco, down the peninsula, and up the East Bay shoreline, passing through Antioch and the plains of eastern Contra Costa County toward Tracy (West and Welch 1996:5).

The establishment of Mission Dolores in 1776 began the "Mission Period" in the San Francisco Bay area. The first European record of the Saclan people was the record of baptism of 17 young Saclans in December 1794 at Mission Dolores (Milliken 1995:253). Milliken identifies many reasons why some native people joined the missions:

> Some were drawn by interest in Spanish technology and religion, others driven by the negative effects on village life caused by increased mortality from new diseases, social stress from disrupted tribal trading networks, and environmental stress caused by growing herds of Spanish livestock (Milliken 1997:88).

However, the relationship between Saclans and the missions quickly became strained. In April 1795, a group of Saclan neophytes was granted leave to visit their homeland, but did not return to Mission Dolores. Rather than visit their village, the group had gone to a dance at the

Chimenes rancheria in the North Bay. A group of 14 other Mission Indians (Huchiunes, Yelamus, and Saclans) were sent to retrieve them. When the posse reached the rancheria, the runaway Saclans and their hosts attacked them, killing seven (Milliken 1995:138–139).

Rifts between tribes deepened, as the Huchiun brother-in-law of one of the victims carried out Mission-sanctioned raids on the East Bay tribes (Milliken 1995:153–155). Saclan emissaries began to actively campaign against the missions, urging other tribes to resist their incursion rather than join them:

> The Christian Tilomeno told the troop leader that they had witnessed some pagans arguing with a pagan captain who lives near the mission, telling him and his people not to work at the mission nor get involved with it. Their own captains had said that if these [nearby people] worked at the mission they would have to kill them, as well as the Fathers and the soldiers...It is definite that many *rancherías* are joining together. They are manufacturing arrows.
>
> Those two pagans are from the villages of the Saclan, those who committed the offenses against the Christians of San Francisco. All of them are neighbors of the people of the Valley of San Jose [Livermore Valley], from that area of the bay shore across from San Francisco (Amador [1797]) (Milliken 1995:155–156).

On July 15, 1797, a party of twenty armed Spanish horsemen attacked the Saclan village of Jussent, "probably located in the present Moraga or Lafayette area," with the aim of retrieving the individuals responsible for the Chimenes killings and any other Mission runaways (Milliken 1995:157). In two hours of fighting, the Spaniards killed seven Saclans and took nine others—those suspected in the Chimenes killings—as prisoners. These nine men were taken to the Presidio, tried, and found guilty, and were sentenced to lashings and imprisonment (Milliken 1995:157–160). Some Saclan agitators continued to work against the missions, threatening those who would join them, but resistance to the missions began to fade in the wake of Spanish intimidation (Milliken 1995:159,162).

In 1797, at the time of the Spanish raid on Jussent, Milliken estimates that the total Saclan population was probably less than 130 people, including 50 or so neophytes who had fled the missions (Milliken 1995:156). In June 1798, 48 Saclan and Huchiun runaway neophytes turned themselves in to Mission Dolores; a few months later an additional 33 Saclan runaways were returned to Mission San Jose by force (Milliken 1995:164).

At the turn of the nineteenth century, the three Bay Area missions—Mission Dolores, Mission San Jose, and Mission Santa Clara—had become the dominant social organization in the area. Milliken records that, despite continued resistance to Spanish intrusion into the East Bay:

> …neither they nor any other group caused the Spaniards the kind of fear that they had felt in the months immediately following the Chimenes incident. Pedro Amador's victory against the Saclans in July of 1797, and Luis Peralta's intimidation of the Taunans in 1798, combined to solidify the Spaniards' feelings of confidence. The point had been driven home to the frontier tribes that small groups of forty or fifty warriors, armed only with bows, lacked the power to protect their borders against Spanish invaders (Milliken 1995:166).

In the years following the 1810 Mexican Revolution, Mexican political instability added to the diminishing conditions at, and funding to, the missions. As a result, the missions' power and influence waned during this period.

Rancho Period (1833-1846)

In 1833, the Mexican Congress passed a bill that secularized the Missions of Upper and Lower California, releasing these lands to be granted to Mexican citizens (Hittell 1878:70). In 1835, Joaquin Moraga and his cousin Juan Bernal petitioned Governor Castro for "the land named Rancho Laguna de los Palos Colorados" (Norman et al. 2004:21–22). The petition was granted in 1841, and construction soon began on the Moraga Adobe (Norman et al. 2004:22–23). Well north of the project area, the Moraga Adobe still stands within the city of Orinda and is listed on the National Register of Historic Places.

Rancho Laguna de los Palos Colorados, which means Redwoods Lake Ranch, measured over 13,000 acres stretching from what is now SR-24 south almost to the Contra Costa County line, and from just beyond San Leandro Creek to Las Trampas Ridge. Moraga and Bernal grazed cattle on the ranch.

American Period (1846-Present)

On July 8, 1846, a landing party from the sloop-of-war *Portsmouth*, under the command of Captain John B. Montgomery, waded ashore at the town of Yerba Buena and raised the stars and stripes to the top of the flagpole in the town's dusty plaza. The American claim on California was largely unchallenged.

After the deaths of Moraga and Bernal, the ranch lands were subdivided among heirs and sold piecemeal. Horace Carpentier, a speculator, purchased many of the parcels through agents and was in possession of most of the original rancho by 1889 (Skinner 2016). In 1912, Carpentier sold his property to Charles Hooper, who by 1923 had sold it to James Irvine. Irvine formed the Irvine Moraga Company, which developed portions of the rancho (mostly near present-day Orinda) for residential and commercial use. Saint Mary's College acquired 400 acres from the Irvine Moraga Company in the 1920s (Skinner 2016).

In the 1930s and 1940s, Irvine and his heirs sold the land to other development companies, such as Utah Construction Company. By the 1970s, the Utah Construction and Mining Company had developed and/or sold off most of its holdings to private owners. On November 13, 1974, Moraga was incorporated as Contra Costa County's 15th city (Skinner 2016).

Archival Research

On January 28, 2016, Michelle Staley, M.A., of Archeo-Tec searched the records of the Northwest Information Center in Rohnert Park, CA, for information regarding known cultural resources near the Project area (File #15-1066). A total of four studies have been conducted within a one-mile radius of the Project area, including a portion of the Camino Pablo Subdivision property (Figure 4). Please note that the information revealed in this section and depicted on Figure 4 is confidential and may not be included in any public documents.

In 1981, Ecumene Associates performed a pedestrian survey of Sanders Ranch, a large property including a portion of the Project area. Ecumene identified three flake scrapers at two locations within the property: one scraper approximately 510 meters to the northeast of the Camino Pablo Subdivision property and the other two approximately 750 meters to the north. No other cultural materials or soils were found in association with any of the flake scrapers (Ecumene Associates 1981:107).

None of the other three studies encountered any prehistoric cultural resources or significant historical resources within a mile of the Project area. These three studies consisted of a survey of the property that was later developed into Rancho Laguna Park (Dietz 1979), a more intensive survey of three acres of the Sanders Ranch development that had been unavailable for study in 1981 (Little 1982), and a survey of 1,600 acres along Buckhorn and Kaiser creeks (Archeo-Tec 1987). The latter study did identify two archaeological sites, one historic and one pre- or proto-historic, along Kaiser Creek and two prehistoric isolates along Buckhorn Creek, but all of these finds were more than a mile away from the present Project area.

Native American Consultation

On January 18, 2016, Emily Wick of Archeo-Tec contacted the Native American Heritage Commission to formally request they search their Sacred Lands File to determine whether the project encroaches on any recorded areas of cultural importance. On February 1, 2016, Sharaya Souza reported that the Sacred Lands File search "was completed for the USGS quadrangle information provided with negative results." She further advised that Archeo-Tec contact selected Native American individuals/organizations who may have knowledge of cultural resources in the area; Ms. Souza provided a list of said individuals/organizations and their contact information.

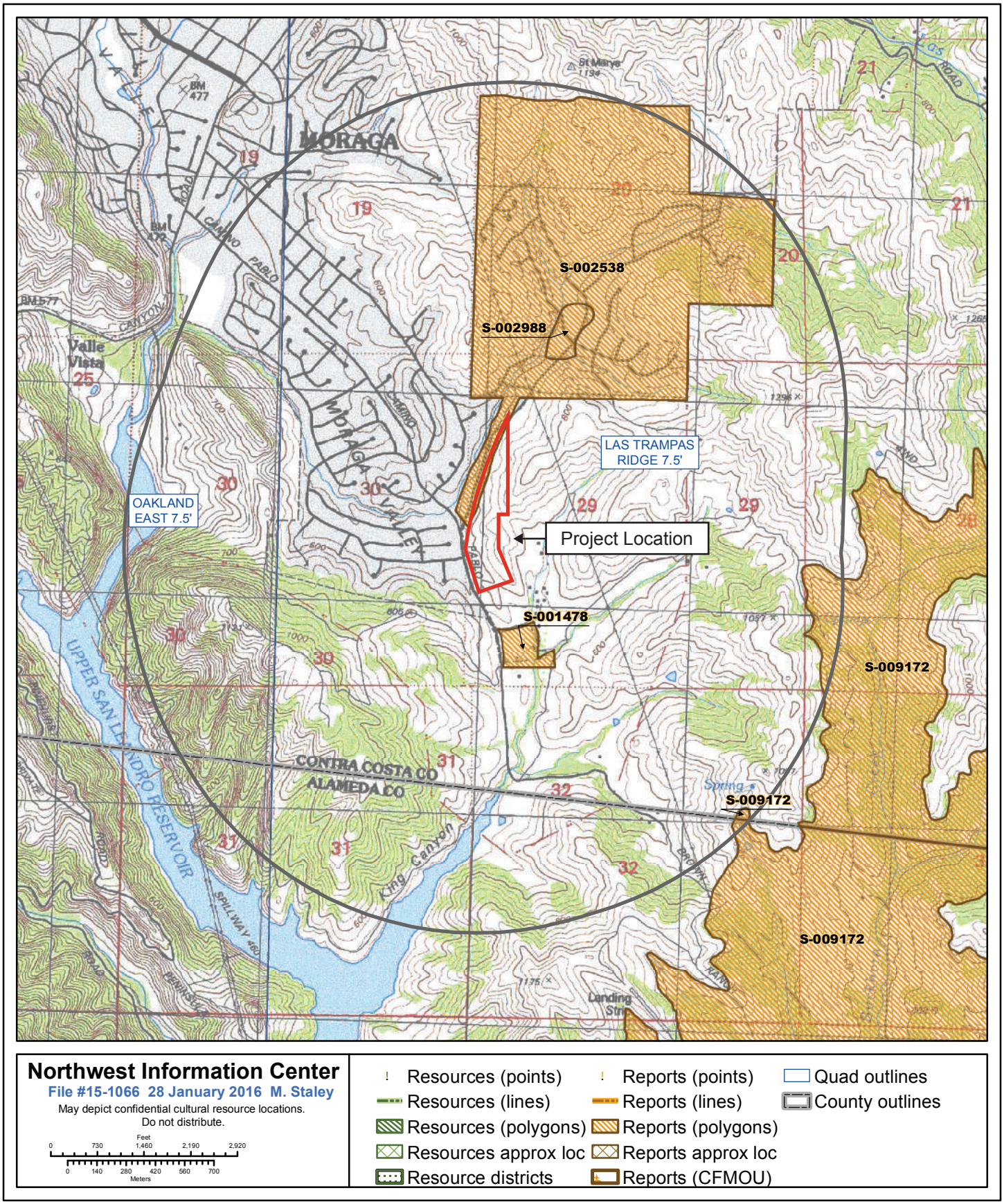


Figure 4. Records Search Results (Confidential)

Camino Pablo Subdivision Project

Letters were sent by email to all five individuals/representatives on February 9, 2016. On February 10, 2016, Michelle Staley spoke by phone with Ann Marie Sayers, Chairperson of the Mutsun Band of Costanoan. Ms. Sayers recommended both archaeological and Native American monitoring of all construction excavation, and recommended that if a burial is found, it be re-buried in the open space portion of the property with an easement preventing any further disturbance.

Andrew Galvan responded by email on February 15, 2016, requesting Archeo-Tec's archaeological recommendations for the project. Ms. Wick responded the same day, explaining that the current report, which had not yet been finalized, would contain the official recommendations. Ms. Wick provided additional information about the site's geography, and stated the possibility that limited archaeological monitoring of targeted areas would be recommended. No additional input from Mr. Galvan was received.

On February 15, 2016, Emily Wick telephoned the remaining individuals on the list. Ms. Wick spoke briefly with Rosemary Cambra, Chairperson of the Muwekma Ohlone Indian Tribe of the San Francisco Bay Area, who requested a call back the following day. The next day, Ms. Wick left a message on Chairperson Cambra's voicemail. Additional voicemail messages were left for Irenne Zwierlein, Chairperson of the Amah Mutsun Tribal Band of Mission San Juan Bautista, and for Raymond Hitchcock, Chairperson of the Wilton Rancheria.

As of this writing, efforts to discuss the project with Chairperson Cambra or to reach Chairperson Zwierlein or Chairperson Hitchcock have been unsuccessful. If any correspondence is received within 30 days of initial outreach, an addendum to this report will be prepared detailing the additional correspondence.

Copies of all correspondence with the NAHC and tribal representatives are provided in Appendix I.

Surface Survey

On February 1, 2016, Juliana Quist of Archeo-Tec conducted a surface survey of the portion of the project area that would be developed (Figure 3). Parcel A, which would be reserved as open space, was only partially surveyed. The survey area (parcels B, C, and D) was an active cow pasture best characterized as a small saddle bounded by significantly steep sloping hills. The overall surface visibility was about 20% due to thick grasses caused by recent El Niño rains, but areas with high cow traffic and/or erosion were muddy and clear of grass.

The survey was completed in transects spaced roughly 20 feet apart, following natural topography. Pin flags were used to demarcate sections to ensure complete coverage.

The soil was a silty clay loam with almost no rocks or gravel. The land had been furrowed to prevent erosion, but recent rains had caused a few erosion channels to form. These were examined closely for archaeological material, as was the large existing channel in the southern portion of Parcel A. No artifacts of any kind were encountered anywhere on the property. No evidence was seen of any preexisting structure. Aside from a small scattering of modern trash and debris, no cultural materials were observed.

Much of the Camino Pablo Subdivision property consists of slopes greater than 10%. Within the areas of proposed construction, only Lots 12 and 13, which are located in the western portion of Parcel D along Camino Pablo (Figure 3), are relatively flat. Due to the lower likelihood of human settlement or activity on steep slopes, it is estimated that the highest potential sensitivity for archaeological sites would be within Lots 12 and 13.

Conclusions and Recommendations

Previous surveys in and around the Camino Pablo Subdivision property have identified three prehistoric artifacts, located 500 m and 750 m away from the northern (open space) edge of the Project area. Archeo-Tec's survey of the parcels that would be developed as part of the Project did not identify any evidence of cultural materials.

The results of the Native American consultation indicate that one of the five individuals consulted with Native American contact list recommends both Native American and archaeological monitoring, and such a course of action for all observable ground disturbance would represent the most thorough and conservative course of action.

Although no remains were encountered during the surface survey, it remains possible that undetected resources exist within the construction footprint. If such resources do exist, they are most likely within the relatively gentle slopes of Lots 12 and 13. It is recommended that one day of archaeological monitoring of construction excavation, concomitant with on-site education, take place in this area.

After these precautionary measures are taken, it is still possible, though unlikely, that presently unanticipated prehistoric and/or historic-period cultural resources of significance are encountered within the project alignment during ground-disturbing activities. If such a scenario occurs during any stage of construction, all earthmoving activity in the area of impact must cease until the owner retains the services of a qualified archaeological consultant, who shall examine the findings, assess their significance, and offer proposals for any procedures deemed appropriate to further investigate and/or mitigate adverse impacts to those cultural resources which have been encountered.

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Appendix I

Initial Consultation with the Native American Heritage Commission

ARCHEO-TEC

CONSULTING ARCHAEOLOGISTS

Debbie Pilas-Treadway
Native American Heritage Commission
1550 Harbor Blvd, Suite 100
West Sacramento, California 95691

18 January 2016

Subject: Sacred Lands File & Native American Contacts List Request for the Camino Pablo Subdivision Project, Contra Costa County, California

Dear Ms. Pilas-Treadway:

Douglas Herring & Associates proposes to undertake the Camino Pablo Subdivision Project, an approximately 24-acre parcel of land located in the town of Moraga, Contra Costa County, California. The parcel fronts on Camino Pablo, which runs along the southern portion of its west side, south of Tharp Drive. To the east of the parcel lies undeveloped land.

Current plans entail construction of 13 single-family homes situated within the southwest portion of the subject property, coupled with the preservation of the upper hillslope and the northern part of the subject property as permanent open space. The subject parcel is currently used for grazing and no structures exist within its borders.

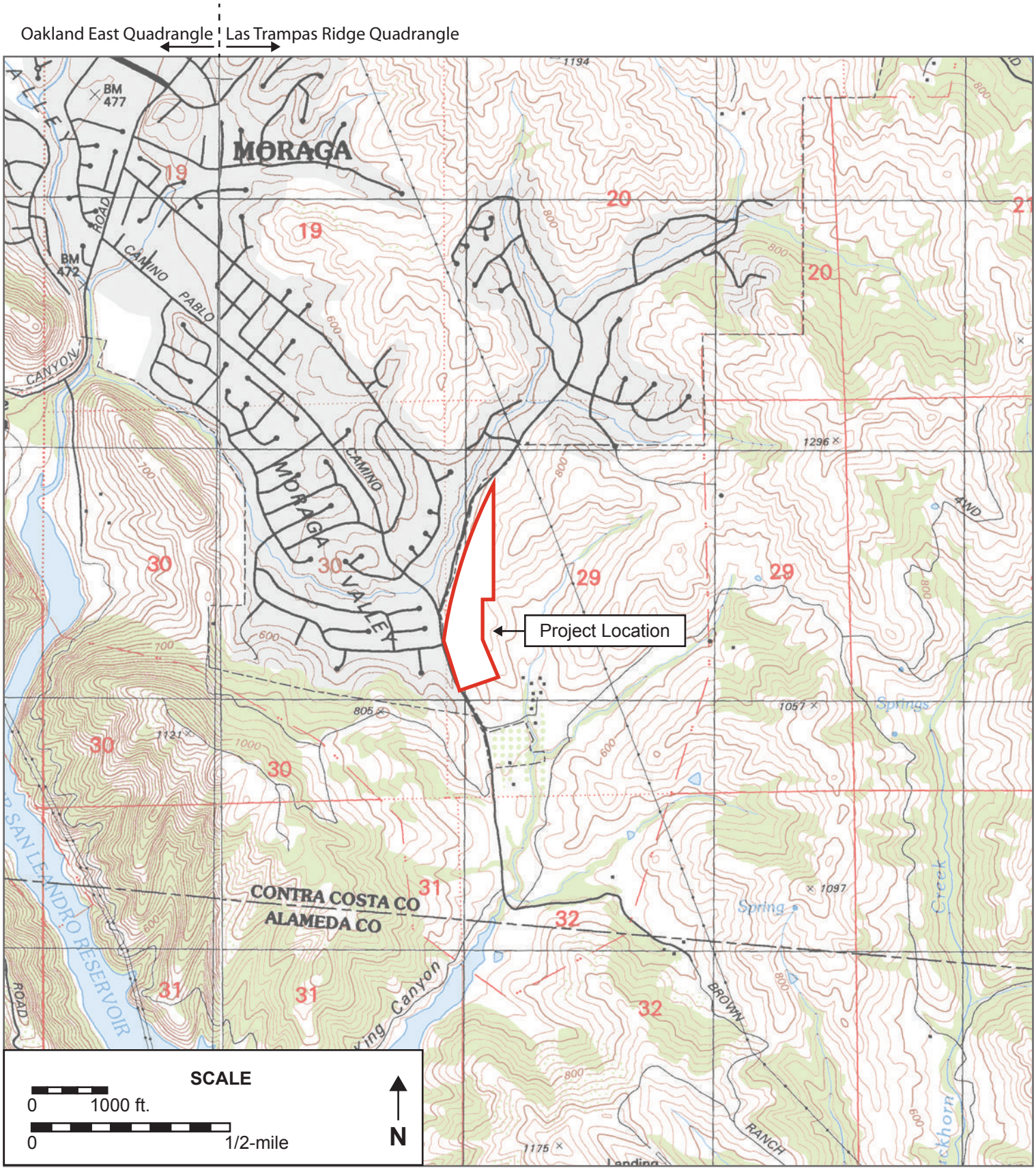
As shown on the attached map, the subject parcel is located on the "Las Trampas Ridge, CA" 7.5-minute USGS topographic map within Township 1S, Range 2W.

Please review the Sacred Lands File and notify us of any sacred lands that would be affected by the Project, as well as individual or groups whom we should contact. As always, we can accept the results by email at archeo-tec@archeo-tec.com or by fax at (510) 858-7248.

Sincerely,

Emily Wick
Archeo-Tec Consulting Archaeologists

5283 Broadway, Oakland, California 94618 • (510) 601-6185 • Fax (510) 858-7248 • archeo-tec@archeo-tec.com



1993 USGS "Oakland East, CA" and "Las Trampas Ridge, CA", 7.5-minute Topographic Maps

Project Location Map

Camino Pablo Subdivision Project

NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., Suite 100
West Sacramento, CA 95691
(916) 373-3710
(916) 373-5471 FAX

February 1st, 2016

Emily Wick
Archeo-Tec Consulting Agencies
5283 Broadway
Oakland, CA 94618

Sent by Email: archeo-tec@archeo-tec.com
Number of Pages: 3

RE: Pablo Subdivision Project, Contra Costa County

Dear Ms. Wick:
Attached is a consultation list of tribes with traditional lands or cultural places located within the boundaries of the above referenced counties. Please note that the intent above reference codes is to mitigate impacts to tribal cultural resources, as defined, for California Environmental Quality Act (CEQA) projects.

As of July 1, 2015, Public Resources Code Sections 21080.1, 21080.3.1 and 21080.3.2 require public agencies to consult with California Native American tribes identified by the Native American Heritage Commission (NAHC) for the purpose mitigating impacts to tribal cultural resources:

> Within 14 days of determining that an application for a project is complete or a decision by a public agency to undertake a project, the lead agency shall provide formal notification to the designated contact of, or a tribal representative of, traditionally and culturally affiliated California Native American tribes that have requested notice, which shall be accomplished by means of at least one written notification that includes a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation pursuant to this section. (Public Resources Code Section 21080.1(d))

The law does not preclude agencies from initiating consultation with the tribes that are culturally and traditionally affiliated with their jurisdictions. The NAHC believes that in fact that this is the best practice to ensure that tribes are consulted commensurate with the intent of the law.

In accordance with Public Resources Code Section 21080.1(d), formal notification must include a brief description of the proposed project and its location, the lead agency contact information, and a notification that the California Native American tribe has 30 days to request consultation. The NAHC believes that agencies should also include with their notification letters information regarding any cultural resources assessment that has been completed on the APE, such as:

1. The results of any record search that may have been conducted at an Information Center of the California Historical Resources Information System (CHRIS), including, but not limited to:

   - A listing of any and all known cultural resources have already been recorded on or adjacent to the APE;
   - Copies of any and all cultural resource records and study reports that may have been provided by the Information Center as part of the records search response;
   - If the probability is low, moderate, or high that cultural resources are located in the APE.
   - Whether the records search indicates a low, moderate or high probability that unrecorded cultural resources are located in the potential APE; and

- If a survey is recommended by the Information Center to determine whether previously unrecorded cultural resources are present.

2. The results of any archaeological inventory survey that was conducted, including:

   - Any report that may contain site forms, site significance, and suggested mitigation measurers.

     All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure in accordance with Government Code Section 6254.10.

3. The results of any Sacred Lands File (SFL) check conducted through Native American Heritage Commission. A search of the SFL was completed for the USGS quadrangle information provided with negative results.

4. Any ethnographic studies conducted for any area including all or part of the potential APE; and

5. Any geotechnical reports regarding all or part of the potential APE.

Lead agencies should be aware that records maintained by the NAHC and CHRIS is not exhaustive, and a negative response to these searches does not preclude the existence of a cultural place. A tribe may be the only source of information regarding the existence of a tribal cultural resource.

This information will aid tribes in determining whether to request formal consultation. In the case that they do, having the information beforehand well help to facilitate the consultation process.

If you receive notification of change of addresses and phone numbers from tribes, please notify me. With your assistance we are able to assure that our consultation list contains current information.

If you have any questions, please contact me at my email address: sharaya.souza@nahc.ca.gov.

Sincerely,

Sharaya Souza
Staff Services Analyst

Native American Heritage Commission
Tribal Consultation List
Contra Costa County
January 29, 2016

Amah MutsunTribal Band of Mission San Juan Bautista
Irenne Zwierlein, Chairperson
789 Canada Road — Ohlone/Costanoan
Woodside , CA 94062
amahmutsuntribal@gmail.com
(650) 400-4806 Cell

Indian Canyon Mutsun Band of Costanoan
Ann Marie Sayers, Chairperson
P.O. Box 28 — Ohlone/Costanoan
Hollister , CA 95024
ams@indiancanyon.org
(831) 637-4238

Muwekma Ohlone Indian Tribe of the SF Bay Area
Rosemary Cambra, Chairperson
P.O. Box 360791 — Ohlone / Costanoan
Milpitas , CA 95036
muwekma@muwekma.org
(408) 314-1898
(510) 581-5194

The Ohlone Indian Tribe
Andrew Galvan
P.O. Box 3152 — Ohlone/Costanoan
Fremont , CA 94539 — Bay Miwok
chochenyo@AOL.com — Plains Miwok
(510) 882-0527 Cell — Patwin

Wilton Rancheria
Raymond Hitchcock, Chairperson
9728 Kent Street — Miwok
Elk Grove , CA 95624
rhitchcock@wiltonrancheria-nsn.gov
(916) 683-6000 Office

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is applicable only for consultation with Native American tribes under Public Resources Code Sections 21080.3.1 for the proposed Camino Pablo Subdivision Project, Contra Costa County.

Written Correspondence with Individuals on the NAHC List

Subject: Camino Pablo Subdivision Project, Moraga
From: Archeo-Tec <archeo-tec@archeo-tec.com>
Date: 2/9/2016 5:48 PM
To: Andy Galvan <chochenyo@aol.com>
BCC: sent@archeo-tec.com

Dear Mr. Galvan,

I am writing regarding the proposed Camino Pablo Subdivision Project, located in the City of Moraga, Contra Costa County, California. Enclosed please find a map of the project area. The project would include the construction of 13 single-family homes within the southwest portion of the Project area, while preserving the upper hillslope and the northern part of the subject property as permanent open space. The subject parcel is currently used for grazing and no structures exist within its borders. The Lead Agency for the Project is the Town of Moraga Planning Department, which is located at 329 Rheem Blvd in Moraga, CA, and can be contacted at (925) 888-7240.

A records search at the Northwest Information Center (NWIC) found no recorded archaeological resources within the Project area, a portion of which had been surveyed in 1981. That survey, which encompassed a much larger area than the current Project area, located two scrapers approximately 500 meters northeast of the present Project boundaries and a third scraper 750 meters north of the Project. No archaeological sites have been formally recorded within 1 mile of the Project area. However, based on the geographical setting of the Project, the NWIC determined that "there is a high potential of identifying Native American archaeological resources and a low potential of identifying historic-period archaeological resources in the project area." Archeo-Tec surveyed the current Project area on February 1, 2016, and found no evidence of archaeological resources.

We have already contacted the Native American Heritage Commission and a search of the sacred lands file has failed to indicate the presence of Native American cultural resources in the immediate project area. We are interested to know if you have information about culturally significant resources on this site, or can recommend others who might share such information. Please send any response you may have within the next 30 days.

Sincerely,
Allen G. Pastron
President

Archeo-Tec
5283 Broadway
Oakland, CA 94618
(510) 601-6185 phone
(510) 858-7248 fax

Attachments:

Camino Pablo Project Loca on Map.pdf 1.3 MB

From: Andy Galvan <chochenyo@aol.com>
To: Archeo-Tec <archeo-tec@archeo-tec.com>
Sent: Mon, Feb 15, 2016 3:33 pm
Subject: Re: Camino Pablo Subdivision Project, Moraga

Hi there,

Could you please tell me what are the professional archaeological recommendations for this project?

Andrew Galvan

An Ohlone/Bay Miwok Man

From: Archeo-Tec <archeo-tec@archeo-tec.com>
To: Andy Galvan <chochenyo@aol.com>
Sent: Mon, Feb 15, 2016 4:11 pm
Subject: Re: Camino Pablo Subdivision Project, Moraga

Hi Andy,

We have not yet completed the Phase I report, and are soliciting information/recommendations from you to include in the report. We do not yet have official archaeological recommendations.

As our initial letter described, we have completed a survey and records search, both with negative results. In addition, the majority of the parcel is comprised of steep terrain. We are not planning on recommending pre-construction archaeological testing. If we recommend archaeological monitoring of construction excavation, it will most likely be limited to a small portion of the parcel that does not slope steeply. However, I must again emphasize that our Phase I report is still in progress.

I hope this additional information is helpful to you in formulating any recommendations you may have.

Thank you,

Emily

Emily Wick
Archeo-Tec Consulting Archaeologists
5283 Broadway
Oakland, CA 94618
(510) 601-6185

Subject: Camino Pablo Subdivision Project, Moraga
From: Archeo-Tec <archeo-tec@archeo-tec.com>
Date: 2/9/2016 5:47 PM
To: Rosemary Cambra <muwekma@muwekma.org>
BCC: sent@archeo-tec.com

Dear Chairperson Cambra,

I am writing regarding the proposed Camino Pablo Subdivision Project, located in the City of Moraga, Contra Costa County, California. Enclosed please find a map of the project area. The project would include the construction of 13 single-family homes within the southwest portion of the Project area, while preserving the upper hillslope and the northern part of the subject property as permanent open space. The subject parcel is currently used for grazing and no structures exist within its borders. The Lead Agency for the Project is the Town of Moraga Planning Department, which is located at 329 Rheem Blvd in Moraga, CA, and can be contacted at (925) 888-7240.

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We have already contacted the Native American Heritage Commission and a search of the sacred lands file has failed to indicate the presence of Native American cultural resources in the immediate project area. We are interested to know if you have information about culturally significant resources on this site, or can recommend others who might share such information. Please send any response you may have within the next 30 days.

Sincerely,
Allen G. Pastron
President

Archeo-Tec
5283 Broadway
Oakland, CA 94618
(510) 601-6185 phone
(510) 858-7248 fax

Attachments:

Camino Pablo Project Loca on Map.pdf 1.3 MB

Subject: Camino Pablo Subdivision Project, Moraga
From: Archeo-Tec <archeo-tec@archeo-tec.com>
Date: 2/9/2016 5:46 PM
To: Ann-Marie Sayers <ams@indiancanyon.org>
BCC: sent@archeo-tec.com

Dear Chairperson Sayers,

I am writing regarding the proposed Camino Pablo Subdivision Project, located in the City of Moraga, Contra Costa County, California. Enclosed please find a map of the project area. The project would include the construction of 13 single-family homes within the southwest portion of the Project area, while preserving the upper hillslope and the northern part of the subject property as permanent open space. The subject parcel is currently used for grazing and no structures exist within its borders. The Lead Agency for the Project is the Town of Moraga Planning Department, which is located at 329 Rheem Blvd in Moraga, CA, and can be contacted at (925) 888-7240.

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Sincerely,
Allen G. Pastron
President

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5283 Broadway
Oakland, CA 94618
(510) 601-6185 phone
(510) 858-7248 fax

Attachments:

Camino Pablo Project Loca on Map.pdf 1.3 MB

Subject: Camino Pablo Subdivision Project, Moraga
From: Archeo-Tec <archeo-tec@archeo-tec.com>
Date: 2/9/2016 5:44 PM
To: Irenne Zwierlein <amahmutsuntribal@gmail.com>
BCC: sent@archeo-tec.com

Dear Chairperson Zwierlein,

I am writing regarding the proposed Camino Pablo Subdivision Project, located in the City of Moraga, Contra Costa County, California. Enclosed please find a map of the project area. The project would include the construction of 13 single-family homes within the southwest portion of the Project area, while preserving the upper hillslope and the northern part of the subject property as permanent open space. The subject parcel is currently used for grazing and no structures exist within its borders. The Lead Agency for the Project is the Town of Moraga Planning Department, which is located at 329 Rheem Blvd in Moraga, CA, and can be contacted at (925) 888-7240.

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Sincerely,
Allen G. Pastron
President

Archeo-Tec
5283 Broadway
Oakland, CA 94618
(510) 601-6185 phone
(510) 858-7248 fax

Attachments:

Camino Pablo Project Loca on Map.pdf 1.3 MB

Subject: Camino Pablo Subdivision Project, Moraga
From: Archeo-Tec <archeo-tec@archeo-tec.com>
Date: 2/9/2016 5:49 PM
To: Raymond Hitchcock <rhitchcock@wiltonrancheria-nsn.gov>
BCC: sent@archeo-tec.com

Dear Chairperson Hitchcock,

I am writing regarding the proposed Camino Pablo Subdivision Project, located in the City of Moraga, Contra Costa County, California. Enclosed please find a map of the project area. The project would include the construction of 13 single-family homes within the southwest portion of the Project area, while preserving the upper hillslope and the northern part of the subject property as permanent open space. The subject parcel is currently used for grazing and no structures exist within its borders. The Lead Agency for the Project is the Town of Moraga Planning Department, which is located at 329 Rheem Blvd in Moraga, CA, and can be contacted at (925) 888-7240.

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Sincerely,
Allen G. Pastron
President

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5283 Broadway
Oakland, CA 94618
(510) 601-6185 phone
(510) 858-7248 fax

Attachments:

Camino Pablo Project Loca on Map.pdf 1.3 MB

Telephone Correspondence with Individuals on the NAHC List

Phone Call Log

Phone calls were made to each person on the list as a follow-up to the initial letter.

Irenne Zwierlein
Caller: Emily Wick
Time: 12:41 PM, 2/15/16
Result: Left voicemail describing project, referencing letter, and requesting input.

Ann Marie Sayers
Caller: Michelle Staley
Time: 10:25 AM, 2/10/16
Result: Ms. Sayers recommended both archaeological and Native American monitoring of all construction excavation, and recommended that if a burial is found, it be re-buried in the open space portion of the property with an easement preventing any further disturbance.

Rosemary Cambra
Caller: Emily Wick
Time: 12:45 PM, 2/15/16
Result: Ms. Cambra said she would return the call at a better time. Ms. Wick offered to call back again the following day, and Ms. Cambra agreed.
Caller: Emily Wick
Time: 12:43 PM, 2/16/16
Result: Left voicemail describing project, referencing letter, and requesting input.

Andrew Galvan
Caller: Emily Wick
Time: 12:54 PM, 2/15/16
Result: Left voicemail describing project, referencing letter, and requesting input. Mr. Galvan emailed back later that day (see email correspondence).

Raymond Hitchcock
Caller: Emily Wick
Time: 12:48 PM, 2/15/16
Result: Left voicemail describing project, referencing letter, and requesting input.

Appendix D

Geotechnical Reports

Preliminary Geologic Exploration

1211 Camino Pablo Property
Moraga, California

Submitted to:
Mr. Matt Dobbins
Dobbins Properties, LLC
1901 W. Kettleman Lane, Suite 102
Lodi, CA 95242

Prepared by:
ENGEO Incorporated

January 21, 2014

Project No:
10741.000.000

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Project No.
10741.000.000

January 21, 2014

Mr. Matt Dobbins
Dobbins Properties, LLC
1901 W. Kettleman Lane, Suite 102
Lodi, CA 95242

Subject: 1211 Camino Pablo Property
Moraga, California

PRELIMINARY GEOLOGIC EXPLORATION

Dear Mr. Dobbins:

With your authorization, we have completed this preliminary geologic exploration report for your property located at 1211 Camino Pablo in Moraga, California. The accompanying report presents the findings of our field exploration together with our conclusions and preliminary recommendations regarding residential development at the site.

Our findings indicate that the project site is suitable for the proposed development provided the preliminary recommendations provided in this report incorporated in the project planning. Additional design-level exploration services will be needed to develop recommendations for grading, drainage, and foundation design. We are pleased to have been of service to you on this project and are prepared to consult further with you and your design team as the project progresses.

Sincerely

ENGEO Incorporated

PROFESSIONAL GEOLOGIST
RAYMOND SKINNER
No. 1239
Exp. 2/28/2015
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Raymond P. Skinner CEG

Macy Tong, GE

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APPENDIX B – Soil Tectonics report (Dr. Glen Borchardt, dated January 20, 2014)

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purposes of this preliminary geologic exploration have been to evaluate a possible fault that is is shown on the regional geologic maps crossing the southern portion of the site and to characterize suspected landslide areas in the area of planned development. This study included the following scope of services:

- Published geologic maps and literature pertinent to the site were reviewed.
- A geologic reconnaissance was performed by an ENGEO geologist.
- Aerial photographs were examined to identify geomorphic features that may be related to faulting, landsliding and other geologic conditions.
- Excavating and logging of eight exploratory test pits.
- Excavation and logging of one exploratory trench (Trench T-1).
- Preparation of this preliminary geologic report summarizing our findings, conclusions and preliminary recommendations to assist in site planning.

We prepared this report exclusively for Dobbins Properties, LLC and their design team consultants. ENGEO should review any changes made in the character, design or layout of the development to modify the conclusions and recommendations contained in this report, as necessary. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without the express written consent of ENGEO.

1.2 SITE LOCATION AND DESCRIPTION

The study area is located in an area of relatively steep hillside terrain as shown on the Vicinity Map, Figure 1. The site is open grassland that is currently used for grazing. Existing improvements appear to be limited to perimeter fencing.

1.3 PROPOSED DEVELOPMENT

Preliminary plans prepared by DK Consulting indicate that the property may be developed with 10 to 12 single-family residential lots. Due to various site constraints, it is expected that the development area will be limited to an area of somewhat flatter terrain adjacent to Camino Pablo in the southern portion of the property. We understand that the extent of grading for the project has not been determined at this time.

2.0 REGIONAL GEOLOGY

2.1 GEOLOGIC SETTING

The study area is located in the Coast Ranges geomorphic province of California. The Coast Ranges are characterized by a series of northwest-trending valleys and mountain ranges. The bedrock in this region has been folded and faulted in a tectonic setting that is experiencing translational and compressional deformations of the earth's crust.

Regional geologic mapping by Graymer et al. (1994) indicates that the study area is underlain by bedrock of the lower member of the Mulholland formation. Bedrock structure in the area is mapped striking to the northwest and dipping to the northeast.

2.2 FAULTING

The site is not within a State of California Earthquake Fault Zone for known active faults. The nearest known active fault is the Hayward fault, which is located about 4 miles to the southwest of the site. Other active faults in the region include the Calaveras fault located about 5 miles to the east, and the San Andreas fault located about 22 miles to the southwest.

A southwest dipping thrust fault is mapped by Crane (1988) crossing the southwestern portion of the site as shown the attached Regional Geologic Map, Figure 2. A southwest dipping thrust fault is also mapped by Graymer et al. (1994) and Wagner (1978) roughly coincident with Camino Pablo. These mapped thrust faults are not considered active or potentially active based on maps showing recency of faulting by Bortugno (1991) or Jennings and Bryant (2010).

3.0 AERIAL PHOTOGRAPH INTERPRETATION

Several sets of aerial photographs (see list of references) were examined to study geomorphic features that could be associated with faulting and landsliding at the site. Based on our review of the mapping by Nilsen (1975), examination of aerial photographs and site reconnaissance, areas that appear to be underlain by landslide deposits were mapped as shown on the Preliminary Geologic Map, Figure 3.

The thrust fault mapped by Crane (1988) crosses a topographic saddle and is aligned along linear valleys on both sides of the saddle. Based on our review of aerial photographs we did not observed scarps, tonal lineations or others features that are sometimes indicative of active faulting along the trace of the fault mapped by Crane. In some photographs, vegetation exhibits a darker tone in the linear valley; however, this darker tone appears to be associated with the thicker colluvial soils. It also appears that the linear valley is parallel to the strike of bedrock structure. The linear valley may be related to differential erosion rather than faulting. The ridges adjacent to the valley appear to be underlain by sandstone beds that are more resistant to erosion than the claystone that was encountered in the linear valley.

4.0 FIELD EXPLORATION

The field exploration for this study was conducted during January 2014, and consisted of excavating eight test pits and one exploratory trench at the approximate locations shown on the Preliminary Geologic Map, Figure 3. The test pits and trench were excavated using a track-mounted excavator. An ENGEO geologist logged the conditions exposed on the excavations and the logs are provided in Appendix A.

After completion of logging, the excavations were backfilled using nominal compactive effort by the excavator bucket and trackwalking the surface. Depending on future grading activities in this area, it should be anticipated that the excavation spoils will need to be removed and replaced as engineered fill.

4.1 FAULT EXPLORATION

Exploratory Trench T-1, totaled approximately 176 lineal feet, and was excavated perpendicular to the thrust fault mapped by Crane (1988) at the location shown on Figure 3. The trench was located in the field by tape measuring from existing features. The log of the trench is included in Appendix A. The trench extended across a relatively well defined topographic saddle between two ridges.

The depth of the trench averaged about 9 feet below the adjacent ground surface. The southeast wall of the trench was cleaned with hand tools and examined by ENGEO geologists. The exposure was logged at a horizontal and vertical scale of 1 inch to 5 feet. A level line was established in the trench and measurements were referenced to this line.

Bedrock of the Mulholland formation was encountered at both the northeast and southwest ends of the trench. In the central section of the trench, thick colluvial soil deposits were encountered and bedrock was not exposed. As indicated on the trench log, several soil strata were mapped and were observed to be continuous across the trench exposure. No shears, clay gouge or other indications of faulting were observed in the trench exposure.

The services of a soil scientist, Dr. Glen Borchardt, were retained to evaluate the relative age of the colluvial soils exposed in the trench. Dr. Borchardt prepared a detailed log of the soil profile, performed laboratory testing and analysis of the soil stratigraphy. The report prepared by Dr. Borchardt is presented in Appendix B to this report. Dr. Borchardt's report indicates that the colluvial soils exposed in the trench represent deposition and soil development that has occurred over roughly the last 40,000 years. Based on this finding, no evidence of active faulting was found in Trench T-1.

4.2 TEST PIT EXPLORATION

Eight exploratory test pits were excavated to depths of about 6 to 14 feet below grade. In Test Pit TP-1, colluvial soil deposits were encountered to a depth of 14 feet. The colluvium consisted of dark brown silty clay that was dry to moist and very stiff. Based on visual examination, the soils encountered on site appear to range from low to high plasticity.

Landslide deposits were encountered in several tests pits consisting of predominatly soil material. Well-defined basal slide planes were encountered in Test Pits TP- 4 and TP-5. Based on the findings of our exploration, the landslide deposits appear to range from about 5 to 15 feet thick.

Bedrock encountered in the test pits consisted of interbedded claystone, siltstone and sandstone. The bedrock is typically weak, highly fractured and varies from thinly to thickly bedded. Bedrock structure was generally found to be consistent with regional mapping by Graymer (1994), striking to the northwest and dipping steeply to the northeast.

4.3 GROUNDWATER

No groundwater was encountered during the test pit and trench exploration performed in conjunction with this study. An area of suspected seepage or near surface ground water was noted during our reconnaissance at the location indicated on Figure 3. No free water was observed in this area at the time of our site visit but green vegetation and deep footprints from cattle grazing suggests that seepage may occur seasonally in this area. Fluctuations in groundwater levels occur seasonally and over a period of years because of variations in precipitation, temperature, irrigation, or other factors.

5.0 CONCLUSIONS

From a geologic and geotechnical standpoint, the study area is generally suitable for the proposed residential development. The preliminary recommendations in this report should be considered in the initial planning for the study area. Design-level exploration will be required to develop recommendations for site grading and foundations.

5.1 FAULT HAZARDS

Based on the findings of our exploration, no indications of active faulting were encountered in the exploratory trench that was excavated across the location of the thrust fault that was mapped by Crane (1988). Based on these findings, it is our opinion that the potential for ground rupture from active faulting at the site is low and setbacks from the map fault are not necessary.

Based on the findings of this exploration it is uncertain if an older inactive fault exists at the location mapped by Crane (1988). Fault zones sometimes contain weak, highly expansive material that can adversely affect roadways and/or foundations. During grading operations for the project, conditions exposed along the mapped fault should be examined by the project geologist to determine if indications of faulting are exposed and if mitigation measures are needed. If indications of an inactive fault are found, mitigation measures typically involved overexcavation of the weaker material to some depth below planned finish grade and replacement of the weak material with engineered fill.

5.2 LANDSLIDE HAZARDS

As described above, several landslide areas were mapped within the study area. Our exploration indicates that these landslides range from about 5 to 15 feet thick and involve primarily soil material. These landslides appear to occur as relatively shallow slumps and earthflows. As noted on Figure 3, portions of the mapped landslides have been recently active.

Depending the relationship of landslides to the planned development, we anticipated landslide mitigation measures could consisting of setbacks from the landslides, construction of debris benches between the slide areas and the planned improvements, or repair of the landslide areas by reconstruction of the slopes with subdrains and engineered fill.

We should be given the opportunity to consult with you and the project civil engineer to develop landslide mitigation measures that are appropriate for the planned development. For planning purposes, we recommend that debris benches situated between residential lots and upslope landslide areas should be at least 40 feet wide. Debris benches situated between roadways and upslope landslide areas should be at least 20 feet wide. In general, it is preferable for debris benches to slope away from the hillside at a gradient between 5 and 10 percent to promote proper drainage. It is preferable for V-ditches to be located near the outboard (downslope) edge of the debris bench so that it is less likely that the functionality of the V-ditch will be impacted by sedimentation and slide debris. Access to debris benches should be provided for maintenance purposes.

6.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report is issued with the understanding that it is the responsibility of the owner to transmit the information and recommendations of this preliminary report to developers, owners, buyers, architects, engineers, and designers for the project so that the necessary steps can be taken by the contractors and subcontractors to carry out such recommendations in the field. The conclusions and recommendations contained in this preliminary report are solely professional opinions.

The professional staff of ENGEO strives to perform its services in a proper and professional manner with reasonable care and competence but is not infallible. There are risks of earth movement and property damages inherent in land development. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our services.

This preliminary report is based upon field and other conditions discovered at the time of preparation of ENGEO's preliminary report. This document must not be subject to unauthorized reuse that is, reusing without written authorization of ENGEO. Such authorization is essential because it requires ENGEO to evaluate the document's applicability given new circumstances, not the least of which is passage of time. Actual field or other conditions will necessitate clarifications, adjustments, modifications or other changes to ENGEO's documents. Therefore, ENGEO must be engaged to prepare the necessary clarifications, adjustments, modifications or

other changes before construction activities commence or further activity proceeds. If ENGEO's scope of services does not include on-study area construction observation, or if other persons or entities are retained to provide such services, ENGEO cannot be held responsible for any or all claims arising from or resulting from the performance of such services by other persons or entities, and from any or all claims arising from or resulting from clarifications, adjustments, modifications, discrepancies or other changes necessary to reflect changed field or other conditions.

SELECTED REFERENCES

Borchardt, G., January 17, 2014, Pedochronological Report for 1211 Camino Pablo, Moraga, California, Soil Tectonics, unpublished report.

Bortugno, E. J.; et al., 1991, Map Showing Recency of Faulting, San Francisco-San Jose Quadrangle USGS Map Sheet 5A.

Crane, R. C.; 1988, Geologic Map of the Las Trampas 7.5 minute Quadrangle, NCGS Field Trip Guide to the Geology of the San Ramon Valley & Environs.

Dibblee Jr., T. W., 1980, Preliminary Geologic Map of the Las Trampas Ridge Quadrangle, Contra Costa County, California, USGS Open-File Map 80-545.

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Figure 2 - Regional Geologic Map (Crane, 1988)
Figure 3 - Preliminary Geologic Map

FIGURES

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BASE MAP SOURCE: GOOGLE EARTH PRO

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VICINITY MAP
1211 CAMINO PABLO
MORAGA, CALIFORNIA

PROJECT NO.: 10741.000.000		FIGURE NO. 1
SCALE: AS SHOWN		
DRAWN BY: LL	CHECKED BY: MT	

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ORIGINAL FIGURE PRINTED IN COLOR

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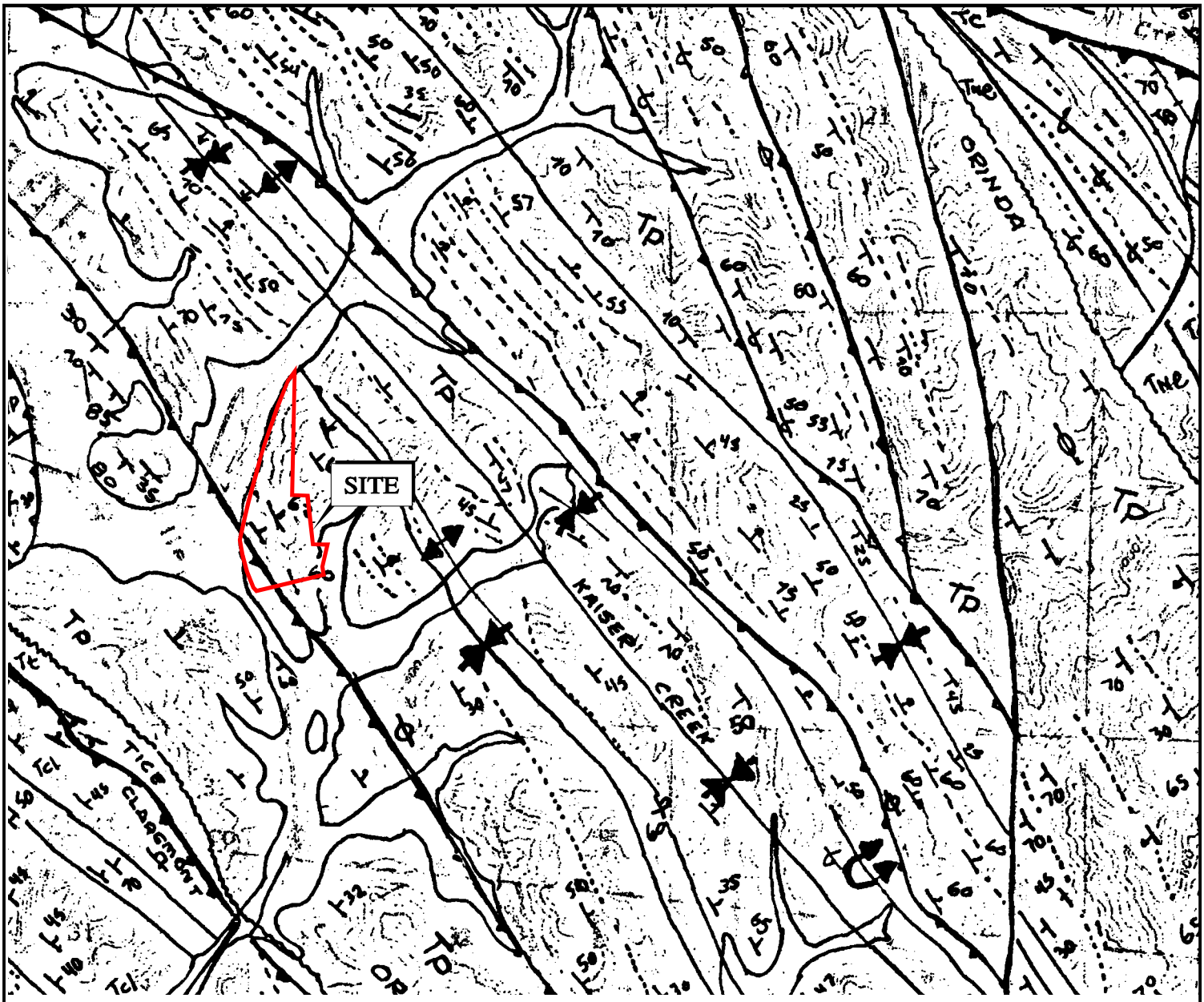

EXPLANATION

- Tp ORINDA FORMATION (PLIOCENE)
- THRUST FAULT
- ANTICLINAL FOLD AXIS
- SYNCLINAL FOLD AXIS
- STRIKE AND DIP OF BEDDING

N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: CRANE, 1959

ENGEO Expect Excellence

REGIONAL GEOLOGIC MAP

1211 CAMINO PABLO

MORAGA, CALIFORNIA

PROJECT NO.: 10741.000.000		FIGURE NO. 2
SCALE: AS SHOWN		
DRAWN BY: LL	CHECKED BY: MT	

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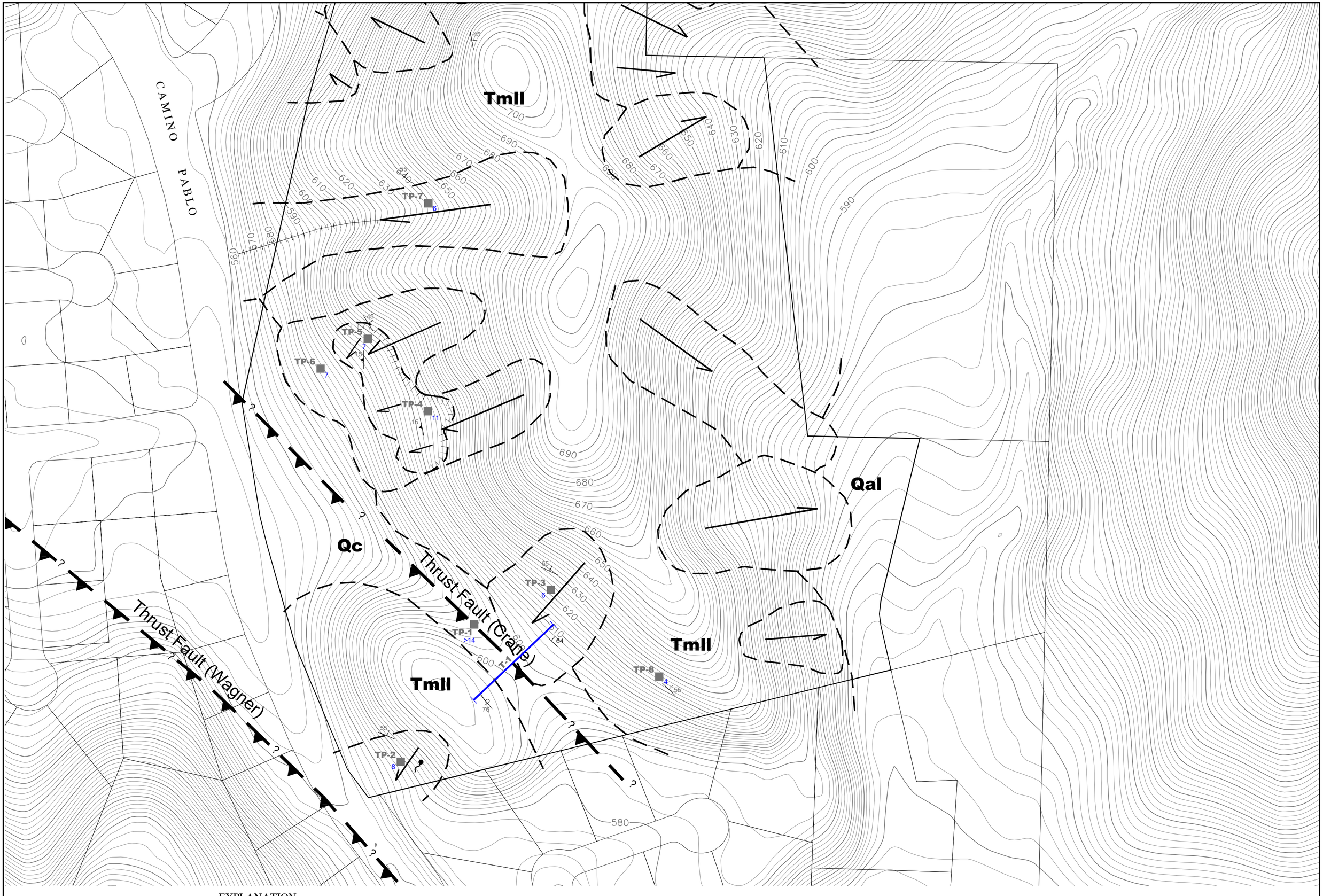

EXPLANATION

Qc	COLLUVIUM
Qal	ALLUVIUM
Tmll	MULHOLLAND FORMATION
	GULLY
	RECENT LANDSLIDE
	GEOLOGIC CONTACT, DASHED WHERE APPROXIMATE
	SURFICIAL LANDSLIDE
	SEEPAGE AREA
TP-8 4	APPROXIMATE LOCATION OF TEST PIT (DEPTH TO BEDROCK NOTED)
T-1	APPROXIMATE LOCATION OF TRENCH LOG
65	STRIKE AND DIP OF BEDDING
15	STRIKE AND DIP OF SLIDE PLANE
65	STRIKE AND DIP OF OVERTURNED BEDDING

BASE MAP SOURCE: TOPOGRAPHY (USGS, 9TH ARC DEM), PARCEL (CONTRA COSTA COUNTY GIS, 2013)

ENGEO Expect Excellence

PRELIMINARY GEOLOGIC MAP
1211 CAMINO PABLO
MORAGA, CALIFORNIA

PROJECT NO.: 10741.000.000
SCALE: AS SHOWN
DRAWN BY: LL
CHECKED BY: MT

FIGURE NO. 3

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APPENDIX A

Test Pit and Trench Logs

APPENDIX A

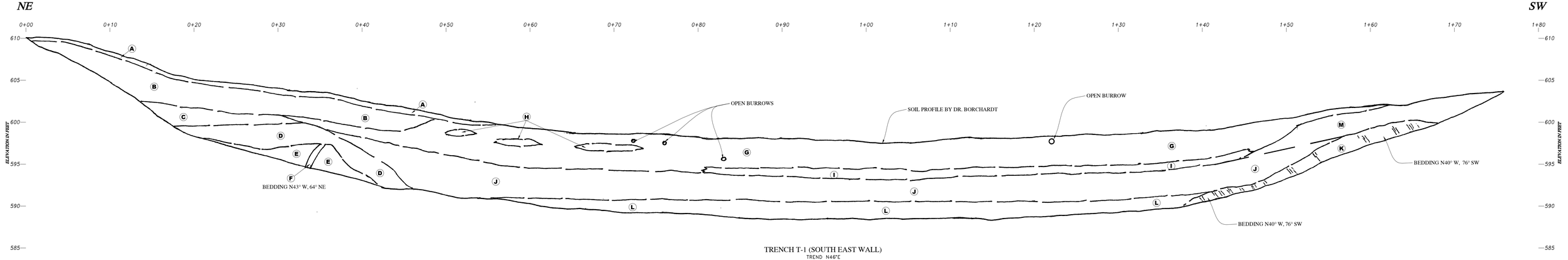
ENGEO INCORPORATED	Test Pit Logs
1211 Camino Pablo Preliminary Geologic Exploration Moraga, California 10741.000.000	Logged By: R. Skinner Logged Date: 1/13/14 and 1/14/14

Test Pit Number	Depth (Feet)	Description
TP-1	0 – 5	SILTY CLAY (CH), dark brown, very stiff, dry (Qc)
	5 – 14	SILTY CLAY (CL), brown, very stiff, moist (Qc) Total depth 14 feet, no free groundwater encountered
TP-2	0 – 8	SILTY CLAY (CL), brown, very stiff, dry (Qls)
	8 – 10½	Interbedded CLAYSTONE and SANDSTONE, light gray, weak, closely fractured, thinly bedded, N60W 55NE. (Mulholland Formation) Total depth 10½ feet, no free groundwater encountered
TP-3	0 – 4½	SILTY CLAY (CH), dark brown, hard, dry.
	4½ - 6	SILTY CLAY and ROCK FRAGMENTS (CL), light gray, stiff, moist (Qls) .
	6 – 8	SILTSTONE, light gray, weak, closely fractured, thickly bedded, N65W 65NE. (Mulholland Formation) Total depth 8 feet, no free groundwater encountered
TP-4	0 – 10	SILTY CLAY (CL), brown, stiff, dry, with fine gravel (Qls)
	10 – 11	SILTY CLAY (CL), light gray, stiff, moist, slickensided surface at 11 feet, N20W 15W, prominent downslope striations. (Qls)
	11 - 13	CLAYSTONE, gray-brown, weak, closely fractured, thickly bedded. (Mulholland Formation) Total depth 13 feet, no free groundwater encountered

ENGEO INCORPORATED	Test Pit Logs
1211 Camino Pablo Preliminary Geologic Exploration Moraga, California 10741.000.000	Logged By: R. Skinner Logged Date: 1/13/14 and 1/14/14

Test Pit Number	Depth (Feet)	Description
TP-5	0 – 6½	SILTY CLAY (CL), dark brown, vert stiff,dry to moist (Qls)
	6½	Slickensided surface NS 15W
	6½– 9	CLAYSTONE, gray, weak, very closely fractured, thinly bedded, N30W 45NE (Mulholland Formation)
		Total depth 9 feet, no free groundwater encountered
TP-6	0 – 4	SILTY CLAY (CL), dark brown, hard, dry (Qls)
	4 – 7	SILTY CLAY (CL), brown, very stiff, moist, sharp contact at 7 feet. (Qls)
	7 – 8½	SANDSTONE, light gray, weak, moderately fractured, thickly bedded. (Mulholland Formation)
		Total depth 8½ feet, no free groundwater encountered
TP-7	0 – 4½	SILTY CLAY (CH), dark brown, hard, dry.
	4½ – 5½	SILTY CLAY (CL), brown with brown, very stiff, moist.
	5½ – 7	Interbedded CLAYSTONE and SILTSTONE, light gray, weak, closely fractured, thinly bedded, N50W 55NE (Mulholland Formation)
		Total depth 7 feet, no free groundwater encountered

ENGEO INCORPORATED		Test Pit Logs
1211 Camino Pablo Preliminary Geologic Exploration Moraga, California 10741.000.000		Logged By: R. Skinner Logged Date: 1/13/14 and 1/14/14
Test Pit Number	Depth (Feet)	Description
TP-8	0 – 3½ 3½– 6	SILTY CLAY (CH), dark brown, hard, dry. CLAYSTONE, gray, weak, closely fractured, thinly bedded, N45W 55NE (Mulholland) Total depth 6 feet, no free groundwater encountered

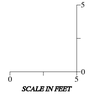


TRENCH T-1 (SOUTH EAST WALL)

TREND N46°E

EXPLANATION

- **A** silty CLAY, light gray, dry, soft, low plasticity, highly dessicated, abundant roots (relatively young slope wash, colluvium)
- **B** silty CLAY, dark gray-brown, dry to moist, very stiff, high plasticity
- **C** silty CLAY, red-brown, moist, very stiff, high plasticity, some rounded siltstone and claystone fragments
- **D** silty CLAY, light gray, moist, very stiff, abundant claystone and siltstone fragments (highly weathered bedrock)
- **E** CLAYSTONE, gray and red-brown, weak, highly fractured, thickly bedded (Mulholland formation)
- **F** SILTSTONE, gray, weak, moderately fractured, thinly bedded (Mulholland formation)
- **G** silty CLAY, light gray, dry, stiff, few small rock fragments, porous, low plasticity (Holocene colluvium)
- **H** silty CLAY, dark gray, dry, stiff, abundant rootlets, slightly porous (Holocene colluvium)
- **I** silty CLAY, dark brown, moist, stiff, low plasticity, prominent blocky ped structure, well development clay films on ped surfaces (Pleistocene colluvium)
- **J** sandy CLAY, light red-brown, moist, stiff, low plasticity, some small rock fragments (Pleistocene colluvium)
- **K** SILTSTONE with some interbeds of claystone and sandstone, light to dark gray, weak, highly fractured, thinly bedded (Mulholland formation)
- **L** sandy CLAY, gray-brown, moist, stiff, low plasticity, some small rock fragments, poorly developed ped structure with light films on ped surfaces (Pleistocene colluvium).
- **M** silty CLAY, dark brown, dry, very stiff, high plasticity



ENGEO Expect Excellence	TRENCH LOG T-1 1211 CAMINO PABLO MORAGA, CALIFORNIA	PROJECT NO.: 10741.000.000 SCALE: AS SHOWN DRAWN BY: LL CHECKED BY: MT	FIGURE NO. A1

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APPENDIX B

Soil Tectonics report (Dr. Glen Borchardt, dated January 20, 2014)

APPENDIX B

APPENDIX B

PEDOCHRONOLOGICAL REPORT FOR 1211 CAMINO PABLO, MORAGA, CALIFORNIA

ENGEO, Inc., San Ramon, CA 94583, Job No. 10741.000.000

2014-01-21

Soil Tectonics
P.O. Box 5335
Berkeley, CA 94705

Glenn Borchardt

Principal Soil Scientist
Certified Professional Soil Scientist No. 24836

PEDOCHRONOLOGICAL REPORT FOR 1211 CAMINO PABLO, MORAGA, CALIFORNIA

ENGEO, Inc., San Ramon, CA 94583, Job No. 10741.000.000

2014-01-21

Glenn Borchardt

INTRODUCTION

An assessment of seismic and landslide risk due to ground movement can be aided greatly by the techniques of pedochronology (Borchardt, 1992, 1998), soil dating. This is because the youngest geological unit overlying fault traces is generally a soil horizon. The age and relative activity of ground movement often can be estimated by evaluating the age and relative disturbance of overlying soil units, as well as buried soils called paleosols. Terms, prefixes, and suffixes are defined in the Soils Glossary at the end of this report.

Soil horizons exhibit a wide range of physical, chemical, and mineralogical properties that evolve at varying rates. Soil scientists use various terms to describe these properties. A black, highly organic "A" horizon, for example, may form within a few centuries, while a dark brown, clayey "Bt" horizon may take up to 40,000 years to form. Certain soil properties are invariably absent in young soils. For instance, soils developed in granitic alluvium of the San Joaquin Valley do not have Munsell hues redder than 10YR until they are at least 100,000 years old (Birkeland, 1999; Harden, 1982). Still other properties, such as the movement and deposition of clay-size particles and the precipitation of calcium carbonate at extraordinary depths, indicate soil formation during a climate much wetter than at present. In the absence of a radiometric age date for the material from which a particular soil formed, an estimate of its age must take into account all the known properties of the soil and the landscape and climate in which it evolved.

METHOD

The first step in studying a soil is the compilation of the data necessary for describing it (Birkeland, 1999; Borchardt, 2010). At minimum, this requires a Munsell color chart, hand lens, acid bottle, and instruments for 1:1 soil:water pH and conductivity measurements. The second step may involve collecting samples of each horizon of the soil profile column for laboratory analysis of particle size. This is done to check the textural classifications made in the field and to evaluate the genetic relationships between horizons and between different soils in the

landscape. When warranted, the clay mineralogy and chemistry of the soil also is analyzed to provide additional information on the changes undergone by the initial material from which the soil weathered. The last step is the comparison of this accumulated soil data with that for soils having developed under similar conditions, preferably in the same region. Such information is scattered in soil survey reports (e.g., Welch, 1981), soil science journals, and consulting reports. In a particular locality, there is seldom enough comparative data available for this purpose. That is why, at the very least, the study of one soil profile always makes the evaluation of the next that much easier.

RESULTS OF THIS EVALUATION

Soil Profile No. 1 was studied to assess the age of the colluvium in a swale across a mapped trace of a fault (Table 1).

Soil Profile No. 1

This profile was sampled in the middle of a colluvium-filled saddle in the Mulholland Formation. The saddle coincidently forms the crest of a ridge that slopes in opposite directions, to the SE and NW (Figure 1). Mapped as Los Osos clay loam, this particular variant is silt loam, having an especially thick solum (260 cm vs. the 81 cm of the typical Los Osos profile) (Table 1; Figure 2 and Figure 3). The mapped soil is typically on 15-30% slopes, while the sampled soil is on a flat surface formed as a colluvial fill eroded from the siltstone to the SW and NE. The 75-cm thick A horizon is has a dark grayish brown A1 overlying a very dark grayish brown A2. This color reversal seems to have occurred due to pedoturbation by ground squirrels (Figure 4). The 185-cm thick Bt horizon is dark brown to dark greyish brown silty clay with thin to thick clay films lining pores and coating peds (Figure 3). The parent material is best represented by the CB horizon, which is a greyish brown silty clay with massive to medium weak subangular blocky structure.

The pH of the soil profile generally increases with depth, with the surface being strongly acid and the subsurface being medium acid (Figure 5). This pattern is typical for soils that have been influenced by the usual acid rainfall for a long time. Aside from the A1 horizon, which may have been influenced by the addition of fertilizer, soil conductivity increased with depth until the bottom of the solum soil was reached (Figure 6). All these processes are typical of weathering in which soils tend to become acid with age, while releasing cations to the leachate and translocating fine clays from the A to the B horizon.

<u>Comparative Pedology</u>

Generally, soils this thick (260 cm) tend to have higher chromas (e.g., 7.5YR) than the 10YR chromas observed. That is because thick soils often form in coarse alluvium that has large enough pores to transport clays for long distances under high redox conditions when precipitation is plentiful. The parent material here, however, is silty clay (see CB horizon in

Table 1), which apparently allows clay translocation only through pores produced by flora and fauna. The upshot is that translocation and leaching to such great depths required a long time under a much wetter climate than at present (McFadden, 1982). Bt horizons 2 to 3 m thick are common in coarse alluvium estimated to be at 40 to 80 ka in the Livermore Valley (Borchardt, 1985). Early and Late Wisconsin soils developed in silty alluvium above the Sangamon wave-cut platform at Point Pinole also had low chromas (Borchardt, 1988).

CONCLUSIONS

1. The soil in the center of this swale is approximately 40,000 years old.
2. None of the soil boundaries in the swale were offset, folded, or warped, so we may be assured that no surface fault rupture (SFR) has occurred there during the last 40,000 years.

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Table 1. Description of Soil Profile No. 1 excavated across the mapped trace of a fault in a swale SE of Camino Pablo, Moraga, California. Abbreviations and definitions are given in Schoeneberger and others (2012) and Soil Survey Staff (1993, 1999, 2010).

Description of soil developed in colluvium by Glenn Borchardt, who measured and sampled the soil on January 14, 2014 at latitude N37.81175^{o} and longitude W122.11423^{o} at station 80' in the southeast wall of Trench T-1 at an elevation of 601' [607' (GPS)]. Mediterranean climate with mean annual precipitation of 32.02"/yr at Orinda (1948-1960). Slope 0%. Grass. Excellent drainage. Water table deep. The parent material is silt loam to silty clay. Soil pH is strongly acid in the surface, becoming medium acid in the subsoil. Mapped as: *Typic Argixerolls. Los Osos clay loam.*

Horizon	Depth, cm	Description

A1 0-38 Dark grayish brown (10YR4/2m, 6/2d) silt loam; medium to fine strong granular structure; slightly sticky and slightly plastic when wet, very friable when moist, and very hard when dry; many fine roots; many medium to fine continuous random tubular pores; abrupt irregular boundary; pH 5.3; conductivity 150 uS; Sample No. 14B001.

A2 38-75 Very dark grayish brown (10YR3/2m, 6/3d) silt loam; coarse to fine strong subangular blocky structure; sticky and slightly plastic when wet, very friable when moist, and very hard when dry; few fine roots; few fine continuous random tubular pores; gradual wavy boundary; pH 5.3; conductivity 90 uS; Sample No. 14B002.

B1t 75-101 Dark brown (10YR3/3m, 6/3d) silty clay; medium to coarse strong subangular to angular blocky structure; sticky and plastic when wet, firm when moist, and extremely hard when dry; very few fine roots; common fine continuous random tubular pores; few thin to medium thick clay films lining pores and coating peds; diffuse smooth boundary; pH 5.5; conductivity 150 uS; Sample No. 14B003.

B2t 101-166 Dark greyish brown (10YR4/2m, 5/2d) silty clay; medium to coarse strong angular blocky structure; sticky and plastic when wet, firm when moist, and very hard when dry; common fine continuous random tubular pores; many thin to medium thick clay films lining pores and coating peds; rare calcite filaments; clear smooth boundary; pH 5.5; conductivity 180 uS; Sample No. 14B004.

B3t 166-214 Dark greyish brown (10YR4/2m, 6/3d) silty clay; medium to coarse strong angular to subangular blocky structure; sticky and plastic when wet, firm to friable when moist, and very hard when dry; few fine continuous random tubular pores; many thin to

thick clay films lining pores and coating peds; clear smooth boundary; pH 5.6; conductivity 230 uS; Sample No. 14B005. Level line at 203 cm.

B4t 214-260 Very dark greyish brown (10YR3/2m, 6/3d) silty clay; medium to coarse strong subangular to angular blocky structure; sticky and plastic when wet, firm to friable when moist, and extremely hard when dry; common fine continuous random tubular pores; common thin to medium thick clay films lining pores and thick patchy coatings on peds; diffuse smooth boundary; pH 5.9; conductivity 230 uS; Sample No. 14B006.

CB 260-290+ Greyish brown (10YR5/2m, 6/3d) silty clay; massive to medium weak subangular blocky structure; sticky and plastic when wet, friable when moist, and very hard when dry; few fine continuous random tubular pores; pH 6.0; conductivity 220 uS; Sample No. 14B007.

*ESTIMATED AGE:	t_o	=	40.0	ka
	t_b	=	**0**	ka
	t_d	=	40.0	ky

---

*Pedochronological estimates based on available information. All ages should be considered subject to ±50% variation unless otherwise indicated (Borchardt, 1992). Bold dates are absolute.

t_o = date when soil formation or aggradation began, ka

t_b = date when soil or strata was buried, ka

t_d = duration of soil development or aggradation, ky

Figure 1. View SE (top) and NW (bottom) across the convex part of the swale between two outcrops of the Mulholland Formation east of Camino Pablo, Moraga, California.

Figure 2. Soil Profile No. 1 in the center of the swale showing the 75-cm thick A horizon and the upper portion of the Bt horizon. Nails mark horizon boundaries at 38, 75, and 101 cm.

Figure 3. The B2t horizon of Soil Profile No. 1 showing the angular blocky structure, medium thick to thick clay films coating peds, and the rare thin calcite filaments between 157 cm and 159 cm depths.

Figure 4. Burrow spoil piles from gopher excavations that helped to produce the 75-cm thick A horizon in the swale.

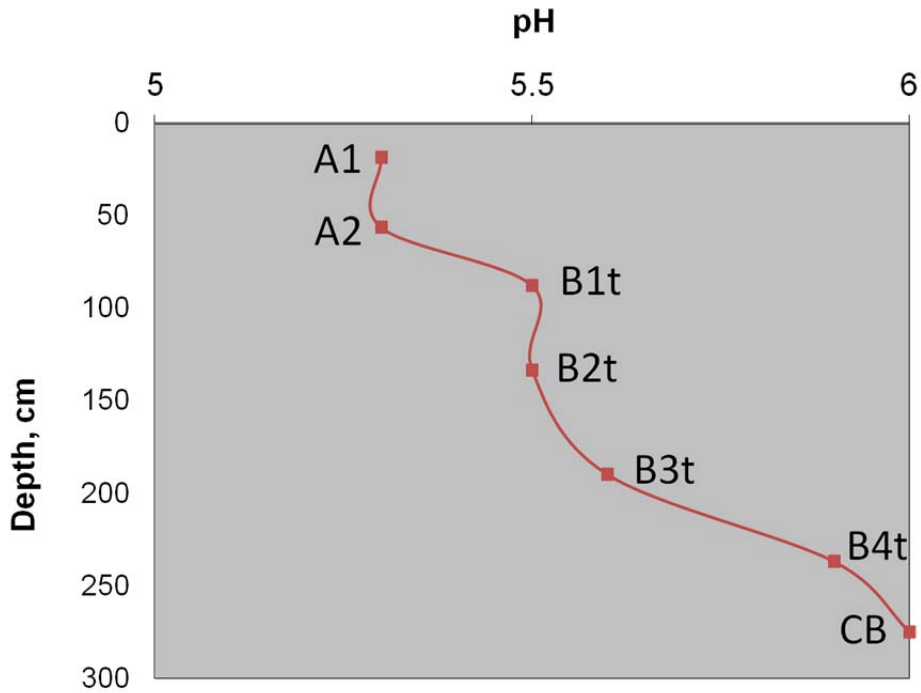

Figure 5. The pH in Soil Profile No. 1 is strongly acid in the surface, becoming medium acid in the subsoil.

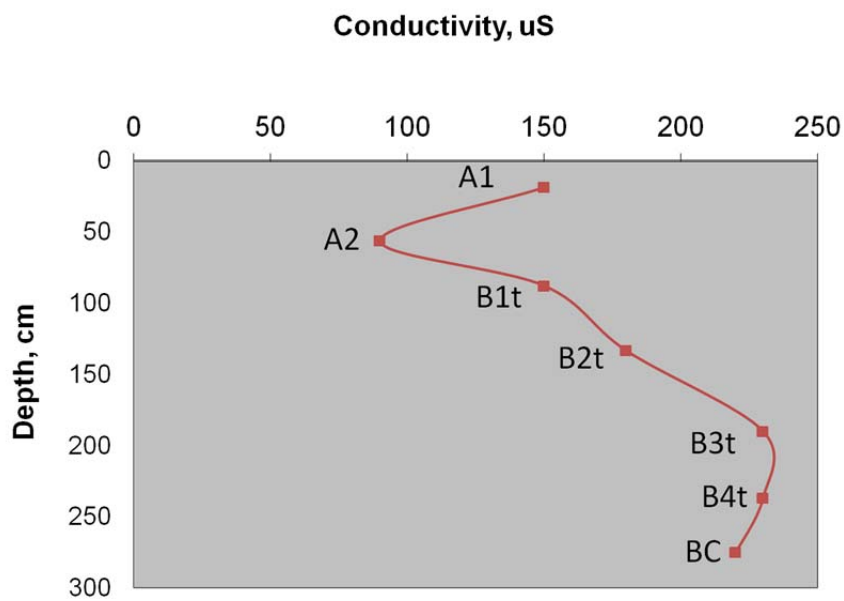

Figure 6. Soil conductivity (related to salt content) in Soil Profile No. 1 tends to increase with depth, with the maximum in the B3t and B4t. An increase in conductivity in the surface is sometimes the result of the recent application of fertilizer.

May 1, 2013

SOILS GLOSSARY

AGE. Elapsed time in calendar years. Because the cosmic production of C-14 has varied during the Quaternary, radiocarbon years (expressed as ky B.P.) must be corrected by using tree-ring and other data. Abbreviations used for corrected ages are: ka (kilo anno or years in thousands) or Ma (millions of years). Abbreviations used for intervals are: yr (years), ky (thousands of years). radiocarbon ages = yr B.P. Calibrated ages are calculated from process assumptions, relative ages fit in a sequence, and correlated ages refer to a matching unit. (See also yr B.P., HOLOCENE, PLEISTOCENE, QUATERNARY, PEDOCHRONOLOGY).

AGGRADATION. A modification of the earth's surface in the direction of uniformity of grade by deposition.

ALKALI (SODIC) SOIL. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 % or more of the total exchangeable bases), or both, that plant growth is restricted.

ALKALINE SOIL. Any soil that has a pH greater than 7.3. (See Reaction, Soil.)

ANGULAR ORPHANS. Angular fragments separated from weathered, well-rounded cobbles in colluvium derived from conglomerate.

ARGILLAN. (See Clay Film.)

ARGILLIC horizon. A horizon containing clay either translocated from above or formed in place through pedogenesis.

ALLUVIATION. The process of building up of sediments by a stream at places where stream velocity is decreased. The coarsest particles settle first and the finest particles settle last.

ANOXIC. (See also GLEYED SOIL). A soil having a low redox potential.

AQUICLUDE. A saturated body of sediment or rock that is incapable of transmitting significant quantities of water under ordinary hydraulic gradients.

AQUITARD. A body of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs but may serve as a storage unit for groundwater.

ATTERBERG LIMITS. The moisture content at which a soil passes from a semi-solid to a plastic state (plastic limit, PL) and from a plastic to a liquid state (liquid limit, LL). The plasticity index (PI) is the numerical difference between the LL and the PL.

BEDROCK. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

BISEQUUM. Two soils in vertical sequence, each soil containing an eluvial horizon and its underlying B horizon.

BOUDIN, BOUDINAGE. From a French word for sausage, describes the way that layers of rock break up under extension. Imagine the hand, fingers together, flat on the table, encased in soft clay and being squeezed from above, as being like a layer of rock. As the spreading clay moves the fingers (sausages) apart, the most mobile rock fractions are drawn or squeezed into the developing gaps.

BURIED SOIL. A developed soil that was once exposed but is now overlain by a more recently formed soil.

CALCAREOUS SOIL. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

CARBONATE MORPHOLOGY STAGES. Descriptive classes of calcite precipitation indicating increasing pedogenesis over time:

Stage	Description	Percent Carbonate
I	Bk horizon with few filaments and coatings	<10
I+	Bk with common filaments and continuous clast coatings	<10
II	Bk with continuous clast coatings, white masses, few nodules	>10
II+	Bk as above, but matrix is completely whitened, common nodules	>15
>II	K horizon that is 90% white, many nodules	>20
III+	K that is completely plugged	>40
IV	K as above, but upper part cemented and has weak platy structure	>50
V	K same as above, but laminar layer is strong with incipient brecciation	>50
VI	K brecciation and recementation, as well as pisoliths, are common	>50

CATENA. A sequence of soils of about the same age, derived from similar parent material and forming under similar climatic conditions, but having different characteristics due to variation in relief and drainage. (See also TOPOSEQUENCE.)

CEC. Cation exchange capacity. The amount of negative charge balanced by positively charged ions (cations) that are exchangeable by other cations in solution (meq/100 g soil = cmol(+)/kg soil).

CLAY. As a soil separate, the mineral soil particles are less than 0.002 mm in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

CLAY FILM. A coating of oriented clay on the surface of a sand grain, pebble, soil aggregate, or ped. Clay films also line pores or root channels and bridge sand grains. Frequency classification is based on the percent of the ped faces and/or pores that contain films: very few--<5%; few--5-25%; common--25-50%; many--50-90%; and continuous--90-100%. Thickness classification is based on visibility of sand grains: thin--very fine sand grains standout; moderately thick--very fine sand grains impart microrelief to film; thick--fine sand grains enveloped by clay and films visible without magnification. Synonyms: clay skin, clay coat, argillan, illuviation cutan.

CLAY LAMELLAE. Thin, generally wavy bands that appear as multiple micro-Bt horizons at the base of the solum in sandy Holocene deposits. The lamellae generally are 1-3 cm in thickness and 5 to 30 cm apart. There may be two to six or more clay lamellae comprising the Bt horizon of such a soil.

COBBLE. Rounded or partially rounded fragments of rock ranging from 7.5 to 25 cm in diameter.

COLLUVIUM. Any loose mass of soil or rock fragments that moves downslope largely by the force of gravity. Usually it is thicker at the base of the slope.

COLLUVIUM-FILLED SWALE. The prefailure topography of the source area of a debris flow.

COMPARATIVE PEDOLOGY. The comparison of soils, particularly through examination of features known to evolve through time.

CONCRETIONS. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

CONDUCTIVITY. The ability of a soil solution to conduct electricity, generally expressed as

the reciprocal of the electrical resistivity. Electrical conductance is the reciprocal of the resistance (1/R = 1/ohm = ohm^{-1} = mho [reverse of ohm] = siemens = S), while electrical conductivity is the reciprocal of the electrical resistivity (EC = 1/r = 1/ohm-cm = mho/cm = S/cm or mmho/cm = dS/m). EC, expressed as uS/cm, is equivalent to the ppm of salt in solution when multiplied by 0.640. Pure rain water has an EC of 0, standard 0.01 N KCl is 1411.8 uS at 25C, and the growth of salt-sensitive crops is restricted in soils having saturation extracts with an EC greater than 2,000 uS/cm. Measurements in soils are usually performed on 1:1 suspensions containing one part by weight of soil and one part by weight of distilled water.

CONSISTENCE, SOIL. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are --

Loose.--Noncoherent when dry or moist; does not hold together in a mass.

Friable.--When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.--When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.--When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.--When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.--When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.--When dry, breaks into powder or individual grains under very slight pressure.

Cemented.--Hard and brittle; little affected by moistening.

CTPOT. Easily remembered acronym for climate, topography, parent material, organisms, and time; the five factors of soil formation.

CUMULIC. A soil horizon that has undergone aggradation coincident with its active development.

CUTAN. (See Clay Film.)

DEBRIS FLOW. Incoherent or broken masses of rock, soil, and other debris that move downslope in a manner similar to a viscous fluid.

DEBRIS SLOPE. A constant slope with debris on it from the free face above.

DEGRADATION. A modification of the earth's surface by erosion.

DURIPAN. A subsurface soil horizon that is cemented by illuvial silica, generally deposited as opal or microcrystalline silica, to the degree that less than 50 percent of the volume of air-dry fragments will slake in water or HCl.

ELUVIATION. The removal of soluble material and solid particles, mostly clay and humus, from a soil horizon by percolating water.

EOLIAN. Deposits laid down by the wind, landforms eroded by the wind, or structures such as ripple marks made by the wind.

FAULT-LINE SCARP. A scarp that has been produced by differential erosion along an old fault line.

FAULTSLIDE. A landslide that shows physical evidence of its interaction with a fault.

FIRST-ORDER DRAINAGE. The most upstream, field-discernible concavity that conducts water and sediments to lower parts of a watershed.

FLOOD PLAIN. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

FOSSIL FISSURE. A buried rectilinear chamber associated with extension due to ground movement. The chamber must be oriented along the strike of the shear and must have vertical and horizontal dimensions greater than its width. It must show no evidence of faunal activity and its walls may have silt or clay coatings indicative of frequent temporary saturation with ground water. May be mistaken for an animal burrow. Also known as a paleofissure.

FRIABILITY. Term for the ease with which soil crumbles. A friable soil is one that crumbles easily.

GENESIS, SOIL. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum (A and B horizons) from the unconsolidated parent material.

GEOMORPHIC. Pertaining to the form of the surface features of the earth. Specifically, geomorphology is the analysis of landforms and their mode of origin.

GLEYED SOIL. A soil having one or more neutral gray horizons as a result of water logging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent water logging.

GRAVEL. Rounded or angular fragments of rock 2 to 75 mm in diameter. Soil textures with >15% gravel have the prefix "gravelly" and those with >90% gravel have the suffix "gravel."

HIGHSTAND. The highest elevation reached by the ocean during an interglacial period.

HOLOCENE. The most recent epoch of geologic time, extending from 10 ka to the present.

HORIZON, SOIL. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major soil horizons:

> O horizon.--The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.
>
> A horizon.--The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).
>
> E horizon -- This eluvial horizon is light in color, lying beneath the A horizon and above the B horizon. It is made up mostly of sand and silt, having lost most of its clay and iron oxides through reduction, chelation, and translocation.
>
> B horizon.--The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these.
>
> C horizon.--The relatively unweathered material immediately beneath the solum. Included are sediment, saprolite, organic matter, and bedrock excavatable with a spade. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a number precedes the letter C.
>
> R horizon.--Consolidated rock not excavatable with a spade. It may contain a few cracks filled with roots or clay or oxides. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Major horizons may be further distinguished by applying prefix Arabic numbers to designate differences in parent materials as they are encountered (e.g., 2B, 2BC, 3C) or by applying suffix numerals to designate minor changes (e.g., B1, B2).

The following is from the Natural Resources Conservation Service, except for the proposed addition of mn:

“Suffix Symbols

Lowercase letters are used as suffixes to designate specific kinds of master horizons and layers.

The term “accumulation” is used in many of the definitions of such horizons to indicate that these horizons must contain more of the material in question than is presumed to have been present in the parent material. The suffix symbols and their meanings are as follows:

a Highly decomposed organic material

This symbol is used with O to indicate the most highly decomposed organic materials, which have a fiber content of less than 17 percent (by volume) after rubbing.

b Buried genetic horizon

This symbol is used in mineral soils to indicate identifiable buried horizons with major genetic features that were developed before burial. Genetic horizons may or may not have formed in the overlying material, which may be either like or unlike the assumed parent material of the buried soil. This symbol is not used in organic soils, nor is it used to separate an organic layer from a mineral layer.

c *Concretions or nodules*

This symbol indicates a significant accumulation of concretions or nodules. Cementation is required. The cementing agent commonly is iron, aluminum, manganese, or titanium. It cannot be silica, dolomite, calcite, or more soluble salts.

co *Coprogenous earth*

This symbol, used only with L, indicates a limnic layer of coprogenous earth (or sedimentary peat).

d *Physical root restriction*

This symbol indicates noncemented, root-restricting layers in natural or human-made sediments or materials. Examples are dense basal till, plowpans, and other mechanically compacted zones.

di *Diatomaceous earth*

This symbol, used only with L, indicates a limnic layer of diatomaceous earth.

e *Organic material of intermediate decomposition*

This symbol is used with O to indicate organic materials of intermediate decomposition. The fiber content of these materials is 17 to 40 percent (by volume) after rubbing.

f *Frozen soil or water*

This symbol indicates that a horizon or layer contains permanent ice. The symbol is not

used for seasonally frozen layers or for dry permafrost.

ff *Dry permafrost*

This symbol indicates a horizon or layer that is continually colder than 0° C and does not contain enough ice to be cemented by ice. This suffix is not used for horizons or layers that have a temperature warmer than 0° C at some time of the year.

g *Strong gleying*

This symbol indicates either that iron has been reduced and removed during soil formation or that saturation with stagnant water has preserved it in a reduced state. Most of the affected layers have chroma of 2 or less, and many have redox concentrations. The low chroma can represent either the color of reduced iron or the color of uncoated sand and silt particles from which iron has been removed. The symbol g is not used for materials of low chroma that have no history of wetness, such as some slates or E horizons. If g is used with B, pedogenic change in addition to gleying is implied. If no other pedogenic change besides gleying has taken place, the horizon is designated Cg.

h *Illuvial accumulation of organic matter*

This symbol is used with B to indicate the accumulation of illuvial, amorphous, dispersible complexes of organic matter and sesquioxides if the sesquioxide component is dominated by aluminum but is present only in very small quantities. The organo-sesquioxide material coats sand and silt particles. In some horizons these coatings have coalesced, filled pores, and cemented the horizon. The symbol h is also used in combination with s as “Bhs” if the amount of the sesquioxide component is significant but the color value and chroma, moist, of the horizon are 3 or less.

i *Slightly decomposed organic material*

This symbol is used with O to indicate the least decomposed of the organic materials. The fiber content of these materials is 40 percent or more (by volume) after rubbing.

j *Accumulation of jarosite*

Jarosite is a potassium or iron sulfate mineral that is commonly an alteration product of pyrite that has been exposed to an oxidizing environment. Jarosite has hue of 2.5Y or yellower and normally has chroma of 6 or more, although chromas as low as 3 or 4 have been reported. [Note: No longer used to indicate “juvenile.”]

jj *Evidence of cryoturbation*

Evidence of cryoturbation includes irregular and broken horizon boundaries, sorted rock fragments, and organic soil materials existing as bodies and broken layers within and/or

between mineral soil layers. The organic bodies and layers are most commonly at the contact between the active layer and the permafrost.

k *Accumulation of secondary carbonates*

This symbol indicates an accumulation of visible pedogenic calcium carbonate (less than 50 percent, by volume). Carbonate accumulations exist as carbonate filaments, coatings, masses, nodules, disseminated carbonate, or other forms.

kk *Engulfment of horizon by secondary carbonates*

This symbol indicates major accumulations of pedogenic calcium carbonate. The suffix kk is used when the soil fabric is plugged with fine grained pedogenic carbonate (50 percent or more, by volume) that exists as an essentially continuous medium. The suffix corresponds to the stage III plugged horizon or higher of the carbonate morphogenetic stages (Gile et al., 1966).

m *Cementation or induration*

This symbol indicates continuous or nearly continuous cementation. It is used only for horizons that are more than 90 percent cemented, although they may be fractured. The cemented layer is physically root-restrictive. The dominant cementing agent (or the two dominant ones) may be indicated by adding defined letter suffixes, singly or in pairs. The horizon suffix km or kkm indicates cementation by carbonates; qm, cementation by silica; sm, cementation by iron; yym, cementation by gypsum; kqm, cementation by lime and silica; and zm, cementation by salts more soluble than gypsum.

ma *Marl*

This symbol, used only with L, indicates a limnic layer of marl.

mn *Mangans*

This symbol indicates an accumulation of manganese oxide, generally as ped coatings called mangans (First used by Borchardt on 20130418.)

n *Accumulation of sodium*

This symbol indicates an accumulation of exchangeable sodium.

o *Residual accumulation of sesquioxides*

This symbol indicates a residual accumulation of sesquioxides.

p *Tillage or other disturbance*

This symbol indicates a disturbance of the surface layer by mechanical means, pasturing, or similar uses. A disturbed organic horizon is designated Op. A disturbed mineral horizon is designated Ap even though it is clearly a former E, B, or C horizon.

q *Accumulation of silica*

This symbol indicates an accumulation of secondary silica.

r *Weathered or soft bedrock*

This symbol is used with C to indicate cemented layers (moderately cemented or less cemented). Examples are weathered igneous rock and partly consolidated sandstone, siltstone, or slate. The excavation difficulty is low to high.

s *Illuvial accumulation of sesquioxides and organic matter*

This symbol is used with B to indicate an accumulation of illuvial, amorphous, dispersible complexes of organic matter and sesquioxides if both the organic-matter and sesquioxide components are significant and if either the color value or chroma, moist, of the horizon is 4 or more. The symbol is also used in combination with h as "Bhs" if both the organic-matter and sesquioxide components are significant and if the color value and chroma, moist, are 3 or less.

se *Presence of sulfides*

Typically dark colors (e.g., value <4, chroma <2); may have a sulphurous odor.

ss *Presence of slickensides*

This symbol indicates the presence of slickensides. Slickensides result directly from the swelling of clay minerals and shear failure, commonly at angles of 20 to 60 degrees above horizontal. They are indicators that other vertic characteristics, such as wedge-shaped peds and surface cracks, may be present.

t *Accumulation of silicate clay*

This symbol indicates an accumulation of silicate clay that either has formed *in situ* within a horizon or has been moved into the horizon by illuviation, or both. At least some part of the horizon should show evidence of clay accumulation either as coatings on surfaces of peds or in pores, as lamellae, or as bridges between mineral grains.

u *Presence of human-manufactured materials (artifacts)*

This symbol indicates the presence of manufactured artifacts that have been created or modified by humans, usually for a practical purpose in habitation, manufacturing,

excavation, or construction activities. Examples of artifacts are processed wood products, liquid petroleum products, coal, combustion by-products, asphalt, fibers and fabrics, bricks, cinder blocks, concrete, plastic, glass, rubber, paper, cardboard, iron and steel, altered metals and minerals, sanitary and medical waste, garbage, and landfill waste.

v *Plinthite*

This symbol indicates the presence of iron-rich, humus-poor, reddish material that is firm or very firm when moist and hardens irreversibly when exposed to the atmosphere and to repeated wetting and drying.

w *Development of color or structure*

This symbol is used with B to indicate the development of color or structure, or both, with little or no apparent illuvial accumulation of material. It should not be used to indicate a transitional horizon.

x *Fragipan character*

This symbol indicates a genetically developed layer that has a combination of firmness and brittleness and commonly a higher bulk density than the adjacent layers. Some part of the layer is physically root-restrictive.

y *Accumulation of gypsum*

This symbol indicates an accumulation of gypsum (<50% by volume).

yy *Dominance of gypsum*

This symbol indicates an accumulation of gypsum (>50% by volume); light colored (e.g., value >7, chroma <4); may be pedogenically derived or inherited transformation of primary gypsum from parent material.

z *Accumulation of salts more soluble than gypsum*

This symbol indicates an accumulation of salts that are more soluble than gypsum; e.g., NaCl.

HUMUS. The well-decomposed, more or less stable part of the organic matter in mineral soils.

ILLUVIATION. The deposition by percolating water of solid particles, mostly clay or humus, within a soil horizon.

INTERFLUVE. The land lying between streams.

ISOCHRONOUS BOUNDARY. A gradational boundary between two sedimentary units

indicating that they are approximately the same age. Opposed to a nonisochronous boundary, which by its abruptness indicates that it delineates units having significant age differences.

KROTOVINA. An animal burrow filled with soil.

LEACHING. The removal of soluble material from soil or other material by percolating water.

LOWSTAND. The lowest elevation reached by the ocean during a glacial period.

MANGAN. A thin coating of manganese oxide (cutan) on the surface of a sand grain, pebble, soil aggregate, or ped. Mangans also line pores or root channels and bridge sand grains.

MODERN SOIL. The portion of a soil section that is under the influence of current pedogenetic conditions. It generally refers to the uppermost soil regardless of age.

MODERN SOLUM. The combination of the A and B horizons in the modern soil.

MORPHOLOGY, SOIL. The physical make-up of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

MOTTLING, SOIL. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance--few, common, and many; size--fine, medium, and coarse; and contrast--faint, distinct and prominent. The size measurements are these: fine, less than 5 mm in diameter along the greatest dimension; medium, from 5 to 15 mm, and coarse, more than 15 mm.

MRT (MEAN RESIDENCE TIME.) The average age of the carbon atoms within a soil horizon. Under ideal reducing conditions, the humus in a soil will have a C-14 age that is half the true age of the soil. In oxic soils humus is typically destroyed as fast as it is produced, generally yielding MRT ages no older than 300-1000 years, regardless of the true age of the soil.

MUNSELL COLOR NOTATION. Scientific description of color determined by comparing soil to a Munsell Soil Color Chart (Available from Macbeth Division of Kollmorgen Corp., 2441 N. Calvert St., Baltimore, MD 21218). For example, dark yellowish brown is denoted as 10YR3/4m in which the 10YR refers to the hue or proportions of yellow and red, 3 refers to value or lightness (0 is black and 10 is white), 4 refers to chroma (0 is pure black and white and 20 is the pure color), and m refers to the moist condition rather than the dry (d) condition.

OVERBANK DEPOSIT. Fine-grained alluvial sediments deposited from floodwaters outside of the fluvial channel.

OXIC. A soil having a high redox potential. Such soils typically are well drained, seldom being waterlogged or lacking in oxygen. Rubification in such soils tends to increase with age.

PALEO SOIL TONGUE. A soil tongue that formed during a previous soil-forming interval.

PALEOSEISMOLOGY. The study of prehistoric earthquakes through the examination of soils, sediments, and rocks.

PALEOSOL. A soil that formed on a landscape in the past with distinctive morphological features resulting from a soil-forming environment that no longer exists at the site. The former pedogenic process was either altered because of external environmental change or interrupted by burial.

PALINSPASTIC RECONSTRUCTION. Diagrammatic reconstruction used to obtain a picture of what geologic and/or soil units looked like before their tectonic deformation.

PARENT MATERIAL. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

PED. An individual natural soil aggregate, such as a granule, a prism, or a block.

PEDOCHRONOLOGY. The study of pedogenesis with regard to the determination of when soil formation began, how long it occurred, and when it stopped. Also known as soil dating. Two ages and the calculated duration are important:

t_o = age when soil formation or aggradation began, ka

t_b = age when the soil or stratum was buried, ka

t_d = duration of soil development or aggradation, ky

Pedochronological estimates are based on available information. All ages should be considered subject to $\pm$50% variation unless otherwise indicated.

PEDOCHRONOPALEOSEISMOLOGY. The study of prehistoric earthquakes by using pedochronology.

PEDOLOGY. The study of the process through which rocks, sediments, and their constituent minerals are transformed into soils and their constituent minerals at or near the surface of the earth.

PEDOGENESIS. The process through which rocks, sediments, and their constituent minerals are transformed into soils and their constituent minerals at or near the surface of the earth.

PERCOLATION. The downward movement of water through the soil.

pH VALUE. The negative log of the hydrogen ion concentration. Measurements in soils are usually performed on 1:1 suspensions containing one part by weight of soil and one part by weight of distilled water. A soil with a pH of 7.0 is precisely neutral in reaction because it is

neither acid nor alkaline. An acid or "sour" soil is one that gives an acid reaction; an alkaline soil is one that gives an alkaline reaction. In words, the degrees of acidity or alkalinity are expressed as:

Extremely acid	<4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	>9.0
Used if significant:	
Very slightly acid	6.6 to 6.9
Very mildly alkaline	7.1 to 7.3

PHREATIC SURFACE. (See Water Table.)

PLANATION. The process of erosion whereby a portion of the surface of the Earth is reduced to a fundamentally even, flat, or level surface by a meandering stream, waves, currents, glaciers, or wind.

PLEISTOCENE. An epoch of geologic time extending from 10 ka to 1.8 Ma; it includes the last Ice Age.

PROFILE, SOIL. A vertical section of the soil through all its horizons and extending into the parent material.

QUATERNARY. A period of geologic time that includes the past 1.8 Ma. It consists of two epochs--the Pleistocene and Holocene.

PROGRADATION. The building outward toward the sea of a shoreline or coastline by nearshore deposition.

RELICT SOIL. A surface soil that was partly formed under climatic conditions significantly

different from the present.

RUBIFICATION. The reddening of soils through the release and precipitation of iron as an oxide during weathering. Munsell hues and chromas of well-drained soils generally increase with soil age.

SALINE SOIL. A soil that contains soluble salts in amounts that impair the growth of crop plants but that does not contain excess exchangeable sodium.

SAND. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 mm. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

SECONDARY FAULT. A minor fault that bifurcates from or is associated with a primary fault. Movement on a secondary fault never occurs independently of movement on the primary, seismogenic fault.

SHORELINE ANGLE. The line formed by the intersection of the wave-cut platform and the sea cliff. It approximates the position of sea level at the time the platform was formed.

SILT. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 mm) to the lower limit of very find sand (0.05 mm.) Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

SLICKENSIDES. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may form along a fault plane; at the bases of slip surfaces on steep slopes; on faces of blocks, prisms, and columns undergoing shrink-swell. In tectonic slickensides the striations are strictly parallel.

SLIP RATE. The rate at which the geologic materials on the two sides of a fault move past each other over geologic time. The slip rate is expressed in mm/yr, and the applicable duration is stated. Faults having slip rates less than 0.01 mm/yr are generally considered inactive, while faults with Holocene slip rates greater than 0.1 mm/yr generally display tectonic geomorphology.

SMECTITE. A fine, platy, aluminosilicate clay mineral that expands and contracts with the absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when moist.

SOIL. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

SOIL SEISMOLOGIST. Soil scientist who studies the effects of earthquakes on soils.

SOIL SLICKS. Curvilinear striations that form in swelling clayey soils, where there is marked change in moisture content. Clayey slopes buttressed by rigid materials may allow minor amounts of gravitationally driven plastic flow, forming soil slicks sometimes mistaken for evidence of tectonism. Soil slicks disappear with depth and the striations are seldom strictly parallel as they are when movement is major. (See also SLICKENSIDES.)

SOIL TECTONICS. The study of the interactions between soil formation and tectonism.

SOIL TONGUE. That portion of a soil horizon extending into a lower horizon.

SOLUM. Combined A and B horizons. Also called the true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

STONELINE. A thin, buried, planar layer of stones, cobbles, or bedrock fragments. Stonelines of geological origin may have been deposited upon a former land surface. The fragments are more often pebbles or cobbles than stones. A stoneline generally overlies material that was subject to weathering, soil formation, and erosion before deposition of the overlying material. Many stonelines seem to be buried erosion pavements, originally formed by running water on the land surface and concurrently covered by surficial sediment.

STRATH TERRACE. A gently sloping terrace surface bearing little evidence of aggradation.

STRUCTURE, SOIL. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are--platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

SUBSIDIARY FAULT. A branch fault that extends a substantial distance from the main fault zone.

TECTOTURBATION. Soil disturbance resulting from tectonic movement.

TEXTURE, SOIL. Particle size classification of a soil, generally given in terms of the USDA system which uses the term "loam" for a soil having equal properties of sand, silt, and clay. The basic textural classes, in order of their increasing proportions of fine particles are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sand clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

TOPOSEQUENCE. A sequence of kinds of soil in relation to position on a slope. (See also CATENA.)

TRANSLOCATION. The physical movement of soil particles, particularly fine clay, from one soil horizon to another under the influence of gravity.

UNIFIED SOIL CLASSIFICATION SYSTEM. The particle size classification system used by the U.S. Army Corps of Engineers and the Bureau of Reclamation. Like the ASTM and AASHO systems, the sand/silt boundary is at 80 um instead of 50 um used by the USDA. Unlike all other systems, the gravel/sand boundary is at 4 mm instead of 2 mm and the silt/clay boundary is determined by using Atterberg limits.

VERTISOL. A soil with at least 30% clay, usually smectite, that fosters pronounced changes in volume with change in moisture. Cracks greater than 1 cm wide appear at a depth of 50 cm during the dry season each year. One of the ten USDA soil orders.

WATER TABLE. The upper limit of the soil or underlying rock material that is wholly saturated with water. Also called the phreatic surface.

WAVE-CUT PLATFORM. The relatively smooth, slightly seaward-dipping surface formed along the coast by the action of waves generally accompanied by abrasive materials.

WEATHERING. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

WETTING FRONT. The greatest depth affected by moisture due to precipitation.

yr B.P. Uncorrected radiocarbon age expressed in years before present, calculated from 1950. Calendar-corrected ages are expressed in ka, or, if warranted, as A.D. or B.C.

PRELIMINARY GEOTECHNICAL REPORT

SOUTH CAMINO PABLO ANNEXATION PROJECT
SUBDIVISION 9396
MORAGA, CALIFORNIA

Submitted to:
Mr. Matt Dobbins
Dobbins Properties, LLC
1901 W. Kettleman Lane, Suite 102
Lodi, CA 95242

Prepared by:
ENGEO Incorporated

March 25, 2015

Project No:
10741.000.000

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Project No.
10741.000.000

March 25, 2015

Mr. Matt Dobbins
Dobbins Properties, LLC
1901 W. Kettleman Lane, Suite 102
Lodi, CA 95242

Subject: South Camino Pablo Annexation Project
Subdivision 9396
Moraga, California

PRELIMINARY GEOTECHNICAL REPORT

Dear Mr. Dobbins:

With your authorization, we have completed this preliminary geotechnical exploration report for your property located at 1211 Camino Pablo in Moraga, California. The accompanying report presents the findings of our previous field exploration together with our conclusions and preliminary recommendations regarding residential development at the site.

Our findings indicate that the project site is suitable for the proposed development provided the preliminary recommendations provided in this report are incorporated in the project planning. Additional design-level exploration services will be needed to develop recommendations for grading, drainage, and foundation design. We are pleased to have been of service to you on this project and are prepared to consult further with you and your design team as the project progresses.

Sincerely

ENGEO Incorporated

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

We completed a preliminary geologic exploration that included the project site dated January 21, 2014. The purpose of our study is to provide updated conclusions regarding the geotechnical considerations for the project and updated preliminary recommendations in support of project planning and preliminary design with consideration to these changes.

The scope of our services included the following:

- Review of previously published reports for the Camino Pablo property.
- Analysis of the geological and geotechnical data.
- Review of the Vesting Tentative Map dated March 2015.
- Preparation of this report, which compiles previous data and summarizes our findings and preliminary geotechnical design recommendations.

We prepared this report exclusively for Dobbins Properties, LLC and their design team consultants. ENGEO should review any changes made in the character, design or layout of the development to modify the conclusions and recommendations contained in this report, as necessary. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without the express written consent of ENGEO.

1.2 SITE LOCATION AND DESCRIPTION

The project site is currently undeveloped and is located in an area of relatively steep hillside terrain as shown on the Vicinity Map, Figure 1. The site is open grassland that is currently used for grazing. Existing improvements appear to be limited to perimeter fencing.

1.3 PROPOSED DEVELOPMENT

Based on the Draft Vesting Tentative Map (VTM) prepared by DK Consulting dated March 2015, the planned development will consist of 13 single-family residential lots (Figure 2). The plan depicts cuts up to 17 feet deep and fills up to 30 feet thick the achieve the desired grades. A 3:1 (horizontal: vertical) cut slope is shown extending up from Street “A” approximately 125 feet in the vicinity of Lots 1 and 2, with a midslope debris bench. Retaining walls up to approximately 5 feet high are shown at various locations throughout the development. A long narrow C3 basin is shown below Lots 9 through 13, at the toe-of-slope. Other site improvements are anticipated to include underground utilities and an improved street with access from Camino Pablo.

1.4 PREVIOUS GEOTECHNICAL AND GEOLOGICAL STUDY

In 2013, ENGEO provided a preliminary geotechnical evaluation, which included recommendations for a fault trench study based on regional geologic mapping and aerial photograph review. In 2014, we conducted a preliminary geologic exploration including a trench 176 lineal feet excavated crossing perpendicular to a regionally mapped thrust fault (Crane, 1988) and excavation of eight exploratory test pits to characterize landsliding at the site.

2.0 GEOLOGY AND SEISMICITY

2.1 AERIAL PHOTOGRAPH INTERPRETATION

Several sets of aerial photographs (see list of references) were examined to study geomorphic features that could be associated with faulting and landsliding at the site. Based on our review of the mapping by Nilsen (1975), examination of aerial photographs and site reconnaissance, areas that appear to be underlain by landslide deposits were mapped as shown on the Preliminary Geologic Map, Figure 2.

The thrust fault mapped by Crane (1988) crosses a topographic saddle and is aligned along linear valleys on both sides of the saddle. Based on our review of aerial photographs, we did not observed scarps, tonal lineations or others features that are sometimes indicative of active faulting along the trace of the fault mapped by Crane. In some photographs, vegetation exhibits a darker tone in the linear valley; however, this darker tone appears to be associated with the thicker colluvial soils. It also appears that the linear valley is parallel to the strike of bedrock structure. The linear valley may be related to differential erosion rather than faulting. The ridges adjacent to the valley appear to be underlain by sandstone beds that are more resistant to erosion than the claystone that was encountered in the linear valley.

2.2 REGIONAL GEOLOGY

The study area is located in the Coast Ranges geomorphic province of California. The Coast Ranges are characterized by a series of northwest-trending valleys and mountain ranges. The bedrock in this region has been folded and faulted in a tectonic setting that is experiencing translational and compressional deformations of the earth's crust.

Regional geologic mapping by Graymer et al. (1994) indicates that the study area is underlain by bedrock of the lower member of the Mulholland formation. Bedrock structure in the area is mapped striking to the northwest and dipping to the northeast.

2.2.1 Geologic Mapping

During our previous exploration, ENGEO geologists performed geologic mapping at the site. Below are descriptions of the geologic units observed during mapping and encountered during our explorations at the site as shown on Figure 2.

2.2.1.1 Landslides

In 2014, we performed a site-specific landslide evaluation, including interpretation of low-altitude stereo-paired aerial photographs, and a field reconnaissance to map the landslides. In general, the landslides at the site are approximately 5 to 15 feet thick and can be described as earthflow complexes. Earthflows are a type of landslide that is characterized by mobilization as a viscous, slow-moving mass. Earthflows commonly move by a combination of semi-fluid flow and sliding along weak clay slip planes. Earthflows typically form when cohesive, clayey soils or weak bedrock experience an increase in pore-water pressure and fail. Like debris flows, they commonly mobilize as a result of intense rains, but, due to their high clay content, they tend to move relatively slowly, and movements usually persist for some time following peak rainfalls. Successive earthflows often accumulate as lobate masses of soil with pervasive internal shearing, forming earthflow complexes. The results of our landslide mapping is shown on the geologic map, Figure 2.

2.2.1.2 Surficial Soils and Colluvium (Qc)

The surface of the site is typically mantled stiff to very stiff dark brown silty clay derived from weathering of the underlying parent material. The thickness of surficial soils is typically 2 to 4 feet on upland peaks, shoulders, and spur ridges. The parent materials on the site typically consist of poorly indurated bedrock, both of which contain a high proportion of fine-grained expansive clay.

Deposits of colluvium consisting of transported surficial soil have accumulated in the low-lying portions of the site as depicted on Figure 2, and may be on the order of 20 to 25 feet thick along Camino Pablo.

2.2.1.3 Bedrock Formations

The Mulholland Formation bedrock underlying the project area was found to consist of claystone, siltstone and sandstone in our test pits and trench. The claystone and siltstone is often moderately to highly weathered, closely fractured and weak. The claystone within the Mulholland Formation at the site may have a moderate to high expansion potential. Bedding structure, measured during our exploration, generally strikes northwest and is dipping 46 to 65 degrees northeast.

2.3 FAULTING AND SEISMICITY

The site is not within a State of California Earthquake Fault Zone for known active faults. The nearest known active fault is the Hayward fault, which is located about 4 miles to the southwest of the site. Other active faults in the region include the Calaveras fault located about 5 miles to the east, and the San Andreas fault located about 22 miles to the southwest.

A southwest dipping thrust fault is mapped by Crane (1988) crossing the southwestern portion of the site as shown the attached Regional Geologic Map, Figure 3. A southwest dipping thrust fault is also mapped by Graymer et al. (1994) and Wagner (1978) roughly coincident with Camino Pablo. These mapped thrust faults are not considered active or potentially active based on maps showing recency of faulting by Bortugno (1991) or Jennings and Bryant (2010).

Figure 4 shows the approximate location of Quaternary faults and significant historic earthquakes mapped within the San Francisco Bay Region.

The 2014 Working Group on California Earthquake Probabilities evaluated the regional seismicity of the Bay Area and published their results as The Uniform California Earthquake Rupture Forecast, Version 3 (UCERF 3). The Working Group periodically attempts to summarize seismic risk in California with time-dependent earthquake rupture forecasts, in which the probabilities of future events are conditioned upon the dates of previous earthquakes. According to UCERF 3, there is an aggregated 72 percent probability of 6.7 M_W or greater earthquake on an active Bay Area fault over the next 30 years. The probability of a 6.7M_W or greater earthquake on the Hayward Fault, Calaveras and San Andreas faults are 14, 7, and 6 percent, respectively, over the next 30 years.

3.0 GEOTECHNICAL EXPLORATION

The field exploration for this study was conducted during January 2014, and consisted of excavating eight test pits and one exploratory trench at the approximate locations shown on the Preliminary Geologic Map, Figure 2. The test pits and trench were excavated using a track-mounted excavator. An ENGEO geologist logged the conditions exposed on the excavations and the logs are provided in Appendix A.

After completion of logging, the excavations were backfilled using nominal compactive effort by the excavator bucket and trackwalking the surface. Depending on future grading activities in this area, it should be anticipated that the excavation spoils will need to be removed and replaced as engineered fill.

3.1 FAULT EXPLORATION

Exploratory Trench T-1, totaled approximately 176 lineal feet, and was excavated perpendicular to the thrust fault mapped by Crane (1988) at the location shown on Figure 2. The trench was located in the field by tape measuring from existing features. The log of the trench is included in Appendix A. The trench extended across a relatively well-defined topographic saddle between two ridges.

The depth of the trench averaged about 9 feet below the adjacent ground surface. The southeastern wall of the trench was cleaned with hand tools and examined by ENGEO geologists. The exposure was logged at a horizontal and vertical scale of 1 inch to 5 feet. A level line was established in the trench and measurements were referenced to this line.

Bedrock of the Mulholland formation was encountered at both the northeast and southwest ends of the trench. In the central section of the trench, thick colluvial soil deposits were encountered and bedrock was not exposed. As indicated on the trench log, several soil strata were mapped and were observed to be continuous across the trench exposure. No shears, clay gouge or other indications of faulting were observed in the trench exposure.

The services of a soil scientist, Dr. Glen Borchardt, were retained to evaluate the relative age of the colluvial soils exposed in the trench. Dr. Borchardt prepared a detailed log of the soil profile, performed laboratory testing and analysis of the soil stratigraphy. The report prepared by Dr. Borchardt is presented in Appendix B to this report. Dr. Borchardt's report indicates that the colluvial soils exposed in the trench represent deposition and soil development that has occurred over roughly the last 40,000 years. Based on this finding, no evidence of active faulting was found in Trench T-1.

3.2 TEST PIT EXPLORATION

Eight exploratory test pits were excavated to depths of about 6 to 14 feet below grade. In Test Pit TP-1, colluvial soil deposits were encountered to a depth of 14 feet. The colluvium consisted of dark brown silty clay that was dry to moist and very stiff. Based on visual examination, the soils encountered on site appear to range from low to high plasticity.

Landslide deposits were encountered in several tests pits consisting of predominately soil material. Well-defined basal slide planes were encountered in Test Pits TP- 4 and TP-5. Based on the findings of our exploration, the landslide deposits appear to range from about 5 to 15 feet thick.

Bedrock encountered in the test pits consisted of interbedded claystone, siltstone and sandstone. The bedrock is typically weak, highly fractured and varies from thinly to thickly bedded. Bedrock structure was generally found to be consistent with regional mapping by Graymer (1994), striking to the northwest and dipping steeply to the northeast.

3.3 GROUNDWATER

No groundwater was encountered during the test pit and trench exploration performed in conjunction with this study. An area of suspected seepage or near surface groundwater was noted during our reconnaissance at the location indicated on Figure 2. No free water was observed in this area at the time of our site visit but green vegetation and deep hoofprints from cattle grazing suggests that seepage may occur seasonally in this area. Fluctuations in groundwater levels occur seasonally and over a period of years because of variations in precipitation, temperature, irrigation, or other factors.

4.0 DISCUSSION AND CONCLUSIONS

Based upon our previous geotechnical explorations, we conclude that development of the South Camino Pablo project is feasible from a geotechnical standpoint, provided that the recommendations included in this report, along with appropriate mitigation of geologic hazards and other sound engineering practices, are incorporated in the design and construction of the project. The primary geotechnical design considerations are the presence of landslides and unstable colluvial deposits on slopes, on-site expansive soil and bedrock and earthquake-induced strong ground shaking.

4.1 LANDSLIDE HAZARDS

As described above, several landslide areas were mapped within the study area. Our exploration indicates that these landslides range from about 5 to 15 feet thick and involve primarily soil material. These landslides appear to occur as relatively shallow slumps and earthflows. As noted on Figure 2, portions of the mapped landslides have been recently active.

Based on the proposed tentative map development, we anticipate that landslides with in the development will be mitigated including removal of slide debris and reconstruction of the slopes with subdrains and engineered fill.

4.2 EXPANSIVE SOILS

A significant geotechnical consideration is the expansive potential of the native soil and bedrock across the proposed development area. The clayey soils and claystone units within the bedrock in this region have moderate to high plasticity and moderate to critically high expansion potential.

Expansive soils shrink and swell as a result of seasonal fluctuation in moisture content, which can cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Building damage due to volume changes associated with expansive soils can be reduced through proper foundation design. Successful construction on expansive soils requires special attention during construction. It is imperative that exposed soils be kept moist by watering for several days before placement of concrete. It is extremely difficult to remoisturize clayey soils without excavation, moisture conditioning, and recompaction. Laboratory analysis should be conducted during design-level exploration to characterize expansive soils at the site.

4.3 FAULT HAZARDS

Based on the findings of our exploration, no indications of active faulting were encountered in the exploratory trench that was excavated across the location of the thrust fault that was mapped by Crane (1988). Based on these findings, it is our opinion that the potential for ground rupture from active faulting at the site is low and setbacks from the map fault are not necessary.

Based on the findings of this exploration it is uncertain if an older inactive fault exists at the location mapped by Crane (1988). Fault zones sometimes contain weak, highly expansive material that can adversely affect roadways and/or foundations. During grading operations for the project, conditions exposed along the mapped fault should be examined by the project geologist to determine if indications of faulting are exposed and if mitigation measures are needed. If indications of an inactive fault are found, mitigation measures typically involved overexcavation of the weaker material to some depth below planned finish grade and replacement of the weak material with engineered fill.

4.4 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake may include primary ground rupture, ground shaking, lurching, liquefaction, dynamic densification, lateral spreading, and earthquake-induced landsliding. These hazards are discussed below. Risks from seiches, tsunamis, and volcanic eruption are currently considered negligible.

4.4.1 Ground Rupture

No known active faults cross the South Camino Pablo project. No evidence of Holocene active faulting was observed during our site reconnaissance, aerial photo review or trenching. Based on our previous studies, field mapping, and review of aerial photographs, it is our opinion that fault-related ground rupture is unlikely at the subject property.

4.4.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the San Francisco Bay Region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, all structures shall be designed using sound engineering judgment and latest California Building Code (CBC) requirements, as a minimum. The 2013 CBC references ASCE 7-10 for minimum design loads including seismic design loads.

4.4.2.1 California Building Code Seismic Design Parameters

The 2013 California Building Code (CBC) seismic design parameters in the table below are based on a Site Class D as determined in accordance with ASCE 7-10. The parameters below include design spectral response acceleration parameters based on the mapped Risk-Targeted Maximum Considered Earthquake (MCE_R) spectral response acceleration parameters as well as the Maximum Considered Earthquake geometric mean peak ground acceleration used for geotechnical evaluation.

TABLE 4.4.2.1-1
2013 CBC Seismic Design Parameters

Parameter	Design Value
Site Class	C
Mapped MCE_R Spectral Response Acceleration at Short Periods, S_S (g)	1.634
Mapped MCE_R Spectral Response Acceleration at 1-second Period, S_1 (g)	0.642
Site Coefficient, F_A	1.00
Site Coefficient, F_V	1.30
MCE_R Spectral Response Acceleration at Short Periods, S_{MS} (g)	1.634
MCE_R Spectral Response Acceleration at 1-second Period, S_{M1} (g)	0.835
Design Spectral Response Acceleration at Short Period, S_{DS} (g)	1.089
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	0.557
Mapped MCE Geometric Mean Peak Ground Acceleration (g)	0.632
Site Coefficient, F_{PGA}	1.00
MCE Geometric Mean Peak Ground Acceleration, PGA_M (g)	0.632

4.4.3 Ground Lurching

Ground lurching is a result of the rolling motion imparted to the ground surface during energy released by an earthquake. Such rolling motion can cause ground cracks to form. The potential for the formation of these cracks is considered greater at contacts between deep alluvium and bedrock such as those at the margins of valley flood plains. Although the risk of ground lurching at the site is considered low, the risk of this hazard will be reduced through implementation of typical corrective grading measures.

4.4.4 Earthquake-Induced Landsliding

Several landslides have been mapped within or immediately adjacent to the site; therefore, the potential for earthquake-induced landsliding exists. Seismic ground shaking can trigger deformation of high graded slopes or unstable natural hillsides. Existing landslide deposits within any proposed grading envelope should be mitigated by corrective grading. In general, corrective grading should completely remove unstable soils down to in-place bedrock within the envelope of proposed improvements. Seismic slope deformation of specific slopes proposed within the project should be evaluated during preparation of the 40-scale grading plans so that appropriate foundation designs or other mitigation can be provided.

4.4.5 Liquefaction and Cyclic Softening

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded

fine-grained sands. Empirical evidence indicates that loose to medium dense gravels, silty sands, low-plasticity silts, and some low-plasticity clays are also potentially liquefiable. In addition, sensitive high-plasticity fine-grained soils may be susceptible to significant strength loss (cyclic softening) as a result of significant cyclic loading, such as imposed by earthquakes.

According to a USGS preliminary liquefaction susceptibility map for the San Francisco Bay Region (Wentworth et al., 2000), the potential for liquefaction at the project site is considered negligible.

4.4.6 Lateral Spreading

Lateral spreading involves lateral ground movements caused by seismic shaking. These lateral ground movements are often associated with a weakening or failure of an embankment or soil mass overlying a layer of liquefied or weak soils. Since the onsite soils are unlikely susceptible to liquefaction, the potential for lateral spreading at this site is considered negligible.

4.5 GROUNDWATER

No groundwater was encountered during the test pit and trench exploration performed in conjunction with this study. An area of suspected seepage or near surface ground water was noted during our reconnaissance at the location indicated on Figure 2. No free water was observed in this area at the time of our site visit but green vegetation and deep hoofprints from cattle grazing suggests that seepage may occur seasonally in this area. Fluctuations in groundwater levels occur seasonally and over a period of years because of variations in precipitation, temperature, irrigation, or other factors. Preliminarily, it is not anticipated that groundwater will be encountered during site grading.

4.6 EXCAVATABILITY

Based on our field exploration and experience in the area, it is our opinion that the site soils and bedrock should be rippable with conventional heavy construction equipment, such as a Caterpillar D-9 or larger. Localized cemented lenses or beds may be encountered that may require considerable ripping effort and generate oversized material (greater than six inches in diameter). Backhoes may experience difficulty excavating in some of the lenses of less weathered bedrock. We anticipate that heavy-duty excavators should be capable of trenching the materials.

5.0 EARTHWORK RECOMMENDATIONS

The recommendations included in this report, along with other sound engineering practices, should be incorporated in the design and construction of the project.

5.1 GRADING

All grading and site development plans should continue to be coordinated with the Engineering Geologist and the Geotechnical Engineer to modify the plans such that they mitigate known soil and geologic hazards. Detailed locations of keyways, subdrains, debris benches and subexcavation areas should be shown on the final grading plans upon their completion. Sequence of grading issues, such as placement of various cut materials in specific locations, should also be evaluated during review of final 40-scale grading plans.

The Geotechnical Engineer or qualified representative should be present during all phases of grading operations to observe demolition, site preparation, grading operations, and subdrain placement. The Geotechnical Engineer should be notified a minimum of 72 hours prior to the commencement of any grading or stripping operations at the site. This is to provide time to coordinate the work with the Grading Contractor. After the grading operations commence, geologic observations of cut areas should be made at frequent intervals. This is advised so that revised geologic recommendations can be incorporated into updated grading plans as grading proceeds.

Ponding of storm water, other than within engineered detention basins, should not be permitted at the site, particularly during work stoppage for rainy weather. Before the grading is halted by rain, positive slopes should be provided to carry the surface runoff to storm drainage structures in a controlled manner to prevent erosion damage.

5.2 SELECTION OF MATERIALS

With the exception of some organically contaminated materials (soil which contains more than 3 percent organic content by weight), we anticipate the site soils and bedrock derived materials are suitable for use as engineered fill. Other materials and debris, including trees with their root balls, should be removed from the project site.

Oversized soil or rock materials (those exceeding two-thirds of the lift thickness or 6 inches in dimension, whichever is less) should be removed from the fill and broken down to meet this requirement or otherwise off-hauled.

The Geotechnical Engineer should be informed when import materials are planned for the site. Import materials should be submitted to, and approved by, the Geotechnical Engineer prior to delivery at the site.

5.3 STRIPPING AND REMOVAL OF WEAK AND COMPRESSIBLE SOILS

Site preparation should commence with removal of site vegetation. Site development should include removal of debris, loose soil, and soft compressible materials in any location to be graded. Any soft compressible soils should be removed from areas to receive fill or structures, or

those areas to serve as borrow. Vegetation and debris should be separately stockpiled from soft compressible material and existing soil fill.

No loose or uncontrolled backfilling of depressions resulting from demolition and stripping or other soil removal should be permitted. All exploratory geologic test pits and the test trench excavated during site explorations are shown on Figure 2. It will be necessary to remove and recompact all loose soil within the test pits and the trench where it will remain below final grades and is located within proposed improvement areas. Within the development areas, excavations resulting from demolition, clearing, and/or stripping which extend below final grades should be cleaned to firm undisturbed soil as determined by the Geotechnical Engineer's representative.

5.4 EXISTING FILLS

If existing fills are encountered during grading, they should be treated as unsuitable to remain below proposed structures and should be subexcavated to expose underlying competent native soils that are approved by the Geotechnical Engineer. The base of the excavations should be processed, moisture conditioned, as needed, and compacted in accordance with the subsequent recommendations for engineered fill.

5.5 FILL PLACEMENT

Overcompaction of expansive materials (PI >12) may produce an undesirable environment for expansion in the zone of significant seasonal moisture variation; therefore, special requirements for compaction of expansive soils are necessary within the upper 5 feet in building areas. This recommendation is not to be interpreted as a requirement to remove and replace the top five feet within all lots, but is to be used when fill is placed within the top 5 feet of finished grade. The following compaction control requirements should be generally applied to engineered fills.

TABLE 5.5-1

Description	Materials	Minimum Relative Compaction (%)	Minimum Moisture Content (Percentage Points Above Optimum)
Within the upper 5 ft	Expansive	87 to 92	+5
	Non-expansive	90	+2
From 5 to 50 ft	Expansive	90	+4
	Non-expansive	95	+2

Maximum dry densities and moisture contents should be determined in accordance with ASTM D 1557. Plasticity Index determinations, and possibly supplemental swell test data, should be made as a part of grading control. All fills should be placed in lifts not exceeding 12 inches or the depth of penetration of the compaction equipment used, whichever is less.

5.6 TOE KEYWAYS

After stripping, mass grading should begin with construction of keyways and subdrains. All fills should be adequately keyed into firm natural materials unaffected by shrinkage cracks. Keyways should be compacted to 95 percent relative compaction and minimum 2 percentage points over optimum moisture content.

Anticipated keyway sizes and locations should be determined based on the final grading plans by the Engineering Geologist. Typical minimum keyway sizes and subdrains are shown on Figure 5. The actual depth of the keyways will be determined in the field by the Geotechnical Engineer during grading. Filling above keyways should be benched into firm competent soil or bedrock and drained as appropriate. Unless otherwise recommended by the Geotechnical Engineer, benches should be constructed at vertical intervals of not less than 5 feet. The actual depth and location of the keyways, subexcavated benches, and locations of subdrainage may then be slightly modified in the field by the Geotechnical Engineer, based on the actual field conditions and geometry exposed during grading. Anticipated keyway sizes and locations should be determined, by the Geotechnical Engineer, based on the final grading plans.

5.7 SUBSURFACE DRAINAGE FACILITIES

Subsurface drainage systems are planned for keyways, and at the base of removal areas, as a minimum. Secondary bench subdrains may also be required, depending upon the height of the fill slope and the slope of the underlying native terrain. In addition, observed seepage areas or suspected spring areas should be controlled in development areas through the use of subdrains. Positive fall of at least 1 percent towards an approved outlet should also be provided for all subdrains.

The recommended locations of the subdrains will be approximately located on the remedial grading plans used during site grading. As shown on Figure 6, subdrain systems should consist of a minimum 6-inch-diameter perforated pipe encased in Caltrans Class 2 permeable material, or crushed rock wrapped in filter fabric. As an alternative, prefabricated geocomposite drainage material (such as SKAPS TNS 220-6) could be considered in lieu of the granular medium above the subdrain zone.

Discharge from the subdrains will generally be low but in some instances may be continuous. Subdrains should outlet into the storm drain system or other approved outlets, and their locations should be surveyed and documented by the project Civil Engineer for future maintenance.

Not all sources of seepage are evident during the time of field work because of the intermittent nature of some of these conditions and their dependence on long-term climatic conditions. Furthermore, new sources of seepage may be created by a combination of changed topography, manmade irrigation patterns and potential utility leakage. Since uncontrolled water movements are one of the major causes of detrimental soil movements, it is of utmost importance that a

Geotechnical Engineer be advised of any seepage conditions so that remedial action may be initiated, if necessary.

5.8 DEBRIS BENCHES

A debris bench will be required upslope of Lots 1 through 5 as depicted on the VTM. The outboard side of the debris bench should be provided with a concrete V-ditch discharging into an approved outlet. The size, location, and configuration of required debris benches should be designated as part of the future site planning process.

All debris benches will require periodic maintenance consisting of the removal and disposal of accumulated slope detritus. Proper access should be provided for the heavy equipment, which may be required for removal of slide debris from benches and paved areas.

All debris benches and buttress fills should be jointly designed by the Civil and Geotechnical Engineers to optimize stability, cut/fill balance, and drainage concerns. Recommendations for mass grading are generally applicable to landslide reconstruction and buttress fill installation.

5.9 GRADED SLOPES

We recommend the following slope gradient guidelines for cut and fill slopes:

TABLE 5.9-1
Slope Gradient Guidelines

Slope Height	Maximum Allowable Slope Inclination (horizontal:vertical)
Less than 8 feet	2:1
Greater than 8 feet	3:1

Where steeper slopes than those indicated above are desired, supplemental slope stabilization techniques (e.g. geogrid reinforcing) may be required. Erosion of graded slopes could be significant in areas where slopes are not properly vegetated or erosion control is not properly installed. Analysis and mitigation measures should be determined as necessary during the design-level exploration. We provide recommendations regarding erosion control in Section 7 of this report.

All cut slopes should be viewed by the Engineering Geologist during slope grading for adverse bedding, seepage, or bedrock conditions, which may affect slope stability. In the event that adverse geologic conditions are detected during grading of the cut slopes, overexcavation and reconstruction of these slopes may be necessary. Track rolling to compact faces of slopes is not sufficient. Slopes should be overbuilt at least 2 feet and cut back to design grades.

5.10 SLOPE STABILIZATION

Landslides or unstable hillsides, which pose a potential hazard to the proposed development, should be mitigated. Once final 40-scale grading plans are developed for the project, more detailed mitigation measures for the landslides should be developed by the Geotechnical Engineer and Engineering Geologist. Potential mitigation measures for landsliding at the site are anticipated to include removal of landslide debris and construction of subsurface drainage and toe keyway buttresses. To reduce the potential for landslide danger, subsurface water flow and spring activity should be controlled in development areas through the use of subdrains.

5.11 CUT, FILL, AND CUT-FILL TRANSITION LOTS

Some single-family lots in this project will likely be entirely in cut or traversed by a cut/fill transition. It can be anticipated that significant variations in material properties may occur in areas of cut or cut/fill transition if not mitigated during site grading. It is our opinion that there is a potential for significant differential in swell characteristics across cut areas and cut/fill transitions. Such situations can be detrimental to building performance. Figure 7 represents the typical overexcavation recommended to mitigate the effects of differential materials located under a structure. We recommend that cut lots be overexcavated 2 feet, scarified 12 inches, and recompacted; cut/fill transition lots should be overexcavated 3 feet to provide a uniform thickness of engineered fill within the entire foundation area.

5.12 DIFFERENTIAL FILL THICKNESS

For subexcavation activities that create a differential fill thickness across individual building pads, mitigation to achieve a similar fill thickness across the pad is beneficial for the performance of a shallow foundation system. We recommend that a differential fill thickness of up to 10 feet is acceptable across individual building pads. For a differential fill thickness exceeding 10 feet across an individual pad, we recommend performing subexcavation to bring this vertical distance to within the 10-foot tolerance and that the material is replaced as engineered fill. As a minimum, the subexcavation area should include the entire structure footprint plus 5 feet beyond the edges of the building footprint.

5.13 MONITORING AND TESTING

It is important that all site preparations for site grading be done under the observation of the Geotechnical Engineer's field representative. The Geotechnical Engineer's field representative should observe all graded area preparation, including demolition and stripping. The final grading plans should be submitted to the Geotechnical Engineer for review.

5.14 REMEDIAL GRADING PLANS

Due to the complex geology and hillside topography, we recommend that ENGEO be retained to prepare remedial grading plans for this project. This is important to clarify our geotechnical

recommendations related to keyways, benches, cut/fill transition subexcavations, and subdrains. In preparing these plans, we intend to overlay the grading plans with graphic representations of our grading and subsurface drainage recommendations presented in this report. This allows the unique hillside geotechnical recommendations to be clearly displayed on the grading plans. This can assist in obtaining more accurate earthwork bids as well as clarifying the geotechnical recommendations as they apply to the final grading plan.

6.0 PRELIMINARY FOUNDATION RECOMMENDATIONS

Foundations at the project site, based on design slope grading and the expansive potential of the onsite soils, may consist of pier and grade-beam and/or mat foundations. In order to reduce the effects of the potentially expansive soils, the foundations should be sufficiently stiff to move as rigid units with minimum differential movements. In our opinion, mat foundations are appropriate to accommodate these foundation design considerations for generally level graded lots.

Specific recommendations for these foundation systems will be developed following design-level geotechnical exploration studies.

7.0 EROSION CONTROL

In addition to vegetated cover, viable erosion mitigation measures may include concrete or asphalt lined drainage facilities on slopes graded steeper than 3:1 (horizontal:vertical). These measures are typically used on slopes with heights greater than 30 feet. The purpose of the drainage facilities is to intercept and divert the surface water runoff from the slopes and, combined with the 3:1 or flatter slopes, reduce runoff velocities, water infiltration, and sloughing or erosion of the slope surfaces.

To improve performance of slopes against erosion, in addition to typical erosion control protection such as hydroseeding or other techniques, we recommend that all finished slopes (cut and fill) receive roughly a 6-inch-thick layer of track-walked moistened strippings placed on a roughened, moistened slope. This will promote quick revegetation of slopes that will help hinder slope erosion. Additionally, 2:1 slopes should be provided with erosion control protection such as Rhino Snot Soil Stabilizer or other equivalent soil stabilization product.

All landscaped slopes should be maintained in a vegetated state after project completion with drought tolerant vegetation requiring drip irrigation.

The tops of fill or cut slopes should be graded in such a way as to prevent water from flowing freely down the slopes. Due to the nature of the bedrock, slopes may experience severe erosion when grading is halted by heavy rain. Therefore, before work is stopped, a positive gradient away from the slopes should be provided to carry the surface runoff away from the slopes to areas where erosion can be controlled. It is vital that no completed slope be left standing through a winter season without erosion control measures having been provided.

8.0 DESIGN-LEVEL EXPLORATION

We recommend that a design-level exploration include additional subsurface exploration at the project site to further characterize and analyze the expansion potential and compressibility of the on-site soils. As discussed above, site remedial grading should be developed once final 40-scale plans are available.

9.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report is issued with the understanding that it is the responsibility of the owner to transmit the information and recommendations of this report to developers, owners, buyers, architects, engineers, and designers for the project so that the necessary steps can be taken by the contractors and subcontractors to carry out such recommendations in the field. The conclusions and recommendations contained in this report are solely professional opinions.

The professional staff of ENGEO Incorporated strives to perform its services in a proper and professional manner with reasonable care and competence but is not infallible. There are risks of earth movement and property damages inherent in land development. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our services.

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FIGURES

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N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: GOOGLE EARTH PRO

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VICINITY MAP

SOUTH CAMINO PABLO

MORAGA, CALIFORNIA

PROJECT NO.:	10741.000.000
SCALE:	AS SHOWN
DRAWN BY: LL	CHECKED BY: MT

FIGURE NO. 1

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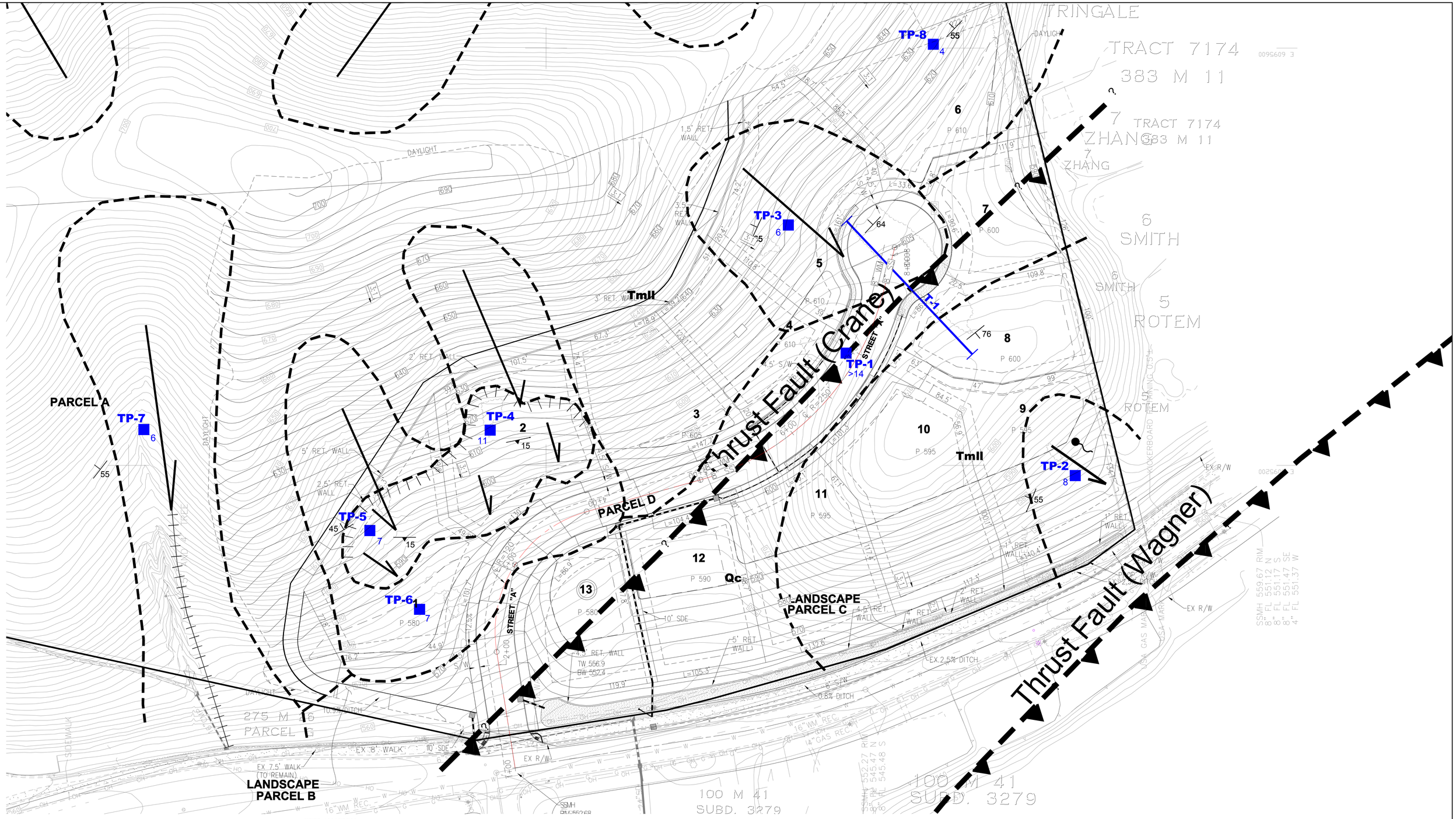

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

Qc	COLLUVIUM
Tmll	MULHOLLAND FORMATION
	GULLY
	RECENT LANDSLIDE
	GEOLOGIC CONTACT, DASHED WHERE APPROXIMATE
	SURFICIAL LANDSLIDE
TP-7 6	SEEPAGE AREA
	APPROXIMATE LOCATION OF TEST PIT (DEPTH TO BEDROCK NOTED)
T-1	APPROXIMATE LOCATION OF TRENCH LOG
65	STRIKE AND DIP OF BEDDING
15	STRIKE AND DIP OF SLIDE PLANE

N

0 FEET 40

0 METERS 20

BASE MAP SOURCE: DK ASSOCIATES

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SITE PLAN
SOUTH CAMINO PABLO
MORAGA, CALIFORNIA

PROJECT NO.: 10741.000.000
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DRAWN BY: LL
CHECKED BY: PS

FIGURE NO. 2

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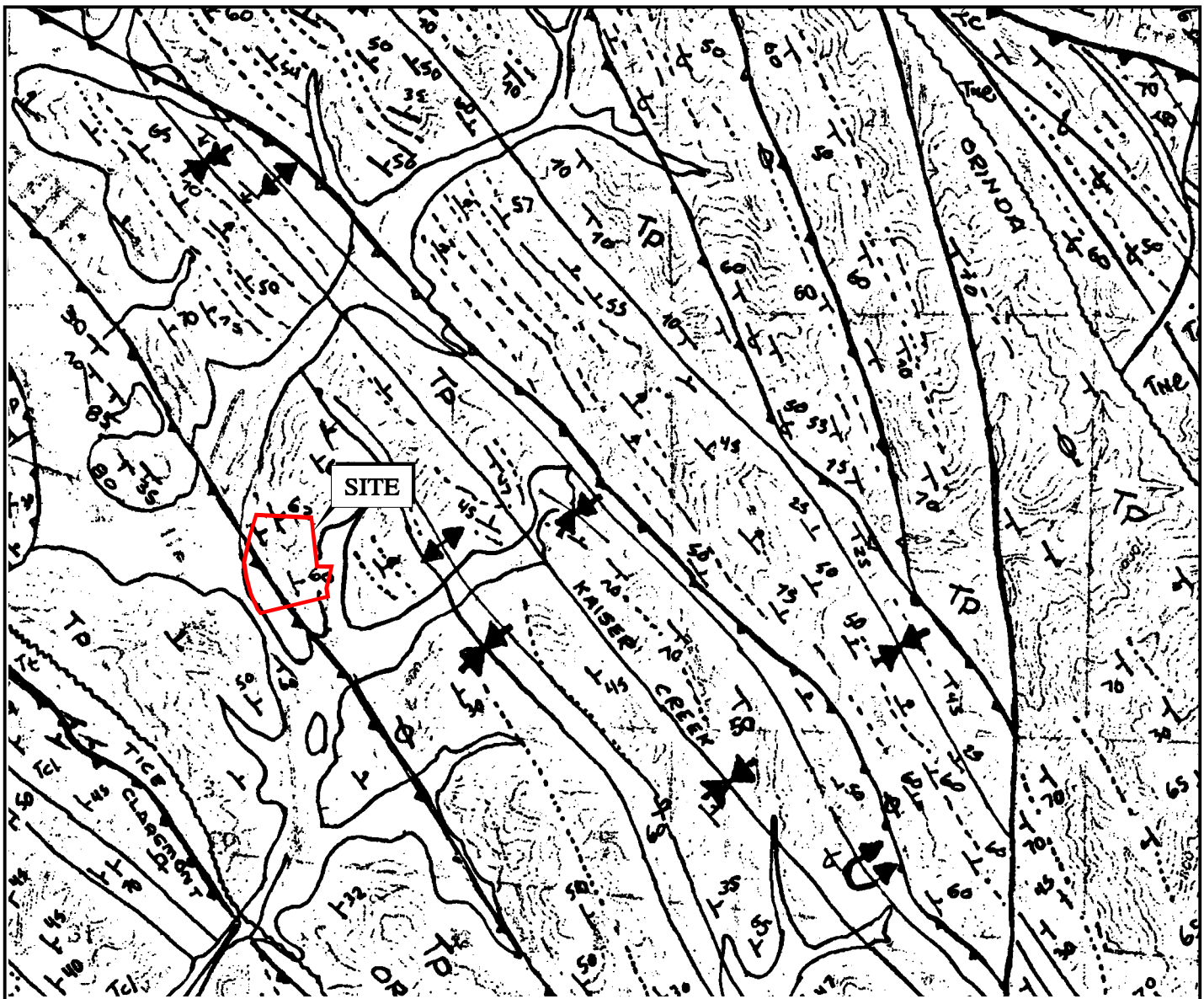

EXPLANATION

- Tp ORINDA FORMATION (PLIOCENE)
- THRUST FAULT
- ANTICLINAL FOLD AXIS
- SYNCLINAL FOLD AXIS
- STRIKE AND DIP OF BEDDING

N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: CRANE, 1988

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REGIONAL GEOLOGIC MAP

SOUTH CAMINO PABLO

MORAGA, CALIFORNIA

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FIGURE NO. 3

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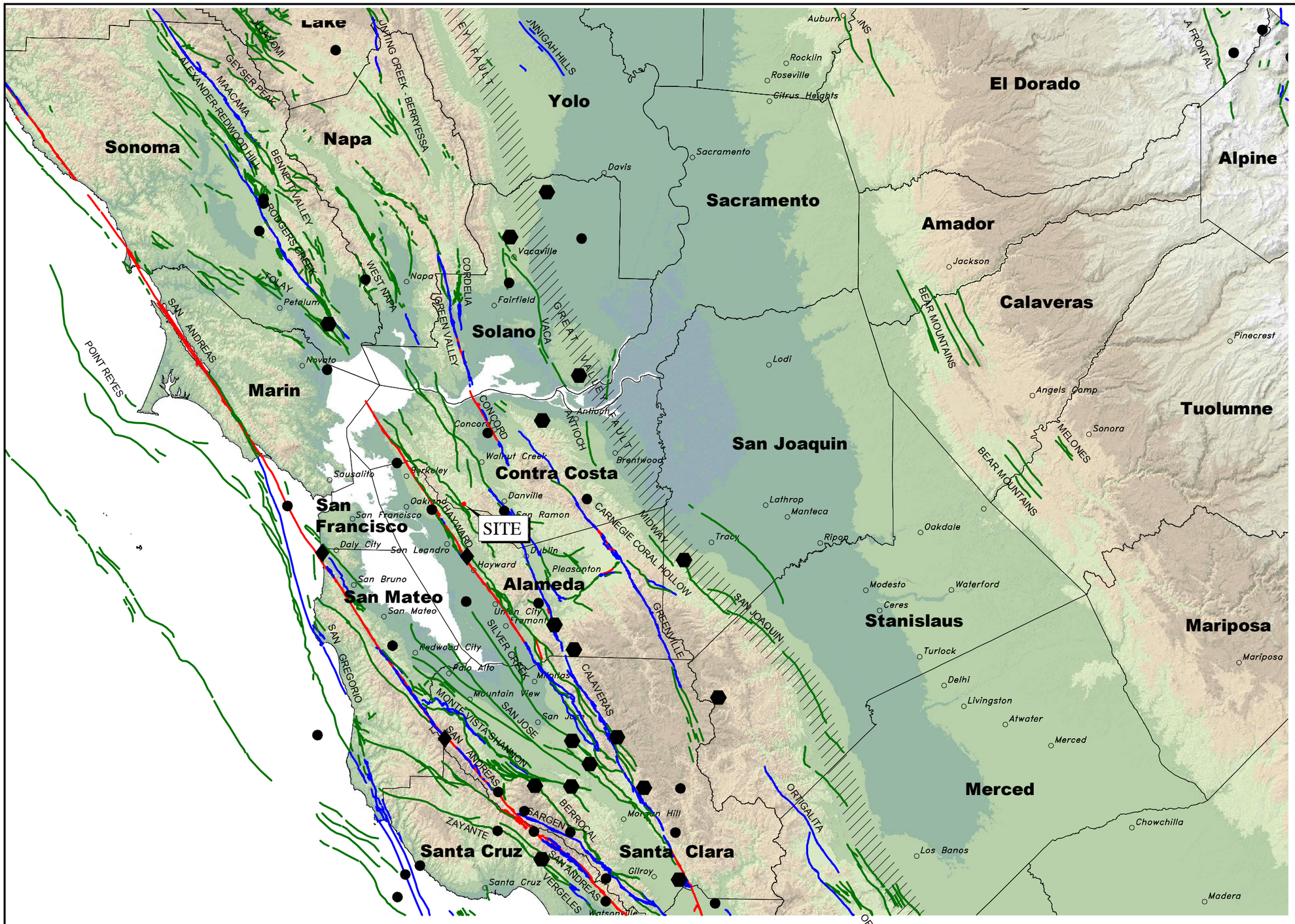

EXPLANATION

- MAGNITUDE 7+
- MAGNITUDE 6-7
- MAGNITUDE 5-6
- HISTORIC FAULT
- HOLOCENE FAULT
- QUATERNARY FAULT
- HISTORIC BLIND THRUST FAULT ZONE

BASE MAP SOURCE:
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATASET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, NOVEMBER, 2010
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800–2000)

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REGIONAL FAULTING AND SEISMICITY
SOUTH CAMINO PABLO
MORAGA, CALIFORNIA

PROJECT NO.: 10741.000.000		FIGURE NO
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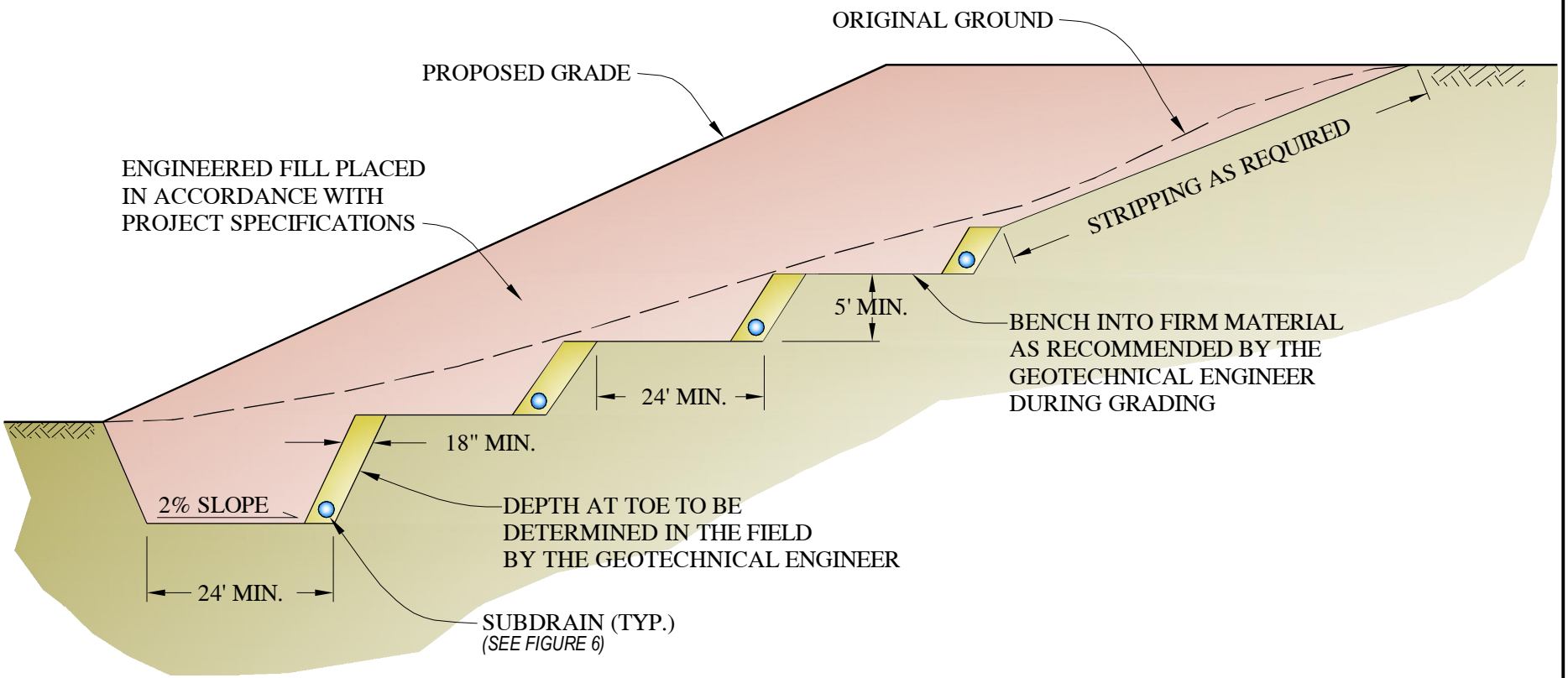

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KEYWAY SECTION
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PROJECT NO.: 10741.000.000	FIGURE NO. 5
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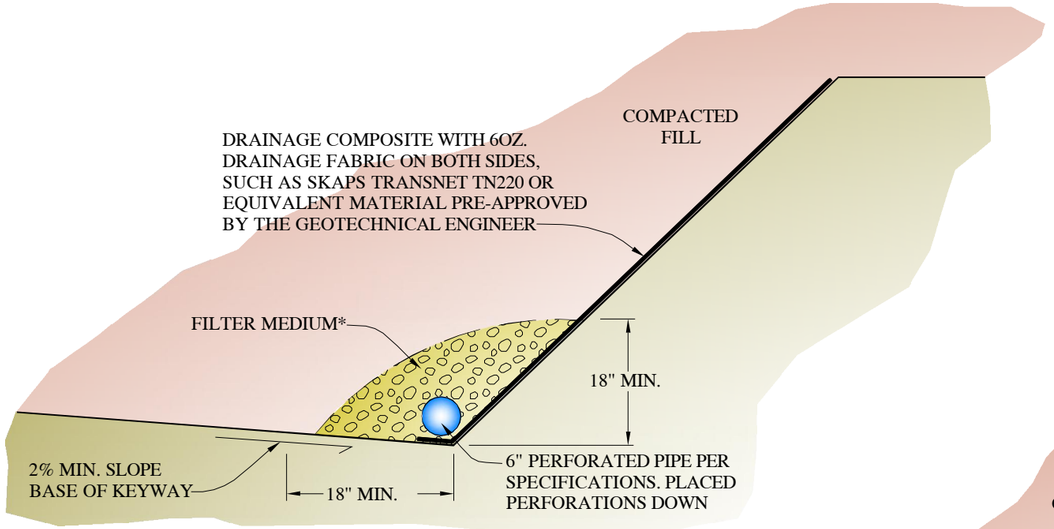
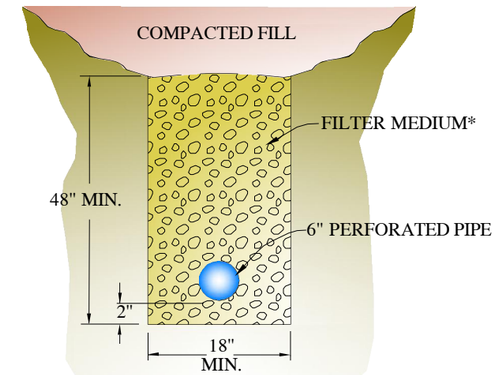
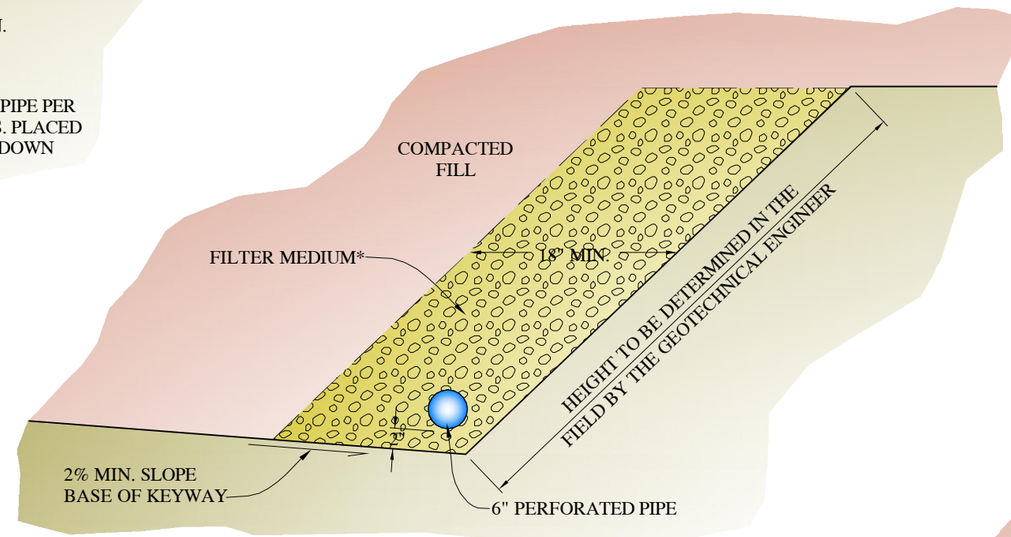


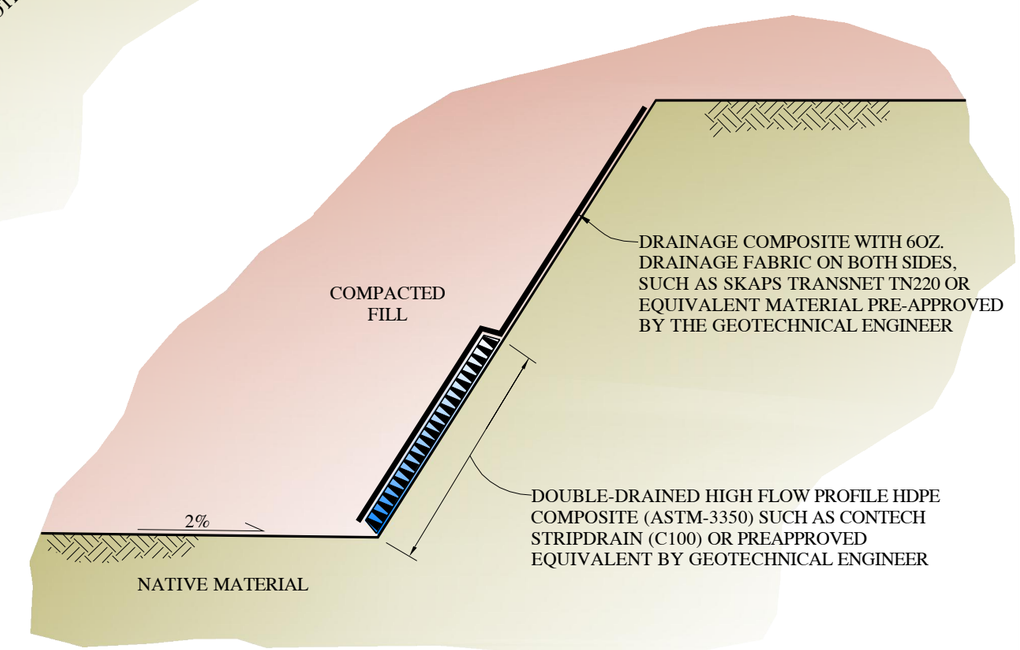
KEYWAY SUBDRAIN - OPTION 1



SWALE SUBDRAIN



KEYWAY SUBDRAIN - OPTION 2



ALTERNATE KEYWAY SUBDRAIN - OPTION 3

(FOR DEPTHS LESS THAN 30 FEET)

*FILTER MEDIUM

ALTERNATIVE A

CLASS 2 PERMEABLE MATERIAL

MATERIAL SHALL CONSIST OF CLEAN, COARSE SAND AND GRAVEL OR CRUSHED STONE, CONFORMING TO THE FOLLOWING GRADING REQUIREMENTS:

SIEVE SIZE	% PASSING SIEVE
1"	100
3/4"	90–100
3/8"	40–100
#4	25–40
#8	18–33
#30	5–15
#50	0–7
#200	0–3

ALTERNATIVE B

CLEAN CRUSHED ROCK OR GRAVEL WRAPPED IN FILTER FABRIC

ALL FILTER FABRIC SHALL MEET THE FOLLOWING MINIMUM AVERAGE ROLL VALUES UNLESS OTHERWISE SPECIFIED BY ENGEO:

GRAB STRENGTH (ASTM D-4632)	180 lbs
MASS PER UNIT AREA (ASTM D-4751)	6 oz/yd^2
APPARENT OPENING SIZE (ASTM D-4751)	70–100 U.S. STD. SIEVE
FLOW RATE (ASTM D-4491)	80 gal/min/ft
PUNCTURE STRENGTH (ASTM D-4833)	80 lbs

NOTES:

1. *ALL PIPE JOINTS SHALL BE GLUED*
2. *ALL PERFORATED PIPE PLACED PERFORATIONS DOWN*
3. *1% FALL (MINIMUM) ON ALL TRENCHES AND DRAIN LINES*

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SUBDRAIN DETAILS
SOUTH CAMINO PABLO
MORAGA, CALIFORNIA

PROJECT NO.: 10741.000.000
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CHECKED BY: PS

FIGURE NO. 6

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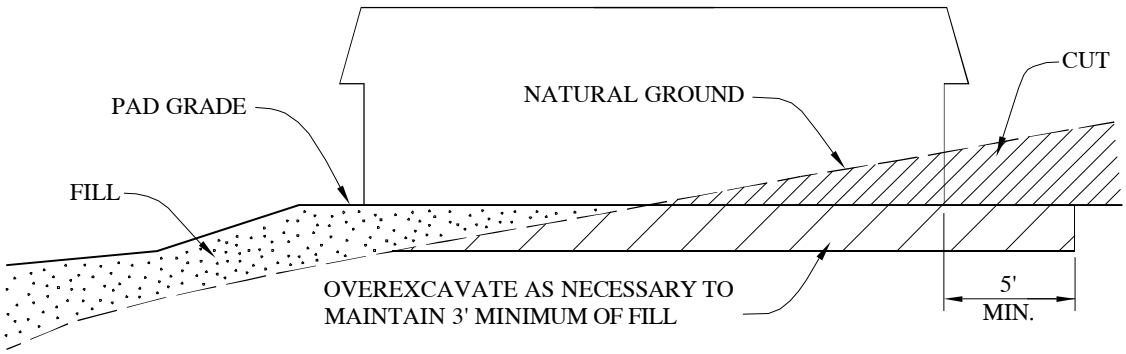
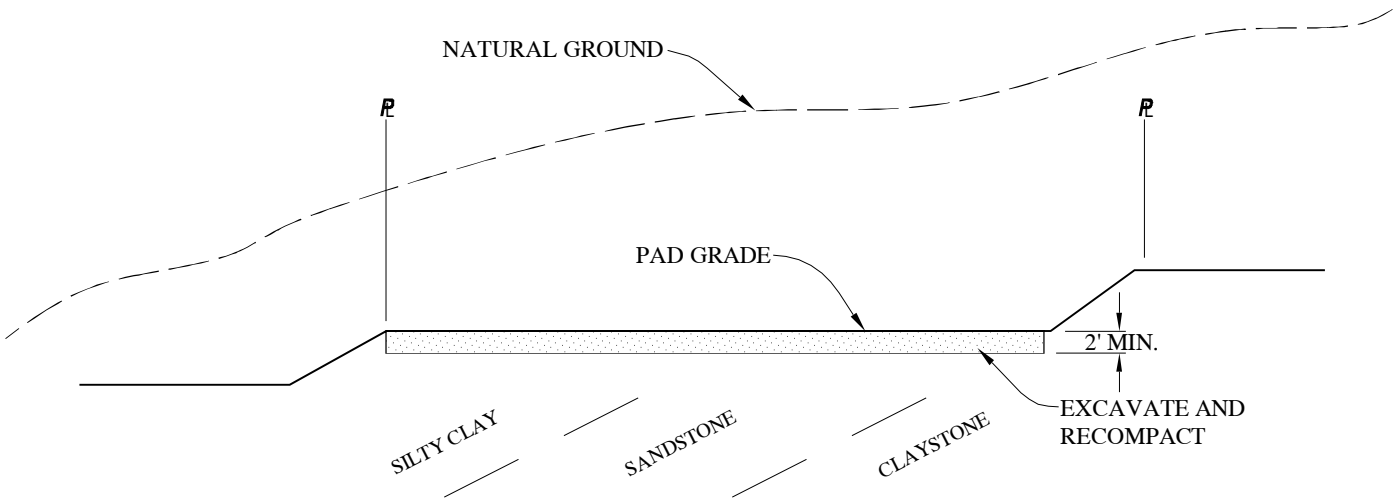


WHERE LOTS ARE PARTIALLY IN FILL, AND PARTIALLY IN CUT, THE CUT PORTION MUST BE OVEREXCAVATED AS SHOWN

CUT/FILL LOT



WHERE LOTS ARE COMPLETELY IN CUT, THE UPPER 2' SHOULD BE EXCAVATED AND RECOMPACTED AS SHOWN

CUT LOT

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CUT FILL & CUT LOT DETAILS SOUTH CAMINO PABLO MORAGA, CALIFORNIA	PROJECT NO.: 10741.000.000 SCALE: NO SCALE DRAWN BY: LL CHECKED BY: PS	FIGURE NO. 7

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APPENDIX A

Previous Exploration Logs (ENGEO, 2014)

APPENDIX A

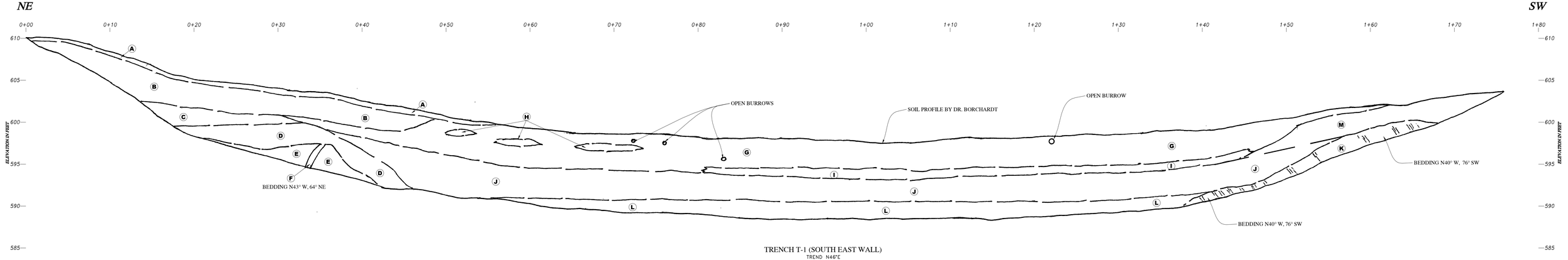
ENGEO INCORPORATED	Test Pit Logs
1211 Camino Pablo Preliminary Geologic Exploration Moraga, California 10741.000.000	Logged By: R. Skinner Logged Date: 1/13/14 and 1/14/14

Test Pit Number	Depth (Feet)	Description
TP-1	0 – 5	SILTY CLAY (CH), dark brown, very stiff, dry (Qc)
	5 - 14	SILTY CLAY (CL), brown, very stiff, moist (Qc)
		Total depth 14 feet, no free groundwater encountered
TP-2	0 – 8	SILTY CLAY (CL), brown, very stiff, dry (Qls)
	8 – 10½	Interbedded CLAYSTONE and SANDSTONE, light gray, weak, closely fractured, thinly bedded, N60W 55NE. (Mulholland Formation)
		Total depth 10½ feet, no free groundwater encountered
TP-3	0 – 4½	SILTY CLAY (CH), dark brown, hard, dry.
	4½ - 6	SILTY CLAY and ROCK FRAGMENTS (CL), light gray, stiff, moist (Qls)
	6 – 8	SILTSTONE, light gray, weak, closely fractured, thickly bedded, N65W 65NE. (Mulholland Formation)
		Total depth 8 feet, no free groundwater encountered
TP-4	0 – 10	SILTY CLAY (CL), brown, stiff, dry, with fine gravel (Qls)
	10 - 11	SILTY CLAY (CL), light gray, stiff, moist, slickensided surface at 11 feet, N20W 15W, prominent downslope striations. (Qls)
	11 - 13	CLAYSTONE, gray-brown, weak, closely fractured, thickly bedded. (Mulholland Formation)
		Total depth 13 feet, no free groundwater encountered

ENGEO INCORPORATED	Test Pit Logs
1211 Camino Pablo Preliminary Geologic Exploration Moraga, California 10741.000.000	Logged By: R. Skinner Logged Date: 1/13/14 and 1/14/14

Test Pit Number	Depth (Feet)	Description
TP-5	0 – 6½	SILTY CLAY (CL), dark brown, vert stiff,dry to moist (Qls)
	6½	Slickensided surface NS 15W
	6½– 9	CLAYSTONE, gray, weak, very closely fractured, thinly bedded, N30W 45NE (Mulholland Formation)
		Total depth 9 feet, no free groundwater encountered
TP-6	0 – 4	SILTY CLAY (CL), dark brown, hard, dry (Qls)
	4 – 7	SILTY CLAY (CL), brown, very stiff, moist, sharp contact at 7 feet. (Qls)
	7 – 8½	SANDSTONE, light gray, weak, moderately fractured, thickly bedded. (Mulholland Formation)
		Total depth 8½ feet, no free groundwater encountered
TP-7	0 – 4½	SILTY CLAY (CH), dark brown, hard, dry.
	4½ – 5½	SILTY CLAY (CL), brown with brown, very stiff, moist.
	5½ – 7	Interbedded CLAYSTONE and SILTSTONE, light gray, weak, closely fractured, thinly bedded, N50W 55NE (Mulholland Formation)
		Total depth 7 feet, no free groundwater encountered

ENGEO INCORPORATED		Test Pit Logs
1211 Camino Pablo Preliminary Geologic Exploration Moraga, California 10741.000.000		Logged By: R. Skinner Logged Date: 1/13/14 and 1/14/14
Test Pit Number	Depth (Feet)	Description
TP-8	0 – 3½ 3½– 6	SILTY CLAY (CH), dark brown, hard, dry. CLAYSTONE, gray, weak, closely fractured, thinly bedded, N45W 55NE (Mulholland) Total depth 6 feet, no free groundwater encountered

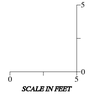


TRENCH T-1 (SOUTH EAST WALL)

TREND N46°E

EXPLANATION

- **A** silty CLAY, light gray, dry, soft, low plasticity, highly dessicated, abundant roots (relatively young slope wash, colluvium)
- **B** silty CLAY, dark gray-brown, dry to moist, very stiff, high plasticity
- **C** silty CLAY, red-brown, moist, very stiff, high plasticity, some rounded siltstone and claystone fragments
- **D** silty CLAY, light gray, moist, very stiff, abundant claystone and siltstone fragments (highly weathered bedrock)
- **E** CLAYSTONE, gray and red-brown, weak, highly fractured, thickly bedded (Mulholland formation)
- **F** SILTSTONE, gray, weak, moderately fractured, thinly bedded (Mulholland formation)
- **G** silty CLAY, light gray, dry, stiff, few small rock fragments, porous, low plasticity (Holocene colluvium)
- **H** silty CLAY, dark gray, dry, stiff, abundant rootlets, slightly porous (Holocene colluvium)
- **I** silty CLAY, dark brown, moist, stiff, low plasticity, prominent blocky ped structure, well development clay films on ped surfaces (Pleistocene colluvium)
- **J** sandy CLAY, light red-brown, moist, stiff, low plasticity, some small rock fragments (Pleistocene colluvium)
- **K** SILTSTONE with some interbeds of claystone and sandstone, light to dark gray, weak, highly fractured, thinly bedded (Mulholland formation)
- **L** sandy CLAY, gray-brown, moist, stiff, low plasticity, some small rock fragments, poorly developed ped structure with light films on ped surfaces (Pleistocene colluvium).
- **M** silty CLAY, dark brown, dry, very stiff, high plasticity



ENGEO Expect Excellence	TRENCH LOG T-1 1211 CAMINO PABLO MORAGA, CALIFORNIA	PROJECT NO.: 10741.000.000 SCALE: AS SHOWN DRAWN BY: LL CHECKED BY: MT	FIGURE NO. A1

ORIGINAL FIGURE PRINTED IN COLOR

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APPENDIX B

Soil Tectonics report (Dr. Glen Borchardt, dated January 20, 2014)

APPENDIX B

APPENDIX B

PEDOCHRONOLOGICAL REPORT FOR 1211 CAMINO PABLO, MORAGA, CALIFORNIA

ENGEO, Inc., San Ramon, CA 94583, Job No. 10741.000.000

2014-01-21

Soil Tectonics
P.O. Box 5335
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Glenn Borchardt

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Certified Professional Soil Scientist No. 24836

PEDOCHRONOLOGICAL REPORT FOR 1211 CAMINO PABLO, MORAGA, CALIFORNIA

ENGEO, Inc., San Ramon, CA 94583, Job No. 10741.000.000

2014-01-21

Glenn Borchardt

INTRODUCTION

An assessment of seismic and landslide risk due to ground movement can be aided greatly by the techniques of pedochronology (Borchardt, 1992, 1998), soil dating. This is because the youngest geological unit overlying fault traces is generally a soil horizon. The age and relative activity of ground movement often can be estimated by evaluating the age and relative disturbance of overlying soil units, as well as buried soils called paleosols. Terms, prefixes, and suffixes are defined in the Soils Glossary at the end of this report.

Soil horizons exhibit a wide range of physical, chemical, and mineralogical properties that evolve at varying rates. Soil scientists use various terms to describe these properties. A black, highly organic "A" horizon, for example, may form within a few centuries, while a dark brown, clayey "Bt" horizon may take up to 40,000 years to form. Certain soil properties are invariably absent in young soils. For instance, soils developed in granitic alluvium of the San Joaquin Valley do not have Munsell hues redder than 10YR until they are at least 100,000 years old (Birkeland, 1999; Harden, 1982). Still other properties, such as the movement and deposition of clay-size particles and the precipitation of calcium carbonate at extraordinary depths, indicate soil formation during a climate much wetter than at present. In the absence of a radiometric age date for the material from which a particular soil formed, an estimate of its age must take into account all the known properties of the soil and the landscape and climate in which it evolved.

METHOD

The first step in studying a soil is the compilation of the data necessary for describing it (Birkeland, 1999; Borchardt, 2010). At minimum, this requires a Munsell color chart, hand lens, acid bottle, and instruments for 1:1 soil:water pH and conductivity measurements. The second step may involve collecting samples of each horizon of the soil profile column for laboratory analysis of particle size. This is done to check the textural classifications made in the field and to evaluate the genetic relationships between horizons and between different soils in the

landscape. When warranted, the clay mineralogy and chemistry of the soil also is analyzed to provide additional information on the changes undergone by the initial material from which the soil weathered. The last step is the comparison of this accumulated soil data with that for soils having developed under similar conditions, preferably in the same region. Such information is scattered in soil survey reports (e.g., Welch, 1981), soil science journals, and consulting reports. In a particular locality, there is seldom enough comparative data available for this purpose. That is why, at the very least, the study of one soil profile always makes the evaluation of the next that much easier.

RESULTS OF THIS EVALUATION

Soil Profile No. 1 was studied to assess the age of the colluvium in a swale across a mapped trace of a fault (Table 1).

Soil Profile No. 1

This profile was sampled in the middle of a colluvium-filled saddle in the Mulholland Formation. The saddle coincidently forms the crest of a ridge that slopes in opposite directions, to the SE and NW (Figure 1). Mapped as Los Osos clay loam, this particular variant is silt loam, having an especially thick solum (260 cm vs. the 81 cm of the typical Los Osos profile) (Table 1; Figure 2 and Figure 3). The mapped soil is typically on 15-30% slopes, while the sampled soil is on a flat surface formed as a colluvial fill eroded from the siltstone to the SW and NE. The 75-cm thick A horizon is has a dark grayish brown A1 overlying a very dark grayish brown A2. This color reversal seems to have occurred due to pedoturbation by ground squirrels (Figure 4). The 185-cm thick Bt horizon is dark brown to dark greyish brown silty clay with thin to thick clay films lining pores and coating peds (Figure 3). The parent material is best represented by the CB horizon, which is a greyish brown silty clay with massive to medium weak subangular blocky structure.

The pH of the soil profile generally increases with depth, with the surface being strongly acid and the subsurface being medium acid (Figure 5). This pattern is typical for soils that have been influenced by the usual acid rainfall for a long time. Aside from the A1 horizon, which may have been influenced by the addition of fertilizer, soil conductivity increased with depth until the bottom of the solum soil was reached (Figure 6). All these processes are typical of weathering in which soils tend to become acid with age, while releasing cations to the leachate and translocating fine clays from the A to the B horizon.

<u>Comparative Pedology</u>

Generally, soils this thick (260 cm) tend to have higher chromas (e.g., 7.5YR) than the 10YR chromas observed. That is because thick soils often form in coarse alluvium that has large enough pores to transport clays for long distances under high redox conditions when precipitation is plentiful. The parent material here, however, is silty clay (see CB horizon in

Table 1), which apparently allows clay translocation only through pores produced by flora and fauna. The upshot is that translocation and leaching to such great depths required a long time under a much wetter climate than at present (McFadden, 1982). Bt horizons 2 to 3 m thick are common in coarse alluvium estimated to be at 40 to 80 ka in the Livermore Valley (Borchardt, 1985). Early and Late Wisconsin soils developed in silty alluvium above the Sangamon wave-cut platform at Point Pinole also had low chromas (Borchardt, 1988).

CONCLUSIONS

1. The soil in the center of this swale is approximately 40,000 years old.
2. None of the soil boundaries in the swale were offset, folded, or warped, so we may be assured that no surface fault rupture (SFR) has occurred there during the last 40,000 years.

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Table 1. Description of Soil Profile No. 1 excavated across the mapped trace of a fault in a swale SE of Camino Pablo, Moraga, California. Abbreviations and definitions are given in Schoeneberger and others (2012) and Soil Survey Staff (1993, 1999, 2010).

Description of soil developed in colluvium by Glenn Borchardt, who measured and sampled the soil on January 14, 2014 at latitude N37.81175^{o} and longitude W122.11423^{o} at station 80' in the southeast wall of Trench T-1 at an elevation of 601' [607' (GPS)]. Mediterranean climate with mean annual precipitation of 32.02"/yr at Orinda (1948-1960). Slope 0%. Grass. Excellent drainage. Water table deep. The parent material is silt loam to silty clay. Soil pH is strongly acid in the surface, becoming medium acid in the subsoil. Mapped as: *Typic Argixerolls. Los Osos clay loam.*

Horizon	Depth, cm	Description

A1 0-38 Dark grayish brown (10YR4/2m, 6/2d) silt loam; medium to fine strong granular structure; slightly sticky and slightly plastic when wet, very friable when moist, and very hard when dry; many fine roots; many medium to fine continuous random tubular pores; abrupt irregular boundary; pH 5.3; conductivity 150 uS; Sample No. 14B001.

A2 38-75 Very dark grayish brown (10YR3/2m, 6/3d) silt loam; coarse to fine strong subangular blocky structure; sticky and slightly plastic when wet, very friable when moist, and very hard when dry; few fine roots; few fine continuous random tubular pores; gradual wavy boundary; pH 5.3; conductivity 90 uS; Sample No. 14B002.

B1t 75-101 Dark brown (10YR3/3m, 6/3d) silty clay; medium to coarse strong subangular to angular blocky structure; sticky and plastic when wet, firm when moist, and extremely hard when dry; very few fine roots; common fine continuous random tubular pores; few thin to medium thick clay films lining pores and coating peds; diffuse smooth boundary; pH 5.5; conductivity 150 uS; Sample No. 14B003.

B2t 101-166 Dark greyish brown (10YR4/2m, 5/2d) silty clay; medium to coarse strong angular blocky structure; sticky and plastic when wet, firm when moist, and very hard when dry; common fine continuous random tubular pores; many thin to medium thick clay films lining pores and coating peds; rare calcite filaments; clear smooth boundary; pH 5.5; conductivity 180 uS; Sample No. 14B004.

B3t 166-214 Dark greyish brown (10YR4/2m, 6/3d) silty clay; medium to coarse strong angular to subangular blocky structure; sticky and plastic when wet, firm to friable when moist, and very hard when dry; few fine continuous random tubular pores; many thin to

thick clay films lining pores and coating peds; clear smooth boundary; pH 5.6; conductivity 230 uS; Sample No. 14B005. Level line at 203 cm.

B4t 214-260 Very dark greyish brown (10YR3/2m, 6/3d) silty clay; medium to coarse strong subangular to angular blocky structure; sticky and plastic when wet, firm to friable when moist, and extremely hard when dry; common fine continuous random tubular pores; common thin to medium thick clay films lining pores and thick patchy coatings on peds; diffuse smooth boundary; pH 5.9; conductivity 230 uS; Sample No. 14B006.

CB 260-290+ Greyish brown (10YR5/2m, 6/3d) silty clay; massive to medium weak subangular blocky structure; sticky and plastic when wet, friable when moist, and very hard when dry; few fine continuous random tubular pores; pH 6.0; conductivity 220 uS; Sample No. 14B007.

*ESTIMATED AGE:	t_o	=	40.0	ka
	t_b	=	**0**	ka
	t_d	=	40.0	ky

---

*Pedochronological estimates based on available information. All ages should be considered subject to ±50% variation unless otherwise indicated (Borchardt, 1992). Bold dates are absolute.

t_o = date when soil formation or aggradation began, ka

t_b = date when soil or strata was buried, ka

t_d = duration of soil development or aggradation, ky

Figure 1. View SE (top) and NW (bottom) across the convex part of the swale between two outcrops of the Mulholland Formation east of Camino Pablo, Moraga, California.

Figure 2. Soil Profile No. 1 in the center of the swale showing the 75-cm thick A horizon and the upper portion of the Bt horizon. Nails mark horizon boundaries at 38, 75, and 101 cm.

Figure 3. The B2t horizon of Soil Profile No. 1 showing the angular blocky structure, medium thick to thick clay films coating peds, and the rare thin calcite filaments between 157 cm and 159 cm depths.

Figure 4. Burrow spoil piles from gopher excavations that helped to produce the 75-cm thick A horizon in the swale.

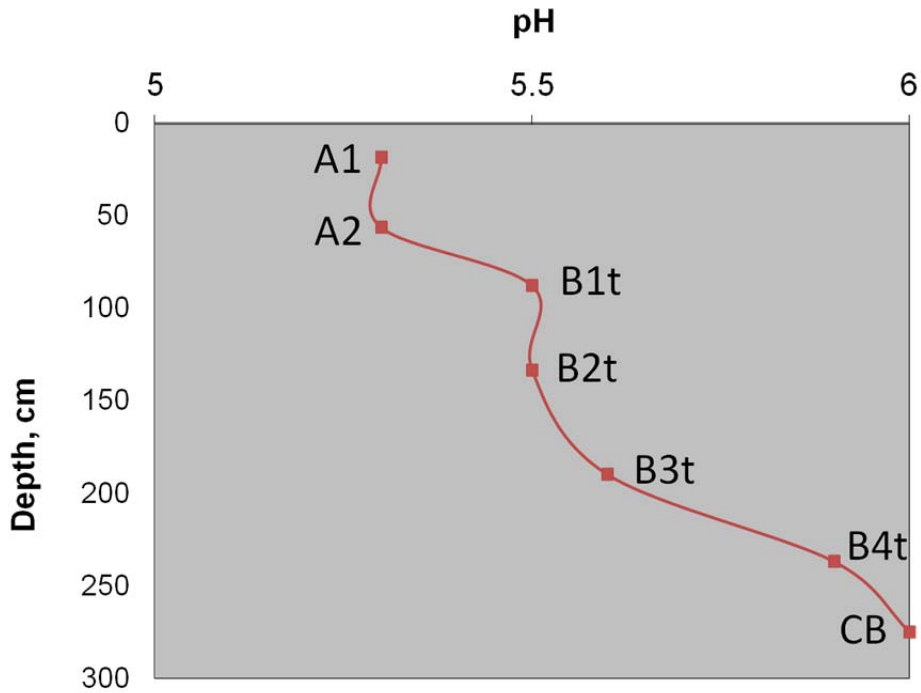

Figure 5. The pH in Soil Profile No. 1 is strongly acid in the surface, becoming medium acid in the subsoil.

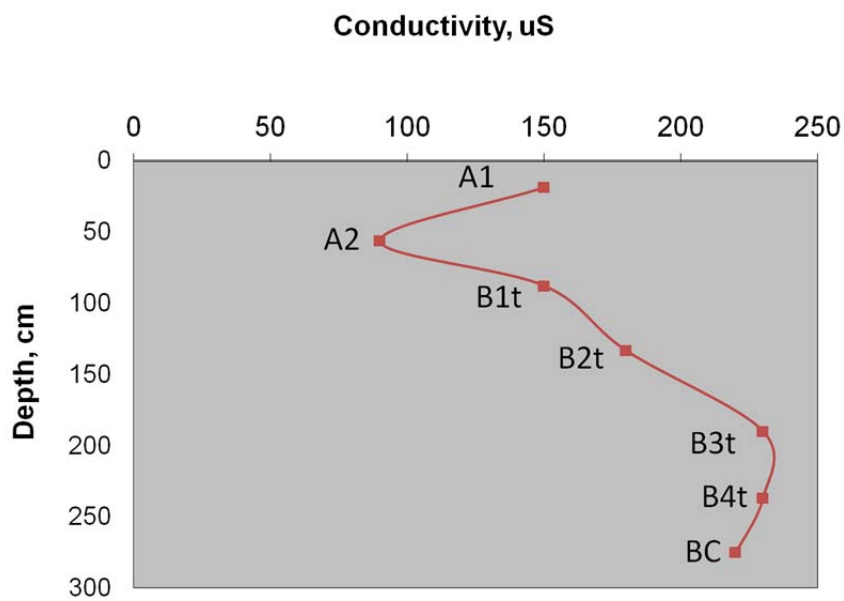

Figure 6. Soil conductivity (related to salt content) in Soil Profile No. 1 tends to increase with depth, with the maximum in the B3t and B4t. An increase in conductivity in the surface is sometimes the result of the recent application of fertilizer.

May 1, 2013

SOILS GLOSSARY

AGE. Elapsed time in calendar years. Because the cosmic production of C-14 has varied during the Quaternary, radiocarbon years (expressed as ky B.P.) must be corrected by using tree-ring and other data. Abbreviations used for corrected ages are: ka (kilo anno or years in thousands) or Ma (millions of years). Abbreviations used for intervals are: yr (years), ky (thousands of years). radiocarbon ages = yr B.P. Calibrated ages are calculated from process assumptions, relative ages fit in a sequence, and correlated ages refer to a matching unit. (See also yr B.P., HOLOCENE, PLEISTOCENE, QUATERNARY, PEDOCHRONOLOGY).

AGGRADATION. A modification of the earth's surface in the direction of uniformity of grade by deposition.

ALKALI (SODIC) SOIL. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 % or more of the total exchangeable bases), or both, that plant growth is restricted.

ALKALINE SOIL. Any soil that has a pH greater than 7.3. (See Reaction, Soil.)

ANGULAR ORPHANS. Angular fragments separated from weathered, well-rounded cobbles in colluvium derived from conglomerate.

ARGILLAN. (See Clay Film.)

ARGILLIC horizon. A horizon containing clay either translocated from above or formed in place through pedogenesis.

ALLUVIATION. The process of building up of sediments by a stream at places where stream velocity is decreased. The coarsest particles settle first and the finest particles settle last.

ANOXIC. (See also GLEYED SOIL). A soil having a low redox potential.

AQUICLUDE. A saturated body of sediment or rock that is incapable of transmitting significant quantities of water under ordinary hydraulic gradients.

AQUITARD. A body of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs but may serve as a storage unit for groundwater.

ATTERBERG LIMITS. The moisture content at which a soil passes from a semi-solid to a plastic state (plastic limit, PL) and from a plastic to a liquid state (liquid limit, LL). The plasticity index (PI) is the numerical difference between the LL and the PL.

BEDROCK. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

BISEQUUM. Two soils in vertical sequence, each soil containing an eluvial horizon and its underlying B horizon.

BOUDIN, BOUDINAGE. From a French word for sausage, describes the way that layers of rock break up under extension. Imagine the hand, fingers together, flat on the table, encased in soft clay and being squeezed from above, as being like a layer of rock. As the spreading clay moves the fingers (sausages) apart, the most mobile rock fractions are drawn or squeezed into the developing gaps.

BURIED SOIL. A developed soil that was once exposed but is now overlain by a more recently formed soil.

CALCAREOUS SOIL. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

CARBONATE MORPHOLOGY STAGES. Descriptive classes of calcite precipitation indicating increasing pedogenesis over time:

Stage	Description	Percent Carbonate
I	Bk horizon with few filaments and coatings	<10
I+	Bk with common filaments and continuous clast coatings	<10
II	Bk with continuous clast coatings, white masses, few nodules	>10
II+	Bk as above, but matrix is completely whitened, common nodules	>15
>II	K horizon that is 90% white, many nodules	>20
III+	K that is completely plugged	>40
IV	K as above, but upper part cemented and has weak platy structure	>50
V	K same as above, but laminar layer is strong with incipient brecciation	>50
VI	K brecciation and recementation, as well as pisoliths, are common	>50

CATENA. A sequence of soils of about the same age, derived from similar parent material and forming under similar climatic conditions, but having different characteristics due to variation in relief and drainage. (See also TOPOSEQUENCE.)

CEC. Cation exchange capacity. The amount of negative charge balanced by positively charged ions (cations) that are exchangeable by other cations in solution (meq/100 g soil = cmol(+)/kg soil).

CLAY. As a soil separate, the mineral soil particles are less than 0.002 mm in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

CLAY FILM. A coating of oriented clay on the surface of a sand grain, pebble, soil aggregate, or ped. Clay films also line pores or root channels and bridge sand grains. Frequency classification is based on the percent of the ped faces and/or pores that contain films: very few--<5%; few--5-25%; common--25-50%; many--50-90%; and continuous--90-100%. Thickness classification is based on visibility of sand grains: thin--very fine sand grains standout; moderately thick--very fine sand grains impart microrelief to film; thick--fine sand grains enveloped by clay and films visible without magnification. Synonyms: clay skin, clay coat, argillan, illuviation cutan.

CLAY LAMELLAE. Thin, generally wavy bands that appear as multiple micro-Bt horizons at the base of the solum in sandy Holocene deposits. The lamellae generally are 1-3 cm in thickness and 5 to 30 cm apart. There may be two to six or more clay lamellae comprising the Bt horizon of such a soil.

COBBLE. Rounded or partially rounded fragments of rock ranging from 7.5 to 25 cm in diameter.

COLLUVIUM. Any loose mass of soil or rock fragments that moves downslope largely by the force of gravity. Usually it is thicker at the base of the slope.

COLLUVIUM-FILLED SWALE. The prefailure topography of the source area of a debris flow.

COMPARATIVE PEDOLOGY. The comparison of soils, particularly through examination of features known to evolve through time.

CONCRETIONS. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

CONDUCTIVITY. The ability of a soil solution to conduct electricity, generally expressed as

the reciprocal of the electrical resistivity. Electrical conductance is the reciprocal of the resistance (1/R = 1/ohm = ohm^{-1} = mho [reverse of ohm] = siemens = S), while electrical conductivity is the reciprocal of the electrical resistivity (EC = 1/r = 1/ohm-cm = mho/cm = S/cm or mmho/cm = dS/m). EC, expressed as uS/cm, is equivalent to the ppm of salt in solution when multiplied by 0.640. Pure rain water has an EC of 0, standard 0.01 N KCl is 1411.8 uS at 25C, and the growth of salt-sensitive crops is restricted in soils having saturation extracts with an EC greater than 2,000 uS/cm. Measurements in soils are usually performed on 1:1 suspensions containing one part by weight of soil and one part by weight of distilled water.

CONSISTENCE, SOIL. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are --

Loose.--Noncoherent when dry or moist; does not hold together in a mass.

Friable.--When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.--When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.--When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.--When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.--When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.--When dry, breaks into powder or individual grains under very slight pressure.

Cemented.--Hard and brittle; little affected by moistening.

CTPOT. Easily remembered acronym for climate, topography, parent material, organisms, and time; the five factors of soil formation.

CUMULIC. A soil horizon that has undergone aggradation coincident with its active development.

CUTAN. (See Clay Film.)

DEBRIS FLOW. Incoherent or broken masses of rock, soil, and other debris that move downslope in a manner similar to a viscous fluid.

DEBRIS SLOPE. A constant slope with debris on it from the free face above.

DEGRADATION. A modification of the earth's surface by erosion.

DURIPAN. A subsurface soil horizon that is cemented by illuvial silica, generally deposited as opal or microcrystalline silica, to the degree that less than 50 percent of the volume of air-dry fragments will slake in water or HCl.

ELUVIATION. The removal of soluble material and solid particles, mostly clay and humus, from a soil horizon by percolating water.

EOLIAN. Deposits laid down by the wind, landforms eroded by the wind, or structures such as ripple marks made by the wind.

FAULT-LINE SCARP. A scarp that has been produced by differential erosion along an old fault line.

FAULTSLIDE. A landslide that shows physical evidence of its interaction with a fault.

FIRST-ORDER DRAINAGE. The most upstream, field-discernible concavity that conducts water and sediments to lower parts of a watershed.

FLOOD PLAIN. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

FOSSIL FISSURE. A buried rectilinear chamber associated with extension due to ground movement. The chamber must be oriented along the strike of the shear and must have vertical and horizontal dimensions greater than its width. It must show no evidence of faunal activity and its walls may have silt or clay coatings indicative of frequent temporary saturation with ground water. May be mistaken for an animal burrow. Also known as a paleofissure.

FRIABILITY. Term for the ease with which soil crumbles. A friable soil is one that crumbles easily.

GENESIS, SOIL. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum (A and B horizons) from the unconsolidated parent material.

GEOMORPHIC. Pertaining to the form of the surface features of the earth. Specifically, geomorphology is the analysis of landforms and their mode of origin.

GLEYED SOIL. A soil having one or more neutral gray horizons as a result of water logging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent water logging.

GRAVEL. Rounded or angular fragments of rock 2 to 75 mm in diameter. Soil textures with >15% gravel have the prefix "gravelly" and those with >90% gravel have the suffix "gravel."

HIGHSTAND. The highest elevation reached by the ocean during an interglacial period.

HOLOCENE. The most recent epoch of geologic time, extending from 10 ka to the present.

HORIZON, SOIL. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major soil horizons:

> O horizon.--The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.
>
> A horizon.--The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).
>
> E horizon -- This eluvial horizon is light in color, lying beneath the A horizon and above the B horizon. It is made up mostly of sand and silt, having lost most of its clay and iron oxides through reduction, chelation, and translocation.
>
> B horizon.--The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these.
>
> C horizon.--The relatively unweathered material immediately beneath the solum. Included are sediment, saprolite, organic matter, and bedrock excavatable with a spade. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a number precedes the letter C.
>
> R horizon.--Consolidated rock not excavatable with a spade. It may contain a few cracks filled with roots or clay or oxides. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Major horizons may be further distinguished by applying prefix Arabic numbers to designate differences in parent materials as they are encountered (e.g., 2B, 2BC, 3C) or by applying suffix numerals to designate minor changes (e.g., B1, B2).

The following is from the Natural Resources Conservation Service, except for the proposed addition of mn:

“Suffix Symbols

Lowercase letters are used as suffixes to designate specific kinds of master horizons and layers.

The term “accumulation” is used in many of the definitions of such horizons to indicate that these horizons must contain more of the material in question than is presumed to have been present in the parent material. The suffix symbols and their meanings are as follows:

a Highly decomposed organic material

This symbol is used with O to indicate the most highly decomposed organic materials, which have a fiber content of less than 17 percent (by volume) after rubbing.

b Buried genetic horizon

This symbol is used in mineral soils to indicate identifiable buried horizons with major genetic features that were developed before burial. Genetic horizons may or may not have formed in the overlying material, which may be either like or unlike the assumed parent material of the buried soil. This symbol is not used in organic soils, nor is it used to separate an organic layer from a mineral layer.

c *Concretions or nodules*

This symbol indicates a significant accumulation of concretions or nodules. Cementation is required. The cementing agent commonly is iron, aluminum, manganese, or titanium. It cannot be silica, dolomite, calcite, or more soluble salts.

co *Coprogenous earth*

This symbol, used only with L, indicates a limnic layer of coprogenous earth (or sedimentary peat).

d *Physical root restriction*

This symbol indicates noncemented, root-restricting layers in natural or human-made sediments or materials. Examples are dense basal till, plowpans, and other mechanically compacted zones.

di *Diatomaceous earth*

This symbol, used only with L, indicates a limnic layer of diatomaceous earth.

e *Organic material of intermediate decomposition*

This symbol is used with O to indicate organic materials of intermediate decomposition. The fiber content of these materials is 17 to 40 percent (by volume) after rubbing.

f *Frozen soil or water*

This symbol indicates that a horizon or layer contains permanent ice. The symbol is not

used for seasonally frozen layers or for dry permafrost.

ff *Dry permafrost*

This symbol indicates a horizon or layer that is continually colder than 0° C and does not contain enough ice to be cemented by ice. This suffix is not used for horizons or layers that have a temperature warmer than 0° C at some time of the year.

g *Strong gleying*

This symbol indicates either that iron has been reduced and removed during soil formation or that saturation with stagnant water has preserved it in a reduced state. Most of the affected layers have chroma of 2 or less, and many have redox concentrations. The low chroma can represent either the color of reduced iron or the color of uncoated sand and silt particles from which iron has been removed. The symbol g is not used for materials of low chroma that have no history of wetness, such as some slates or E horizons. If g is used with B, pedogenic change in addition to gleying is implied. If no other pedogenic change besides gleying has taken place, the horizon is designated Cg.

h *Illuvial accumulation of organic matter*

This symbol is used with B to indicate the accumulation of illuvial, amorphous, dispersible complexes of organic matter and sesquioxides if the sesquioxide component is dominated by aluminum but is present only in very small quantities. The organo-sesquioxide material coats sand and silt particles. In some horizons these coatings have coalesced, filled pores, and cemented the horizon. The symbol h is also used in combination with s as “Bhs” if the amount of the sesquioxide component is significant but the color value and chroma, moist, of the horizon are 3 or less.

i *Slightly decomposed organic material*

This symbol is used with O to indicate the least decomposed of the organic materials. The fiber content of these materials is 40 percent or more (by volume) after rubbing.

j *Accumulation of jarosite*

Jarosite is a potassium or iron sulfate mineral that is commonly an alteration product of pyrite that has been exposed to an oxidizing environment. Jarosite has hue of 2.5Y or yellower and normally has chroma of 6 or more, although chromas as low as 3 or 4 have been reported. [Note: No longer used to indicate “juvenile.”]

jj *Evidence of cryoturbation*

Evidence of cryoturbation includes irregular and broken horizon boundaries, sorted rock fragments, and organic soil materials existing as bodies and broken layers within and/or

between mineral soil layers. The organic bodies and layers are most commonly at the contact between the active layer and the permafrost.

k *Accumulation of secondary carbonates*

This symbol indicates an accumulation of visible pedogenic calcium carbonate (less than 50 percent, by volume). Carbonate accumulations exist as carbonate filaments, coatings, masses, nodules, disseminated carbonate, or other forms.

kk *Engulfment of horizon by secondary carbonates*

This symbol indicates major accumulations of pedogenic calcium carbonate. The suffix kk is used when the soil fabric is plugged with fine grained pedogenic carbonate (50 percent or more, by volume) that exists as an essentially continuous medium. The suffix corresponds to the stage III plugged horizon or higher of the carbonate morphogenetic stages (Gile et al., 1966).

m *Cementation or induration*

This symbol indicates continuous or nearly continuous cementation. It is used only for horizons that are more than 90 percent cemented, although they may be fractured. The cemented layer is physically root-restrictive. The dominant cementing agent (or the two dominant ones) may be indicated by adding defined letter suffixes, singly or in pairs. The horizon suffix km or kkm indicates cementation by carbonates; qm, cementation by silica; sm, cementation by iron; yym, cementation by gypsum; kqm, cementation by lime and silica; and zm, cementation by salts more soluble than gypsum.

ma *Marl*

This symbol, used only with L, indicates a limnic layer of marl.

mn *Mangans*

This symbol indicates an accumulation of manganese oxide, generally as ped coatings called mangans (First used by Borchardt on 20130418.)

n *Accumulation of sodium*

This symbol indicates an accumulation of exchangeable sodium.

o *Residual accumulation of sesquioxides*

This symbol indicates a residual accumulation of sesquioxides.

p *Tillage or other disturbance*

This symbol indicates a disturbance of the surface layer by mechanical means, pasturing, or similar uses. A disturbed organic horizon is designated Op. A disturbed mineral horizon is designated Ap even though it is clearly a former E, B, or C horizon.

q *Accumulation of silica*

This symbol indicates an accumulation of secondary silica.

r *Weathered or soft bedrock*

This symbol is used with C to indicate cemented layers (moderately cemented or less cemented). Examples are weathered igneous rock and partly consolidated sandstone, siltstone, or slate. The excavation difficulty is low to high.

s *Illuvial accumulation of sesquioxides and organic matter*

This symbol is used with B to indicate an accumulation of illuvial, amorphous, dispersible complexes of organic matter and sesquioxides if both the organic-matter and sesquioxide components are significant and if either the color value or chroma, moist, of the horizon is 4 or more. The symbol is also used in combination with h as "Bhs" if both the organic-matter and sesquioxide components are significant and if the color value and chroma, moist, are 3 or less.

se *Presence of sulfides*

Typically dark colors (e.g., value <4, chroma <2); may have a sulphurous odor.

ss *Presence of slickensides*

This symbol indicates the presence of slickensides. Slickensides result directly from the swelling of clay minerals and shear failure, commonly at angles of 20 to 60 degrees above horizontal. They are indicators that other vertic characteristics, such as wedge-shaped peds and surface cracks, may be present.

t *Accumulation of silicate clay*

This symbol indicates an accumulation of silicate clay that either has formed *in situ* within a horizon or has been moved into the horizon by illuviation, or both. At least some part of the horizon should show evidence of clay accumulation either as coatings on surfaces of peds or in pores, as lamellae, or as bridges between mineral grains.

u *Presence of human-manufactured materials (artifacts)*

This symbol indicates the presence of manufactured artifacts that have been created or modified by humans, usually for a practical purpose in habitation, manufacturing,

excavation, or construction activities. Examples of artifacts are processed wood products, liquid petroleum products, coal, combustion by-products, asphalt, fibers and fabrics, bricks, cinder blocks, concrete, plastic, glass, rubber, paper, cardboard, iron and steel, altered metals and minerals, sanitary and medical waste, garbage, and landfill waste.

v *Plinthite*

This symbol indicates the presence of iron-rich, humus-poor, reddish material that is firm or very firm when moist and hardens irreversibly when exposed to the atmosphere and to repeated wetting and drying.

w *Development of color or structure*

This symbol is used with B to indicate the development of color or structure, or both, with little or no apparent illuvial accumulation of material. It should not be used to indicate a transitional horizon.

x *Fragipan character*

This symbol indicates a genetically developed layer that has a combination of firmness and brittleness and commonly a higher bulk density than the adjacent layers. Some part of the layer is physically root-restrictive.

y *Accumulation of gypsum*

This symbol indicates an accumulation of gypsum (<50% by volume).

yy *Dominance of gypsum*

This symbol indicates an accumulation of gypsum (>50% by volume); light colored (e.g., value >7, chroma <4); may be pedogenically derived or inherited transformation of primary gypsum from parent material.

z *Accumulation of salts more soluble than gypsum*

This symbol indicates an accumulation of salts that are more soluble than gypsum; e.g., NaCl.

HUMUS. The well-decomposed, more or less stable part of the organic matter in mineral soils.

ILLUVIATION. The deposition by percolating water of solid particles, mostly clay or humus, within a soil horizon.

INTERFLUVE. The land lying between streams.

ISOCHRONOUS BOUNDARY. A gradational boundary between two sedimentary units

indicating that they are approximately the same age. Opposed to a nonisochronous boundary, which by its abruptness indicates that it delineates units having significant age differences.

KROTOVINA. An animal burrow filled with soil.

LEACHING. The removal of soluble material from soil or other material by percolating water.

LOWSTAND. The lowest elevation reached by the ocean during a glacial period.

MANGAN. A thin coating of manganese oxide (cutan) on the surface of a sand grain, pebble, soil aggregate, or ped. Mangans also line pores or root channels and bridge sand grains.

MODERN SOIL. The portion of a soil section that is under the influence of current pedogenetic conditions. It generally refers to the uppermost soil regardless of age.

MODERN SOLUM. The combination of the A and B horizons in the modern soil.

MORPHOLOGY, SOIL. The physical make-up of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

MOTTLING, SOIL. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance--few, common, and many; size--fine, medium, and coarse; and contrast--faint, distinct and prominent. The size measurements are these: fine, less than 5 mm in diameter along the greatest dimension; medium, from 5 to 15 mm, and coarse, more than 15 mm.

MRT (MEAN RESIDENCE TIME.) The average age of the carbon atoms within a soil horizon. Under ideal reducing conditions, the humus in a soil will have a C-14 age that is half the true age of the soil. In oxic soils humus is typically destroyed as fast as it is produced, generally yielding MRT ages no older than 300-1000 years, regardless of the true age of the soil.

MUNSELL COLOR NOTATION. Scientific description of color determined by comparing soil to a Munsell Soil Color Chart (Available from Macbeth Division of Kollmorgen Corp., 2441 N. Calvert St., Baltimore, MD 21218). For example, dark yellowish brown is denoted as 10YR3/4m in which the 10YR refers to the hue or proportions of yellow and red, 3 refers to value or lightness (0 is black and 10 is white), 4 refers to chroma (0 is pure black and white and 20 is the pure color), and m refers to the moist condition rather than the dry (d) condition.

OVERBANK DEPOSIT. Fine-grained alluvial sediments deposited from floodwaters outside of the fluvial channel.

OXIC. A soil having a high redox potential. Such soils typically are well drained, seldom being waterlogged or lacking in oxygen. Rubification in such soils tends to increase with age.

PALEO SOIL TONGUE. A soil tongue that formed during a previous soil-forming interval.

PALEOSEISMOLOGY. The study of prehistoric earthquakes through the examination of soils, sediments, and rocks.

PALEOSOL. A soil that formed on a landscape in the past with distinctive morphological features resulting from a soil-forming environment that no longer exists at the site. The former pedogenic process was either altered because of external environmental change or interrupted by burial.

PALINSPASTIC RECONSTRUCTION. Diagrammatic reconstruction used to obtain a picture of what geologic and/or soil units looked like before their tectonic deformation.

PARENT MATERIAL. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

PED. An individual natural soil aggregate, such as a granule, a prism, or a block.

PEDOCHRONOLOGY. The study of pedogenesis with regard to the determination of when soil formation began, how long it occurred, and when it stopped. Also known as soil dating. Two ages and the calculated duration are important:

t_o = age when soil formation or aggradation began, ka

t_b = age when the soil or stratum was buried, ka

t_d = duration of soil development or aggradation, ky

Pedochronological estimates are based on available information. All ages should be considered subject to $\pm$50% variation unless otherwise indicated.

PEDOCHRONOPALEOSEISMOLOGY. The study of prehistoric earthquakes by using pedochronology.

PEDOLOGY. The study of the process through which rocks, sediments, and their constituent minerals are transformed into soils and their constituent minerals at or near the surface of the earth.

PEDOGENESIS. The process through which rocks, sediments, and their constituent minerals are transformed into soils and their constituent minerals at or near the surface of the earth.

PERCOLATION. The downward movement of water through the soil.

pH VALUE. The negative log of the hydrogen ion concentration. Measurements in soils are usually performed on 1:1 suspensions containing one part by weight of soil and one part by weight of distilled water. A soil with a pH of 7.0 is precisely neutral in reaction because it is

neither acid nor alkaline. An acid or "sour" soil is one that gives an acid reaction; an alkaline soil is one that gives an alkaline reaction. In words, the degrees of acidity or alkalinity are expressed as:

Extremely acid	<4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	>9.0
Used if significant:	
Very slightly acid	6.6 to 6.9
Very mildly alkaline	7.1 to 7.3

PHREATIC SURFACE. (See Water Table.)

PLANATION. The process of erosion whereby a portion of the surface of the Earth is reduced to a fundamentally even, flat, or level surface by a meandering stream, waves, currents, glaciers, or wind.

PLEISTOCENE. An epoch of geologic time extending from 10 ka to 1.8 Ma; it includes the last Ice Age.

PROFILE, SOIL. A vertical section of the soil through all its horizons and extending into the parent material.

QUATERNARY. A period of geologic time that includes the past 1.8 Ma. It consists of two epochs--the Pleistocene and Holocene.

PROGRADATION. The building outward toward the sea of a shoreline or coastline by nearshore deposition.

RELICT SOIL. A surface soil that was partly formed under climatic conditions significantly

different from the present.

RUBIFICATION. The reddening of soils through the release and precipitation of iron as an oxide during weathering. Munsell hues and chromas of well-drained soils generally increase with soil age.

SALINE SOIL. A soil that contains soluble salts in amounts that impair the growth of crop plants but that does not contain excess exchangeable sodium.

SAND. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 mm. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

SECONDARY FAULT. A minor fault that bifurcates from or is associated with a primary fault. Movement on a secondary fault never occurs independently of movement on the primary, seismogenic fault.

SHORELINE ANGLE. The line formed by the intersection of the wave-cut platform and the sea cliff. It approximates the position of sea level at the time the platform was formed.

SILT. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 mm) to the lower limit of very find sand (0.05 mm.) Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

SLICKENSIDES. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may form along a fault plane; at the bases of slip surfaces on steep slopes; on faces of blocks, prisms, and columns undergoing shrink-swell. In tectonic slickensides the striations are strictly parallel.

SLIP RATE. The rate at which the geologic materials on the two sides of a fault move past each other over geologic time. The slip rate is expressed in mm/yr, and the applicable duration is stated. Faults having slip rates less than 0.01 mm/yr are generally considered inactive, while faults with Holocene slip rates greater than 0.1 mm/yr generally display tectonic geomorphology.

SMECTITE. A fine, platy, aluminosilicate clay mineral that expands and contracts with the absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when moist.

SOIL. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

SOIL SEISMOLOGIST. Soil scientist who studies the effects of earthquakes on soils.

SOIL SLICKS. Curvilinear striations that form in swelling clayey soils, where there is marked change in moisture content. Clayey slopes buttressed by rigid materials may allow minor amounts of gravitationally driven plastic flow, forming soil slicks sometimes mistaken for evidence of tectonism. Soil slicks disappear with depth and the striations are seldom strictly parallel as they are when movement is major. (See also SLICKENSIDES.)

SOIL TECTONICS. The study of the interactions between soil formation and tectonism.

SOIL TONGUE. That portion of a soil horizon extending into a lower horizon.

SOLUM. Combined A and B horizons. Also called the true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

STONELINE. A thin, buried, planar layer of stones, cobbles, or bedrock fragments. Stonelines of geological origin may have been deposited upon a former land surface. The fragments are more often pebbles or cobbles than stones. A stoneline generally overlies material that was subject to weathering, soil formation, and erosion before deposition of the overlying material. Many stonelines seem to be buried erosion pavements, originally formed by running water on the land surface and concurrently covered by surficial sediment.

STRATH TERRACE. A gently sloping terrace surface bearing little evidence of aggradation.

STRUCTURE, SOIL. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are--platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

SUBSIDIARY FAULT. A branch fault that extends a substantial distance from the main fault zone.

TECTOTURBATION. Soil disturbance resulting from tectonic movement.

TEXTURE, SOIL. Particle size classification of a soil, generally given in terms of the USDA system which uses the term "loam" for a soil having equal properties of sand, silt, and clay. The basic textural classes, in order of their increasing proportions of fine particles are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sand clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

TOPOSEQUENCE. A sequence of kinds of soil in relation to position on a slope. (See also CATENA.)

TRANSLOCATION. The physical movement of soil particles, particularly fine clay, from one soil horizon to another under the influence of gravity.

UNIFIED SOIL CLASSIFICATION SYSTEM. The particle size classification system used by the U.S. Army Corps of Engineers and the Bureau of Reclamation. Like the ASTM and AASHO systems, the sand/silt boundary is at 80 um instead of 50 um used by the USDA. Unlike all other systems, the gravel/sand boundary is at 4 mm instead of 2 mm and the silt/clay boundary is determined by using Atterberg limits.

VERTISOL. A soil with at least 30% clay, usually smectite, that fosters pronounced changes in volume with change in moisture. Cracks greater than 1 cm wide appear at a depth of 50 cm during the dry season each year. One of the ten USDA soil orders.

WATER TABLE. The upper limit of the soil or underlying rock material that is wholly saturated with water. Also called the phreatic surface.

WAVE-CUT PLATFORM. The relatively smooth, slightly seaward-dipping surface formed along the coast by the action of waves generally accompanied by abrasive materials.

WEATHERING. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

WETTING FRONT. The greatest depth affected by moisture due to precipitation.

yr B.P. Uncorrected radiocarbon age expressed in years before present, calculated from 1950. Calendar-corrected ages are expressed in ka, or, if warranted, as A.D. or B.C.

Project No.
10741.000.000

August 14, 2015

Mr. Matt Dobbins
Dobbins Properties, LLC
1901 W. Kettleman Lane, Suite 102
Lodi, CA 95242

Subject: South Camino Pablo Annexation Project
Subdivision 9396
Moraga, California

GEOLOGIC HAZARDS AND MITIGATION MEASURES FOR THE SOUTH CAMINO PABLO ANNEXATION PROJECT

References:

1. ENGEO Incorporated, 2015, Preliminary Geotechnical Report, South Camino Pablo Annexation Project – Subdivision 9396, Moraga, California, Project No. 10741.000.000.

2. ENGEO Incorporated; 2014, Preliminary Geologic Exploration, 1211 Camino Pablo Property, Moraga, California, Project No. 10741.000.000.

Dear Mr. Dobbins:

With your authorization, we are providing this letter to address CEQA impacts and mitigation measures for your property located at 1211 Camino Pablo in Moraga, California. We have previously provided a Preliminary Geotechnical Report dated March 25, 2015 (Reference 1), which provided preliminary recommendations for the proposed development based on the Draft Vesting Tentative Map dated March 2015. In addition, we have provided a Preliminary Geologic Exploration (Reference 2) which included exploratory test pits and a trench to observe geologic features at the site.

CEQA standards of geologic hazards are included below and listed 1 through 6, with our comments for the project bulleted below:

1. *The exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault;*

   - The proposed development site is not located within a State of California Earthquake Fault Zone for known active faults. Additionally, a thrust fault mapped crossing the site by Crane (1988) was explored as reported in Reference 2. An exploratory trench was excavated across a saddle to exposed fault features. The exposed soils were interpreted to be up to 40,000 years of age with no indications of faulting observed. Potential Hazards from fault rupture at the site are considered low.

2. *The exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving strong seismic ground shaking or seismic-related ground failure, including liquefaction;*

   - To mitigate the shaking effects, all structures shall be designed using sound engineering judgment and latest California Building Code (CBC) requirements, as a minimum. The 2013 CBC references ASCE 7-10 for minimum design loads including seismic design loads. Additionally, corrective grading measures are anticipated to mitigate landslide deposits affecting the development area. Liquefiable soils were not encountered during our 2014 field exploration and according to a USGS preliminary liquefaction susceptibility map for the San Francisco Bay Region (Wentworth et al., 2000), the potential for liquefaction at the project site is considered negligible.

3. *The exposure of people or structures to potential substantial adverse effects, including the risk of loss, injury or death involving landslides;*

   - As noted above, corrective grading measures are anticipated to mitigate landslide deposits affecting the development area.

4. *Development located on a geologic unit or soil that is unstable (or that would become unstable as a result of the Project) and which could potentially result in on or offsite landslide, lateral spreading, subsidence, liquefaction or collapse;*

   - Corrective grading of potentially unstable soils including; construction of drained keyways, removal of compressible colluvial soils and soft sediment and rebuilding graded slopes with compacted engineered fill is anticipated for project development to minimize the potential for adverse conditions. Additionally, excavations are anticipated to be observed by the Geotechnical Engineer of record during site grading to confirm conformance with recommendations.

5. *Development located on expansive soil, creating substantial risks to life and property;*

   - Foundations at the project site, based on design slope grading and the expansive potential of the onsite soils, may consist of pier and grade-beam and/or mat foundations, sufficiently stiff to move as rigid units. Laboratory testing to confirm foundation recommendations is anticipated to be conducted prior to vertical construction.

6. *The loss of topsoil or development in an area of erodible soils*

   - To mitigate the potential for erosion and promote vegetative growth along graded slopes, construction of concrete lined ditches and the use of erosion control measures such as hydro seeding and/or placement of erosion control fabric is anticipated.

If you have any questions regarding the contents of this letter, please do not hesitate to contact us.

Sincerely,

ENGEO Incorporated

Jacob White, PG

Philip Stuecheli, CEG

PROFESSIONAL GEOLOGIST
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jw/ps/ag

Project No.
10741.000.000

August 17, 2015

Mr. Matt Dobbins
Dobbins Properties, LLC
1901 W. Kettleman Lane, Suite 102
Lodi, CA 95242

Subject: South Camino Pablo Annexation Project
Subdivision 9396
Moraga, California

RESPONSE TO COMMENTS

References:

1. ENGEO Incorporated, 2015, Preliminary Geotechnical Report, South Camino Pablo Annexation Project – Subdivision 9396, Moraga, California, Project No. 10741.000.000.

2. ENGEO Incorporated; 2014, Preliminary Geologic Exploration, 1211 Camino Pablo Property, Moraga, California, Project No. 10741.000.000.

3. Hultgren – Tillis Engineers, Preliminary Geotechnical Review/ Comments, South Camino Pablo Annexation 13 Lot Development; June 9, 2015.

Dear Mr. Dobbins:

We are providing this letter to address review comments included in the memorandum from the Town of Moraga (dated June 10, 2015) and from Hultgren – Tillis Engineers (Reference 3) regarding "inactive" faulting at the South Camino Pablo property in Moraga, California.

Comment 4 under Geotechnical: Based on Engeo's fault exploration there were no indications of active faulting, but there is uncertainty about a possible older inactive fault in the location mapped by Crane (1988). The mapped fault location extends through the building pads on three lots.

ENGEO Response: As discussed in References 1 and 2, the proposed development site is not located within a State of California Earthquake Fault Zone for known active faults. The fault trench exploration (Reference 2) was excavated in a relatively well-defined topographic saddle, and perpendicular to the mapped thrust fault trace by Crane. As stated in the report, soils exposed within the trench represent an age of roughly 40,000 years, with bedrock exposed on either end of the trench. The services of well-known soil scientist Glenn Borchardt were retained to provide a detailed profile and study to confirm the representative age of colluvial soils

exposed. As stated in the ENGEO report, no indications of faulting, active or other were observed within the trench. There is therefore, in our opinion, no uncertainty regarding the activity or location of the older inactive fault mapped by Crane.

If you have any questions regarding the contents of this letter, please do not hesitate to contact us.

Sincerely,

ENGEO Incorporated

Jacob White, PG

Philip Stuecheli, CEG

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jw/pjs/bvv

SUPPLEMENTAL GEOTECHNICAL EXPLORATION

SOUTH CAMINO PABLO ANNEXATION PROJECT
SUBDIVISION 9396
MORAGA, CALIFORNIA

Submitted to:
Mr. Matt Dobbins
Dobbins Properties, LLC
1901 W. Kettleman Lane, Suite 102
Lodi, CA 95242

Prepared by:
ENGEO Incorporated

October 26, 2015

Project No:
10741.000.000

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- Expect Excellence -

Project No.
10741.000.000

October 26, 2015

Mr. Matt Dobbins
Dobbins Properties, LLC
1901 W. Kettleman Lane, Suite 102
Lodi, CA 95242

Subject: South Camino Pablo Annexation Project
Subdivision 9396
Moraga, California

SUPPLEMENTAL GEOTECHNICAL EXPLORATION

Dear Mr. Dobbins:

With your authorization, we have completed this preliminary geotechnical exploration report for your property located at 1211 Camino Pablo in Moraga, California. The accompanying report presents the findings of our previous field exploration together with our conclusions and preliminary recommendations regarding residential development at the site.

Our findings indicate that the project site is suitable for the proposed development provided the preliminary recommendations provided in this report are incorporated in the project planning. Additional design-level exploration services will be needed to develop recommendations for grading, drainage, and foundation design. We are pleased to have been of service to you on this project and are prepared to consult further with you and your design team as the project progresses.

Sincerely

ENGEO Incorporated

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

We have completed a supplemental geotechnical and geologic exploration at the project site to supplement the findings of our previous exploration dated January 21, 2014. The purpose of our study is to provide updated conclusions regarding the geotechnical considerations for the project and updated preliminary recommendations in support of project planning and preliminary design with consideration to these changes.

The scope of our services included the following:

- Review of previously published reports for the Camino Pablo property.
- Review of the Vesting Tentative Map dated July 2015.
- Drilling of five exploratory borings including two continuously cored borings.
- Laboratory testing on select samples obtained during drilling to characterize the site soils and bedrock.
- Analysis of the geological and geotechnical data including slope stability analysis for the proposed development.
- Development of a Preliminary Remedial Grading Plan showing anticipated corrective grading for the proposed development.
- Preparation of this report, which compiles previous data, current exploration and analysis, and summarizes our findings and preliminary geotechnical design recommendations.

We prepared this report exclusively for Dobbins Properties, LLC and their design team consultants. ENGEO should review any changes made in the character, design or layout of the development to modify the conclusions and recommendations contained in this report, as necessary. This document may not be reproduced in whole or in part by any means whatsoever, nor may it be quoted or excerpted without the express written consent of ENGEO.

1.2 SITE LOCATION AND DESCRIPTION

The project site is currently undeveloped and is located in hillside terrain as shown on the Vicinity Map, Figure 1. The site is open grassland that is currently used for grazing. Existing improvements appear to be limited to perimeter fencing.

1.3 PROPOSED DEVELOPMENT

Based on the Draft Vesting Tentative Map (VTM) prepared by DK Consulting dated July 2015, the planned development will consist of 13 single-family residential lots (Figure 2). The plan depicts cuts up to 15 feet deep and fills up to 30 feet thick the achieve the desired grades. A 3:1 (horizontal: vertical) cut slope is shown extending up from Street "A" approximately 125 feet in the vicinity of Lots 1 and 2, with a midslope debris bench. Retaining walls up to approximately 5 feet high are shown at various locations throughout the development. A long narrow C3 basin is shown below Lots 9 through 13, at the toe-of-slope. Other site improvements are anticipated to include underground utilities and an improved street with access from Camino Pablo.

1.4 PREVIOUS GEOTECHNICAL AND GEOLOGICAL STUDY

In 2013, ENGEO provided a preliminary geotechnical evaluation, which included recommendations for a fault trench study based on regional geologic mapping and aerial photograph review. In 2014, we conducted a preliminary geologic exploration including a trench 176 lineal feet excavated crossing perpendicular to a regionally mapped thrust fault (Crane, 1988) and excavation of eight exploratory test pits to characterize landsliding at the site. The previous site studies are summarized in the following and included in the References section of this report.

2.0 GEOLOGY AND SEISMICITY

2.1 AERIAL PHOTOGRAPH INTERPRETATION

Several sets of aerial photographs (see list of references) were examined to study geomorphic features that could be associated with faulting and landsliding at the site. Based on our review of the mapping by Nilsen (1975), examination of aerial photographs, site reconnaissance mapping and field exploration, areas that appear to be underlain by landslide deposits were mapped as shown on the Site Plan, Figure 2.

The thrust fault mapped by Crane (1988) crosses a topographic saddle and is aligned along linear valleys on both sides of the saddle. Based on our review of aerial photographs, we did not observed scarps, tonal lineations or others features that are sometimes indicative of active faulting along the trace of the fault mapped by Crane. In some photographs, vegetation exhibits a darker tone in the linear valley; however, this darker tone appears to be associated with the thicker colluvial soils. It also appears that the linear valley is parallel to the strike of bedrock structure. The linear valley may be related to differential erosion rather than faulting. The ridges adjacent to the valley appear to be underlain by sandstone beds that are more resistant to erosion than the claystone that was encountered in the linear valley.

2.2 REGIONAL GEOLOGY

The study area is located in the Coast Ranges geomorphic province of California. The Coast Ranges are characterized by a series of northwest-trending valleys and mountain ranges. The

bedrock in this region has been folded and faulted in a tectonic setting that is experiencing translational and compressional deformations of the earth's crust.

Regional geologic mapping by Graymer et al. (1994) indicates that the study area is underlain by bedrock of the lower member of the Mulholland formation. Bedrock structure in the area is mapped striking to the northwest and dipping to the northeast.

2.2.1 Geologic Mapping

During our previous and current exploration, ENGEO geologists performed geologic mapping at the site. Below are descriptions of the geologic units observed during mapping and encountered during our explorations at the site as shown on Figure 2.

2.2.1.1 Landslides

In 2014, we performed a site-specific landslide evaluation, including interpretation of low-altitude stereo-paired aerial photographs, and a field reconnaissance to map the landslides. Additional exploration was performed as part of this study to further characterize landsliding at the site. In general, the landslides at the site are approximately 5 to 15 feet thick and can be described as earthflow complexes. Earthflows are a type of landslide that is characterized by mobilization as a viscous, slow-moving mass. Earthflows commonly move by a combination of semi-fluid flow and sliding along weak clay slip planes. Earthflows typically form when cohesive, clayey soils or weak bedrock experience an increase in pore-water pressure and fail. Like debris flows, they commonly mobilize as a result of intense rains, but, due to their high clay content, they tend to move relatively slowly, and movements usually persist for some time following peak rainfalls. Successive earthflows often accumulate as lobate masses of soil with pervasive internal shearing, forming earthflow complexes. The results of our landslide mapping is shown on the geologic map, Figure 2.

2.2.1.2 Surficial Soils and Colluvium (Qc)

The surface of the site is typically mantled with stiff to very stiff dark brown lean clay derived from weathering of the underlying poorly indurated bedrock. The thickness of surficial soils is typically 2 to 4 feet on upland peaks, shoulders, and spur ridges.

Deposits of colluvium consist of transported surficial soil that have accumulated in the low-lying portions of the site as depicted on Figure 2, and as encountered during our field exploration, are up to 27 feet thick along Camino Pablo. Generally, the colluvial deposits consist of medium stiff to hard lean clay. Two representative samples from our field exploration yielded PIs of 14 and 15.

2.2.1.3 Bedrock Formations

The Mulholland Formation bedrock underlying the project area was found to consist of claystone, siltstone and sandstone in our test pits, trench and borings. The claystone and siltstone is

often moderately to highly weathered, closely fractured and weak. The claystone within the Mulholland Formation at the site may have a moderate to high expansion potential. Plasticity Index (PI) testing on a select siltstone sample collected during drilling yielded a result of 21, having a moderate expansion potential. Bedding structure, measured during our exploration, generally strikes northwest and is dipping 46 to 65 degrees northeast, with bedding as steep as 74 degrees as observed in boring 1-B4.

2.3 FAULTING AND SEISMICITY

The site is not within a State of California Earthquake Fault Zone for known active faults. The nearest known active fault is the Hayward fault, which is located about 4 miles to the southwest of the site. Other active faults in the region include the Calaveras fault located about 5 miles to the east, and the San Andreas fault located about 22 miles to the southwest.

A southwest dipping thrust fault is mapped by Crane (1988) crossing the southwestern portion of the site as shown the attached Regional Geologic Map, Figure 3. A southwest dipping thrust fault is also mapped by Graymer et al. (1994) and Wagner (1978) roughly coincident with Camino Pablo. These mapped thrust faults are not considered active or potentially active based on maps showing recency of faulting by Bortugno (1991) or Jennings and Bryant (2010).

Figure 4 shows the approximate location of Quaternary faults and significant historic earthquakes mapped within the San Francisco Bay Region.

The 2014 Working Group on California Earthquake Probabilities evaluated the regional seismicity of the Bay Area and published their results as The Uniform California Earthquake Rupture Forecast, Version 3 (UCERF 3). The Working Group periodically attempts to summarize seismic risk in California with time-dependent earthquake rupture forecasts, in which the probabilities of future events are conditioned upon the dates of previous earthquakes. According to UCERF 3, there is an aggregated 72 percent probability of 6.7 M_W or greater earthquake on an active Bay Area fault over the next 30 years. The probability of a 6.7M_W or greater earthquake on the Hayward Fault, Calaveras and San Andreas faults are 14, 7, and 6 percent, respectively, over the next 30 years.

3.0 GEOTECHNICAL EXPLORATION

The current exploration was completed on September 23 and 24, 2015 and the previous exploration was completed in January 2014 as discussed below.

3.1 EXPLORATORY BORINGS

The current field exploration consisted of drilling five exploratory borings to a maximum depth of about 35½ feet below grade. The areas of subsurface explorations were located by pacing from the existing features, and the elevations were estimated based on the site plan and should be considered accurate only to the degree implied by the method used. The approximate locations of the borings are shown on Figure 2.

Test borings were drilled using a track-mounted CME-55 drill rig equipped with 8-inch-diameter hollow stem augers. Soil samples were collected using either a 3-inch O.D. California-type split-spoon sampler fitted with 6-inch-long brass liners or a 2-inch O.D. Standard Penetration Test (SPT) split-spoon sampler or continuously cored using a dry-core split barrel sampler. The samplers were driven with a 140-pound automatic safety hammer falling a distance of 30 inches. The penetration of the sampler into the native materials was field recorded as the number of blows required to drive the sampler 18 inches in 6-inch increments. The boring logs show the number of blows required for the last one foot of penetration and have not been converted using any correction factors.

Drive sample boreholes were logged in the field by an ENGEO engineer and continuously cored boreholes were logged in the field by an ENGEO geologist. Samples collected during drilling were transported to our laboratory for analysis. Continuously cored samples were placed in core boxes and photographed in the field, then transported to our laboratory. The field logs were used to develop the report borelogs (Appendix A). The logs depict subsurface conditions within the borings for the date of drilling; however, subsurface conditions may vary with time.

3.2 2014 FIELD EXPLORATION

3.2.1 Fault Trench Exploration

Exploratory Trench T-1, totaled approximately 176 lineal feet, and was excavated perpendicular to the thrust fault mapped by Crane (1988) at the location shown on Figure 2. The trench was located in the field by tape measuring from existing features. The log of the trench is included in Appendix C. The trench extended across a relatively well-defined topographic saddle between two ridges.

The depth of the trench averaged about 9 feet below the adjacent ground surface. The southeastern wall of the trench was cleaned with hand tools and examined by ENGEO geologists. The exposure was logged at a horizontal and vertical scale of 1 inch to 5 feet. A level line was established in the trench and measurements were referenced to this line.

Bedrock of the Mulholland formation was encountered at both the northeastern and southwestern ends of the trench. In the central section of the trench, thick colluvial soil deposits were encountered and bedrock was not exposed. As indicated on the trench log, several soil strata were mapped and were observed to be continuous across the trench exposure. No shears, clay gouge or other indications of faulting were observed in the trench exposure.

The services of a soil scientist, Dr. Glen Borchardt, were retained to evaluate the relative age of the colluvial soils exposed in the trench. Dr. Borchardt prepared a detailed log of the soil profile, performed laboratory testing and analysis of the soil stratigraphy. The report prepared by Dr. Borchardt is presented in Appendix C to this report. Dr. Borchardt's report indicates that the colluvial soils exposed in the trench represent deposition and soil development that has occurred over roughly the last 40,000 years. Based on this finding, no evidence of active faulting was found in Trench T-1.

3.2.2 Test Pit Exploration

Eight exploratory test pits were excavated to depths of about 6 to 14 feet below grade. In Test Pit TP-1, colluvial soil deposits were encountered to a depth of 14 feet. The colluvium consisted of dark brown silty clay that was dry to moist and very stiff. Based on visual examination, the soils encountered on site appear to range from low to high plasticity.

Landslide deposits were encountered in several tests pits consisting of predominately soil material. Well-defined basal slide planes were encountered in Test Pits TP- 4 and TP-5. Based on the findings of our exploration, the landslide deposits appear to range from about 5 to 15 feet thick.

Bedrock encountered in the test pits consisted of interbedded claystone, siltstone and sandstone. The bedrock is typically weak, highly fractured and varies from thinly to thickly bedded. Bedrock structure was generally found to be consistent with regional mapping by Graymer (1994), striking to the northwest and dipping steeply to the northeast.

3.3 LABORATORY TESTING

Representative samples recovered during drilling were tested to determine the following soil characteristics:

TABLE 3.3-1

Characteristic	Test Method
Natural Unit Weight and Moisture Content	ASTM D2216 and D7263
Atterberg Limits	ASTM D4318
Isotropic Triax Compression - CU	ASTM D4767
Unconfined Compression	ASTM D2166
Constant Rate of Strain Consolidation	ASTM D4186

The laboratory test results are shown on the boring logs and included in Appendix B.

3.4 GROUNDWATER

Perched groundwater was encountered in boring 1-B1 at 24 feet; samples collected below 24 feet were moist and not saturated. No groundwater was encountered during the test pit and trench exploration. An area of suspected seepage or near surface groundwater was noted during our 2014 reconnaissance at the location indicated on Figure 2. No free water was observed in this area at the time of our site visit during this current study. Fluctuations in groundwater levels occur seasonally and over a period of years because of variations in precipitation, temperature, irrigation, or other factors.

4.0 DISCUSSION AND CONCLUSIONS

Based upon our geotechnical exploration, we conclude that development of the South Camino Pablo project is feasible from a geotechnical standpoint, provided that the recommendations included in this report, along with appropriate mitigation of geologic hazards and other sound engineering practices, are incorporated in the design and construction of the project. The primary geotechnical design considerations are the presence of landslides and unstable colluvial deposits on slopes, onsite expansive soil, and bedrock and earthquake-induced strong ground shaking.

4.1 LANDSLIDE HAZARDS

As described above, several landslide areas were mapped within the study area. Our exploration indicates that these landslides range from about 5 to 15 feet thick and involve primarily soil material. These landslides appear to occur as relatively shallow slumps and earthflows. As noted on Figure 2, portions of the mapped landslides have been recently active.

Based on the proposed tentative map development, we anticipate that landslides with in the development will be mitigated including removal of slide debris and reconstruction of the slopes with subdrains and engineered fill as discussed in subsequent sections of this report.

4.2 COMPRESSIBLE SOILS

Based on consolidation testing, it appears that the deeper deposits of colluvium encountered in Boring 1B-1 will be slightly compressible under the anticipated loads from proposed fills. We estimate that about 2 to 3 inches of settlement of the native colluvium material is possible under the proposed 30 feet of fill. The timing of settlement can be difficult to predict since the rate of settlement will depend to a large extent on the rate that groundwater can drained through the colluvium. Our analyses indicate that the majority of the settlement will be completed within one year. However, it has been our experience with many similar projects that native colluvial soils drain several times faster than rates predicted by laboratory testing, and consolidation is typically substantially complete within several months. Possible measures to mitigate compressible soil settlement are discussed below.

4.3 EXPANSIVE SOILS

A significant geotechnical consideration is the expansive potential of the native soil and bedrock across the proposed development area. The clayey soils and claystone units within the bedrock in this region have moderate to high plasticity and moderate to critically high expansion potential.

Expansive soils shrink and swell as a result of seasonal fluctuation in moisture content, which can cause heaving and cracking of slabs-on-grade, pavements, and structures founded on shallow foundations. Building damage due to volume changes associated with expansive soils can be reduced through proper foundation design. Successful construction on expansive soils requires special attention during construction. It is imperative that exposed soils be kept moist by watering for several days before placement of concrete. It is extremely difficult to moisturize

clayey soils without excavation, moisture conditioning, and recompaction. Additional laboratory analysis should be conducted during design-level exploration to characterize expansive soils at the site.

4.4 FAULT HAZARDS

Based on the findings of our exploration, no indications of active faulting were encountered in the exploratory trench that was excavated across the location of the thrust fault that was mapped by Crane (1988). Based on these findings, it is our opinion that the potential for ground rupture from active faulting at the site is low and setbacks from the map fault are not necessary.

Based on the findings of this exploration it is uncertain if an older inactive fault exists at the location mapped by Crane (1988). Fault zones sometimes contain weak, highly expansive material that can adversely affect roadways and/or foundations. During grading operations for the project, conditions exposed along the mapped fault should be examined by the project geologist to determine if indications of faulting are exposed and if mitigation measures are needed. If indications of an inactive fault are found, mitigation measures typically involved overexcavation of the weaker material to some depth below planned finish grade and replacement of the weak material with engineered fill.

4.5 SEISMIC HAZARDS

Potential seismic hazards resulting from a nearby moderate to major earthquake may include primary ground rupture, ground shaking, lurching, liquefaction, dynamic densification, lateral spreading, and earthquake-induced landsliding. These hazards are discussed below. Risks from seiches, tsunamis, and volcanic eruption are currently considered negligible.

4.5.1 Ground Rupture

No known active faults cross the South Camino Pablo project. No evidence of Holocene active faulting was observed during our site reconnaissance, aerial photo review or trenching. Based on our previous studies, field mapping, and review of aerial photographs, it is our opinion that fault-related ground rupture is unlikely at the subject property.

4.5.2 Ground Shaking

An earthquake of moderate to high magnitude generated within the San Francisco Bay Region could cause considerable ground shaking at the site, similar to that which has occurred in the past. To mitigate the shaking effects, all structures shall be designed using sound engineering judgment and latest California Building Code (CBC) requirements, as a minimum. The 2013 CBC references ASCE 7-10 for minimum design loads including seismic design loads.

4.5.2.1 California Building Code Seismic Design Parameters

The 2013 California Building Code (CBC) seismic design parameters in the table below are based on a Site Class D as determined in accordance with ASCE 7-10. The parameters below include design spectral response acceleration parameters based on the mapped Risk-Targeted Maximum Considered Earthquake (MCE_R) spectral response acceleration parameters as well as the Maximum Considered Earthquake geometric mean peak ground acceleration used for geotechnical evaluation.

TABLE 4.5.2.1-1
2013 CBC Seismic Design Parameters

Parameter	Design Value
Site Class	C
Mapped MCE_R Spectral Response Acceleration at Short Periods, S_S (g)	1.634
Mapped MCE_R Spectral Response Acceleration at 1-second Period, S_1 (g)	0.642
Site Coefficient, F_A	1.00
Site Coefficient, F_V	1.30
MCE_R Spectral Response Acceleration at Short Periods, S_{MS} (g)	1.634
MCE_R Spectral Response Acceleration at 1-second Period, S_{M1} (g)	0.835
Design Spectral Response Acceleration at Short Period, S_{DS} (g)	1.089
Design Spectral Response Acceleration at 1-second Period, S_{D1} (g)	0.557
Mapped MCE Geometric Mean Peak Ground Acceleration (g)	0.632
Site Coefficient, F_{PGA}	1.00
MCE Geometric Mean Peak Ground Acceleration, PGA_M (g)	0.632

4.5.3 Ground Lurching

Ground lurching is a result of the rolling motion imparted to the ground surface during energy released by an earthquake. Such rolling motion can cause ground cracks to form. The potential for the formation of these cracks is considered greater at contacts between deep alluvium and bedrock such as those at the margins of valley flood plains. Although the risk of ground lurching at the site is considered low, the risk of this hazard will be reduced through implementation of typical corrective grading measures.

4.5.4 Earthquake-Induced Landsliding

Several landslides have been mapped within or immediately adjacent to the site; therefore, the potential for earthquake-induced landsliding exists. Seismic ground shaking can trigger deformation of high graded slopes or unstable natural hillsides. Existing landslide deposits within any proposed grading envelope should be mitigated by corrective grading. The corrective

grading will completely remove unstable soils down to in-place bedrock within the envelope of proposed improvements. Removal areas will be backfilled with drained engineered fills.

4.5.5 Liquefaction and Cyclic Softening

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soils most susceptible to liquefaction are, loose, saturated, sands. Empirical evidence indicates low-plasticity silts, and some low-plasticity clays are also potentially liquefiable.

The soils encountered in borings and test pits consist of stiff clays and bedrock that are not susceptible to liquefaction. The potential for liquefaction at the project site is therefore considered negligible.

4.5.6 Lateral Spreading

Lateral spreading involves lateral ground movements caused by seismic shaking. These lateral ground movements are often associated with a weakening or failure of an embankment or soil mass overlying a layer of liquefied or weak soils. Since the onsite soils are unlikely susceptible to liquefaction, the potential for lateral spreading at this site is considered negligible.

4.6 SLOPE STABILITY

The stability of natural and graded slopes at the site will be influenced by a combination of factors, including soil and bedrock shear strength and groundwater seepage. Additionally, potentially compressible colluvial soils and landslide deposits underlie portions of the site, including several graded slopes. Potentially unstable slope conditions can be mitigated by appropriate corrective grading as discussed below.

4.6.1 Slope Stability Analysis

We performed slope stability analysis on Section A-A' and B-B', which was chosen to model both the highest areas of proposed cuts and fills and the thickest section of proposed fill. The location of the cross section is depicted on Figures 2 and 8, and the cross section is depicted on Figure 9.

We performed triaxial shear testing on a Shelby tube sample collected at boring 1-B1 to model the shear strength of colluvial soils at the site. Engineered fill at the site is anticipated to consist of a mixture of colluvial soils and bedrock. Based on the laboratory test results and our experience of the site vicinity, the strength parameters recommended for use in slope stability analysis are presented in the following table.

TABLE 4.6.1-1
Recommended Strength Parameters
For Use in Stability Analysis

Geologic Unit	γ'	Long -Term		Psuedo-static	
		C'	ϕ'	C	ϕ
Engineered Fill	125	400	24	500	17
Colluvium	120	75	31	230	20
Bedrock	150	300	30	0	30

Note: γ' = Moist Unit Weight (pcf)
C' = Effective Cohesion (psf)
ϕ' = Effective Angle of Internal Friction (Degrees)

We performed slope stability analyses using SLIDE 6.0 produced by Roc Science. Limit equilibrium slope stability analyses were performed using Morgenstern and Price (1965) and the Spencer (1967) method for slices. For our analyses, both undrained and drained strength parameters were used to determine the factors of safety for both long-term and short-term loading.

In evaluating the stability of slopes under seismic conditions, we used a "pseudo-static" method of analysis as a screening analysis. SP117A states that slopes that have a pseudo-static factor of safety greater than 1.0 using a seismic coefficient derived from the screening analysis procedure of Stewart et al. (2003) can be considered stable. The pseudo-static coefficient used was determined to be 40 percent of the PGA_M (0.63g) based on 15 cm threshold of displacement as recommended by Stewart et al. (2003). SP117A recommends as a general guideline that displacements of 0 to 15 cm are unlikely to correspond to serious landslide movement and damage.

Based on local geotechnical practice, we recommend that a static factor of safety of 1.5 and a pseudo-static factor of safety of 1.0 be considered adequate for the slope stability. We used the boring logs to develop the appropriate underlying soil geometry. The summary of our global stability analysis is summarized in the table below, while the individual analyses are presented in Appendix D.

TABLE 4.6.1-2
Summary of Slope Stability Analyses

Section A - A'		
Loading Condition	Calculated Factor of Safety	Acceptable Minimum Factor of Safety
Static	2.1	1.5
Pseudo-Static	1.1	1.0

TABLE 4.6.1-3
Summary of Slope Stability Analyses

Section B-B'		
Loading Condition	**Calculated Factor of Safety**	**Acceptable Minimum Factor of Safety**
Static	3.0	1.5
Pseudo-Static	1.8	1.0

4.7 EXCAVATABILITY

Based on our field exploration and experience in the area, it is our opinion that the site soils and bedrock should be rippable with conventional heavy construction equipment, such as a Caterpillar D-9 or larger. Localized cemented lenses or beds may be encountered that may require considerable ripping effort and generate oversized material (greater than six inches in diameter). Backhoes may experience difficulty excavating in some of the lenses of less weathered bedrock. We anticipate that heavy-duty excavators should be capable of trenching the materials.

5.0 EARTHWORK RECOMMENDATIONS

The recommendations included in this report, along with other sound engineering practices, should be incorporated in the design and construction of the project.

5.1 GRADING

All grading and site development plans should continue to be coordinated with the Engineering Geologist and the Geotechnical Engineer to modify the plans such that they mitigate known soil and geologic hazards. Detailed locations of keyways, subdrains, debris benches and subexcavation areas should be shown on the final grading plans upon their completion. Sequence of grading issues, such as placement of various cut materials in specific locations, should also be evaluated during review of final 40-scale grading plans. Recommended preliminary remedial grading for the project site is depicted on Figure 8 and Figure 9 cross sections.

The Geotechnical Engineer or qualified representative should be present during all phases of grading operations to observe demolition, site preparation, grading operations, and subdrain placement. The Geotechnical Engineer should be notified a minimum of 72 hours prior to the commencement of any grading or stripping operations at the site. This is to provide time to coordinate the work with the Grading Contractor. After the grading operations commence, geologic observations of cut areas should be made at frequent intervals. This is advised so that revised geologic recommendations can be incorporated into updated grading plans as grading proceeds.

Ponding of storm water, other than within engineered detention basins, should not be permitted at the site, particularly during work stoppage for rainy weather. Before the grading is halted by

rain, positive slopes should be provided to carry the surface runoff to storm drainage structures in a controlled manner to prevent erosion damage.

5.2 SELECTION OF MATERIALS

With the exception of some organically contaminated materials (soil which contains more than 3 percent organic content by weight), we anticipate the site soils and bedrock derived materials are suitable for use as engineered fill. Other materials and debris, including trees with their root balls, should be removed from the project site.

Oversized soil or rock materials (those exceeding two-thirds of the lift thickness or 6 inches in dimension, whichever is less) should be removed from the fill and broken down to meet this requirement or otherwise off-hauled.

The Geotechnical Engineer should be informed when import materials are planned for the site. Import materials should be submitted to, and approved by, the Geotechnical Engineer prior to delivery at the site.

5.3 STRIPPING AND SITE PREPARATION

Site preparation should commence with removal of site vegetation. Site development should include removal of debris, loose soil, and soft compressible materials in any location to be graded. Any soft compressible soils should be removed from areas to receive fill or structures, or those areas to serve as borrow. Vegetation and debris should be separately stockpiled from soft compressible material and existing soil fill.

No loose or uncontrolled backfilling of depressions resulting from demolition and stripping or other soil removal should be permitted. All exploratory geologic test pits and the test trench excavated during site explorations are shown on Figure 2. It will be necessary to remove and recompact all loose soil within the test pits and the trench where it will remain below final grades and is located within proposed improvement areas. Within the development areas, excavations resulting from demolition, clearing, and/or stripping which extend below final grades should be cleaned to firm undisturbed soil as determined by the Geotechnical Engineer's representative. After stripping, the upper desiccated surficial soil layers should be ripped, moisture-conditioned and recompacted prior to placement of fill.

5.4 COMPRESSIBLE COLLUVIUM MITIGATION

Post-construction settlement of compressible colluvium can be addressed either by completely removing colluvium to bedrock prior to placing fills, or by monitoring native soil settlement during and after construction. Monitoring can be done using either surveyed settlement plates or by installation of settlement monitoring instrumentation placed on the fill subgrade.

5.5 LANDSLIDE AND COLLUVIUM REMOVAL

In general, compressible landslide debris and colluvium within the development area should be removed. Approximate removal areas are depicted on the preliminary remedial grading plan Figure 8 and Figure 9 cross sections. The extent of the actual removals should be determined by the Geotechnical Engineer based on the review of 40-scale grading plans as well as observations in the field during grading.

5.6 EXISTING FILLS

If existing fills are encountered during grading, they should be treated as unsuitable to remain below proposed structures and should be subexcavated to expose underlying competent native soils that are approved by the Geotechnical Engineer. The base of the excavations should be processed, moisture conditioned, as needed, and compacted in accordance with the subsequent recommendations for engineered fill.

5.7 FILL PLACEMENT

Overcompaction of expansive materials (PI >12) may produce an undesirable environment for expansion in the zone of significant seasonal moisture variation; therefore, special requirements for compaction of expansive soils are necessary within the upper 5 feet in building areas. This recommendation is not to be interpreted as a requirement to remove and replace the top five feet within all lots, but is to be used when fill is placed within the top 5 feet of finished grade. The following compaction control requirements should be generally applied to engineered fills.

TABLE 5.7-1

Description	Minimum Relative Compaction (%)	Minimum Moisture Content (Percentage Points Above Optimum)
Within the upper 5 ft	87 to 92	+5
From 5 to 50 ft	90	+3

Maximum dry densities and moisture contents should be determined in accordance with ASTM D 1557. Plasticity Index determinations, and possibly supplemental swell test data, should be made as a part of grading control. All fills should be placed in lifts not exceeding 12 inches or the depth of penetration of the compaction equipment used, whichever is less.

5.8 TOE KEYWAYS

After stripping, mass grading should begin with construction of keyways and subdrains. All fills should be adequately keyed into firm natural materials unaffected by shrinkage cracks. Keyways should be compacted to 95 percent relative compaction and minimum 2 percentage points over optimum moisture content.

Anticipated keyway sizes and locations should be determined based on the final grading plans by the Engineering Geologist. Typical minimum keyway sizes and subdrains are shown on Figure 5 and 6. Recommended preliminary keyway sizes and locations are provided on Figures 8 and 9. The actual depth of the keyways will be determined in the field by the Geotechnical Engineer during grading. Filling above keyways should be benched into firm competent soil or bedrock and drained as appropriate. Unless otherwise recommended by the Geotechnical Engineer, benches should be constructed at vertical intervals of not less than 5 feet. The actual depth and location of the keyways, subexcavated benches, and locations of subdrainage may then be slightly modified in the field by the Geotechnical Engineer, based on the actual field conditions and geometry exposed during grading. Once final 40-scale plans are available, we should be allowed to review changes and adjust remedial recommendations as necessary.

5.9 GEOGRID SLOPE REINFORCEMENT

We recommend that the lower portions of the slope adjacent to Camino Pablo that will be inclined at 2:1 be reinforced with a minimum of four layers of geogrid consisting of Tensar © BX1200 or approved equivalent. The geogrid should be installed beginning at two feet below the toe elevation and spaced at two-foot vertical intervals. The geogrid should be a minimum of 12 feet wide measured horizontally from the slope face. We also recommend installing four layers of grid in the same arrangement described above in the keyway and slope long the south property boundary under Lots 6 and 7. The elevation of the upper layer of geogrid should be held a minimum of eight feet below finished pad grade.

5.10 SUBSURFACE DRAINAGE FACILITIES

Subsurface drainage systems are planned for keyways, and at the base of removal areas, as a minimum. Secondary bench subdrains may also be required, depending upon the height of the fill slope and the slope of the underlying native terrain. In addition, observed seepage areas or suspected spring areas should be controlled in development areas through the use of subdrains. Positive fall of at least 1 percent towards an approved outlet should also be provided for all subdrains. The approximate locations of the recommended subdrains are shown on Figure 8.

As shown on Figure 6, subdrain systems should consist of a minimum 6-inch-diameter perforated pipe encased in Caltrans Class 2 permeable material, or crushed rock wrapped in filter fabric. As an alternative, prefabricated geocomposite drainage material (such as SKAPS TNS 220-6) could be considered in lieu of the granular medium above the subdrain zone.

Discharge from the subdrains will generally be low but in some instances may be continuous. Subdrains should outlet into the storm drain system or other approved outlets, and their locations should be surveyed and documented by the project Civil Engineer for future maintenance.

Not all sources of seepage are evident during the time of field work because of the intermittent nature of some of these conditions and their dependence on long-term climatic conditions. Furthermore, new sources of seepage may be created by a combination of changed topography, manmade irrigation patterns and potential utility leakage. Since uncontrolled water movements

are one of the major causes of detrimental soil movements, it is of utmost importance that a Geotechnical Engineer be advised of any seepage conditions so that remedial action may be initiated, if necessary.

5.11 DEBRIS BENCHES

A debris bench will be required upslope of Lots 1 through 5 as depicted on the VTM. The outboard side of the debris bench should be provided with a concrete V-ditch discharging into an approved outlet. The size, location, and configuration of required debris benches should be designated as part of the future site planning process.

All debris benches will require periodic maintenance consisting of the removal and disposal of accumulated slope detritus. Proper access should be provided for the heavy equipment, which may be required for removal of slide debris from benches and paved areas.

All debris benches and buttress fills should be jointly designed by the Civil and Geotechnical Engineers to optimize stability, cut/fill balance, and drainage concerns. Recommendations for mass grading are generally applicable to landslide reconstruction and buttress fill installation.

5.12 GRADED SLOPES

We recommend the following slope gradient guidelines for cut and fill slopes:

TABLE 5.12-1
Slope Gradient Guidelines

Slope Height	Maximum Allowable Slope Inclination (horizontal:vertical)
Less than 8 feet	2:1
Greater than 8 feet	3:1

Where steeper slopes than those indicated above are desired, supplemental slope stabilization techniques (e.g. geogrid reinforcing) may be required. Erosion of graded slopes could be significant in areas where slopes are not properly vegetated or erosion control is not properly installed. Analysis and mitigation measures should be determined as necessary during the design-level exploration. We provide recommendations regarding erosion control in Section 7 of this report.

All cut slopes should be viewed by the Engineering Geologist during slope grading for adverse bedding, seepage, or bedrock conditions, which may affect slope stability. In the event that adverse geologic conditions are detected during grading of the cut slopes, overexcavation and reconstruction of these slopes may be necessary. Track rolling to compact faces of slopes is not sufficient. Slopes should be overbuilt at least 2 feet and cut back to design grades.

5.13 CUT, FILL, AND CUT-FILL TRANSITION LOTS

Some single-family lots in this project will likely be entirely in cut or traversed by a cut/fill transition. It can be anticipated that significant variations in material properties may occur in areas of cut or cut/fill transition if not mitigated during site grading. It is our opinion that there is a potential for significant differential in swell characteristics across cut areas and cut/fill transitions. Such situations can be detrimental to building performance. Figure 7 represents the typical overexcavation recommended to mitigate the effects of differential materials located under a structure. We recommend that cut lots be overexcavated 2 feet, scarified 12 inches, and recompacted; cut/fill transition lots should be overexcavated 3 feet to provide a uniform thickness of engineered fill within the entire foundation area.

5.14 DIFFERENTIAL FILL THICKNESS

For subexcavation activities that create a differential fill thickness across individual building pads, mitigation to achieve a similar fill thickness across the pad is beneficial for the performance of a shallow foundation system. We recommend that a differential fill thickness of up to 20 feet is acceptable across individual building pads. For a differential fill thickness exceeding 20 feet across an individual pad, we recommend performing subexcavation to bring this vertical distance to within the 20-foot tolerance and that the material is replaced as engineered fill. As a minimum, the subexcavation area should include the entire structure footprint plus 5 feet beyond the edges of the building footprint.

5.15 MONITORING AND TESTING

It is important that all site preparations for site grading be done under the observation of the Geotechnical Engineer's field representative. The Geotechnical Engineer's field representative should observe all graded area preparation, including demolition and stripping. The final grading plans should be submitted to the Geotechnical Engineer for review.

6.0 PRELIMINARY FOUNDATION RECOMMENDATIONS

Foundations at the project site, based on design slope grading and the expansive potential of the onsite soils, may consist of pier and grade-beam and/or mat foundations. In order to reduce the effects of the potentially expansive soils, the foundations should be sufficiently stiff to move as rigid units with minimum differential movements. In our opinion, mat foundations are appropriate to accommodate these foundation design considerations for generally level graded lots.

Specific recommendations for these foundation systems will be developed during design-level geotechnical exploration studies.

7.0 EROSION CONTROL

In addition to vegetated cover, viable erosion mitigation measures may include concrete or asphalt lined drainage facilities on slopes graded steeper than 3:1 (horizontal:vertical). These measures are typically used on slopes with heights greater than 30 feet. The purpose of the drainage facilities is to intercept and divert the surface water runoff from the slopes and, combined with the 3:1 or flatter slopes, reduce runoff velocities, water infiltration, and sloughing or erosion of the slope surfaces. Additionally, 2:1 slopes should be provided with erosion control protection such as Rhino Snot Soil Stabilizer or other equivalent soil stabilization product.

All landscaped slopes should be maintained in a vegetated state after project completion with drought tolerant vegetation requiring drip irrigation.

The tops of fill or cut slopes should be graded in such a way as to prevent water from flowing freely down the slopes. Due to the nature of the bedrock, slopes may experience severe erosion when grading is halted by heavy rain. Therefore, before work is stopped, a positive gradient away from the slopes should be provided to carry the surface runoff away from the slopes to areas where erosion can be controlled. It is vital that no completed slope be left standing through a winter season without erosion control measures having been provided.

8.0 LIMITATIONS AND UNIFORMITY OF CONDITIONS

This report is issued with the understanding that it is the responsibility of the owner to transmit the information and recommendations of this report to developers, owners, buyers, architects, engineers, and designers for the project so that the necessary steps can be taken by the contractors and subcontractors to carry out such recommendations in the field. The conclusions and recommendations contained in this report are solely professional opinions.

The professional staff of ENGEO Incorporated strives to perform its services in a proper and professional manner with reasonable care and competence but is not infallible. There are risks of earth movement and property damages inherent in land development. We are unable to eliminate all risks or provide insurance; therefore, we are unable to guarantee or warrant the results of our services.

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Pacific Aerial Surveys, circa 1983, Color infra-red aerial photographs, un-numbered (Grading at Sanders Ranch in progress).

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FIGURES

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N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: GOOGLE EARTH PRO

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VICINITY MAP

SOUTH CAMINO PABLO ANNEXATION

MORAGA, CALIFORNIA

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FIGURE NO. 1

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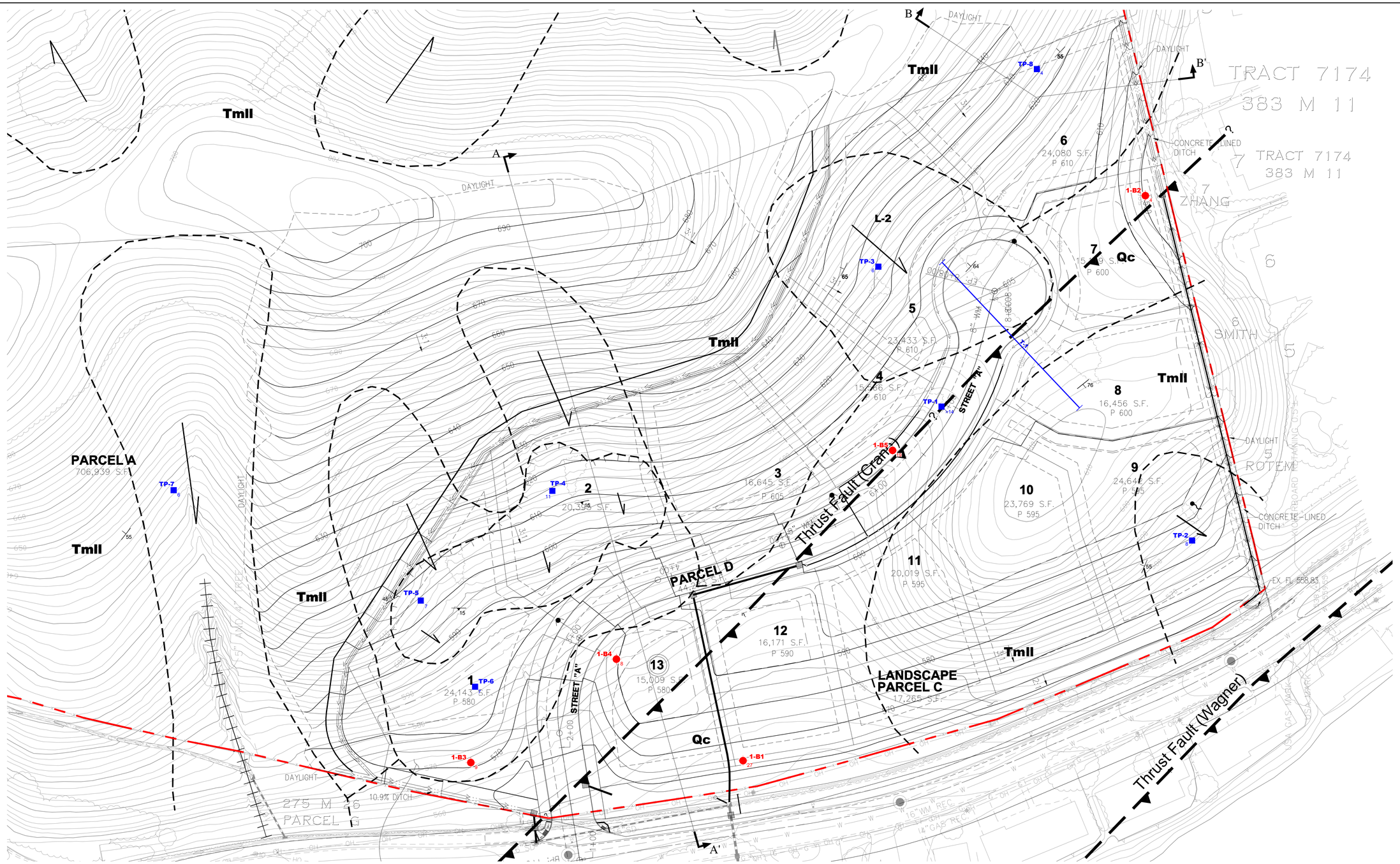

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

Qc	COLLUVIUM
Tmll	MULHOLLAND FORMATION
	GULLY
	RECENT LANDSLIDE
	GEOLOGIC CONTACT
	SURFICIAL LANDSLIDE
	SEEPAGE AREA
1-B5 19	BORING, SHOWING DEPTH TO BEDROCK IN FEET (ENGEO, 2015)
TP-7 6	TEST PIT, SHOWING DEPTH TO BEDROCK IN FEET (ENGEO, 2014)
T-1	TRENCH (ENGEO, 2014)
65	STRIKE AND DIP OF BEDDING
15	STRIKE AND DIP OF SLIDE PLANE
A A'	CROSS SECTION LOCATION

N

0 FEET 40
0 METERS 20

BASE MAP SOURCE: DK ASSOCIATES

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SITE PLAN
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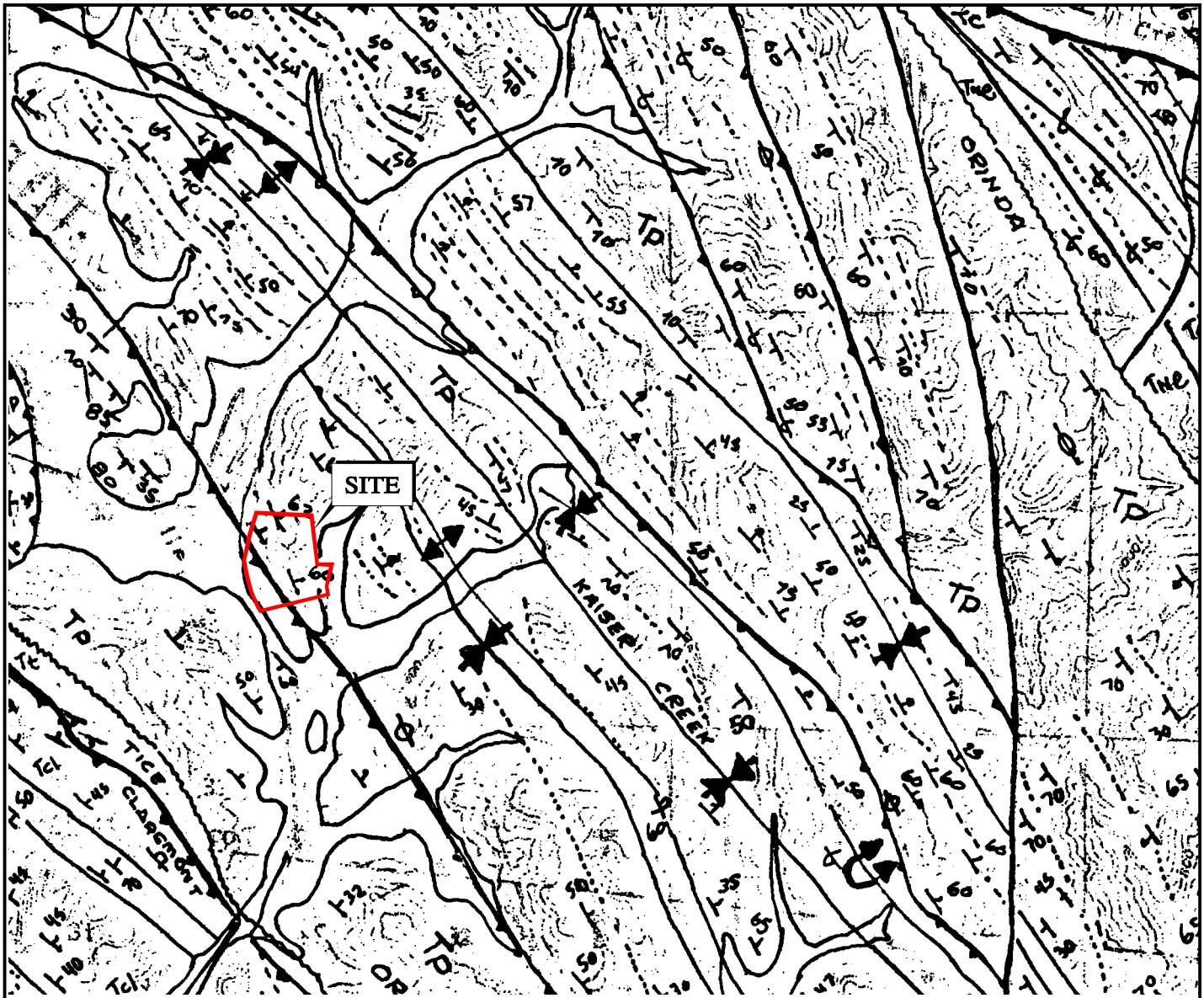

EXPLANATION

- Tp ORINDA FORMATION (PLIOCENE)
- THRUST FAULT
- ANTICLINAL FOLD AXIS
- SYNCLINAL FOLD AXIS
- STRIKE AND DIP OF BEDDING

N

0 FEET 2000

0 METERS 1000

BASE MAP SOURCE: CRANE, 1988

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REGIONAL GEOLOGIC MAP

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FIGURE NO. 3

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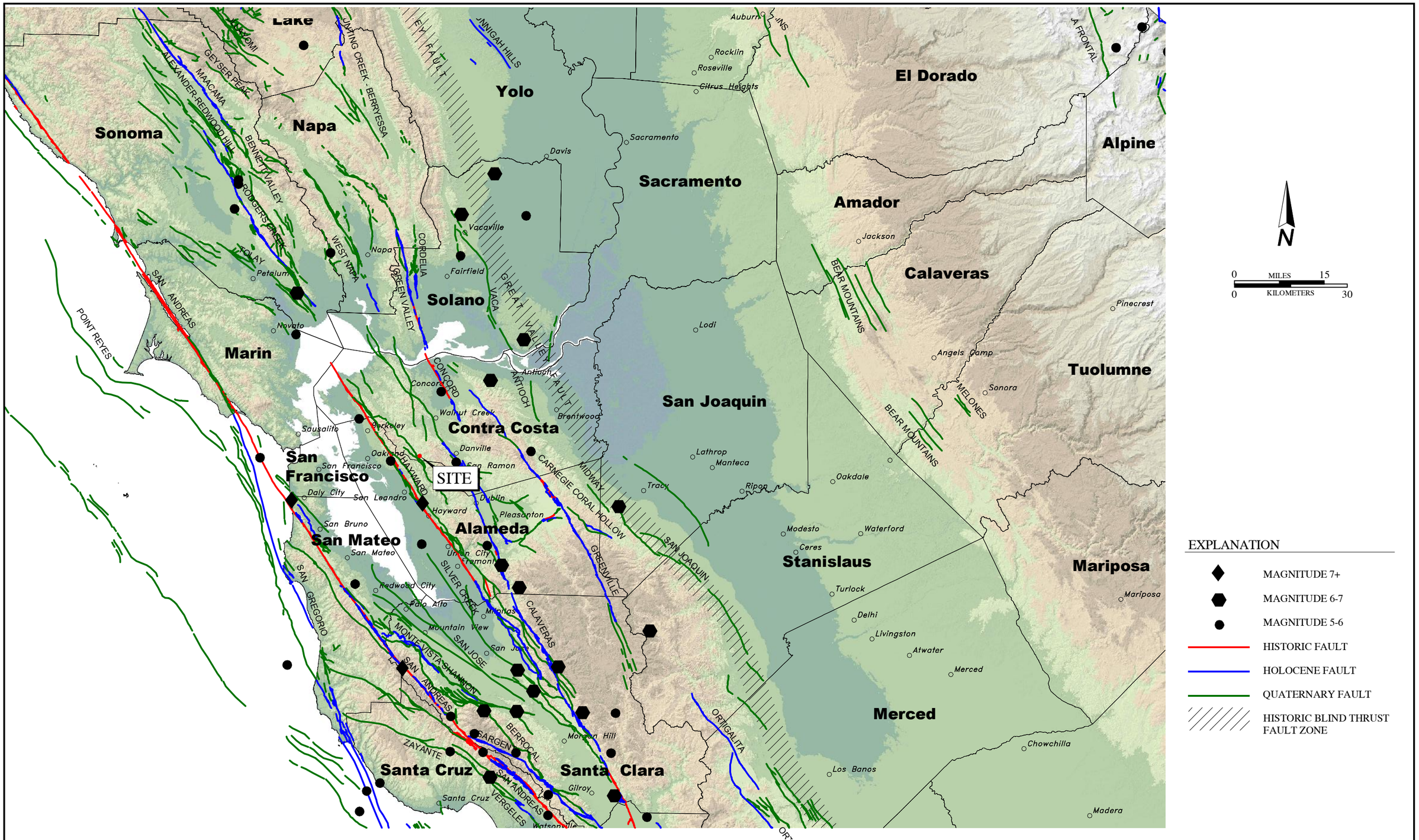

BASE MAP SOURCE:
COLOR HILLSHADE IMAGE BASED ON THE NATIONAL ELEVATION DATASET (NED) AT 30 METER RESOLUTION
U.S.G.S. QUATERNARY FAULT DATABASE, NOVEMBER, 2010
U.S.G.S. HISTORIC EARTHQUAKE DATABASE (1800–2000)

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REGIONAL FAULTING AND SEISMICITY
SOUTH CAMINO PABLO ANNEXATION
MORAGA, CALIFORNIA

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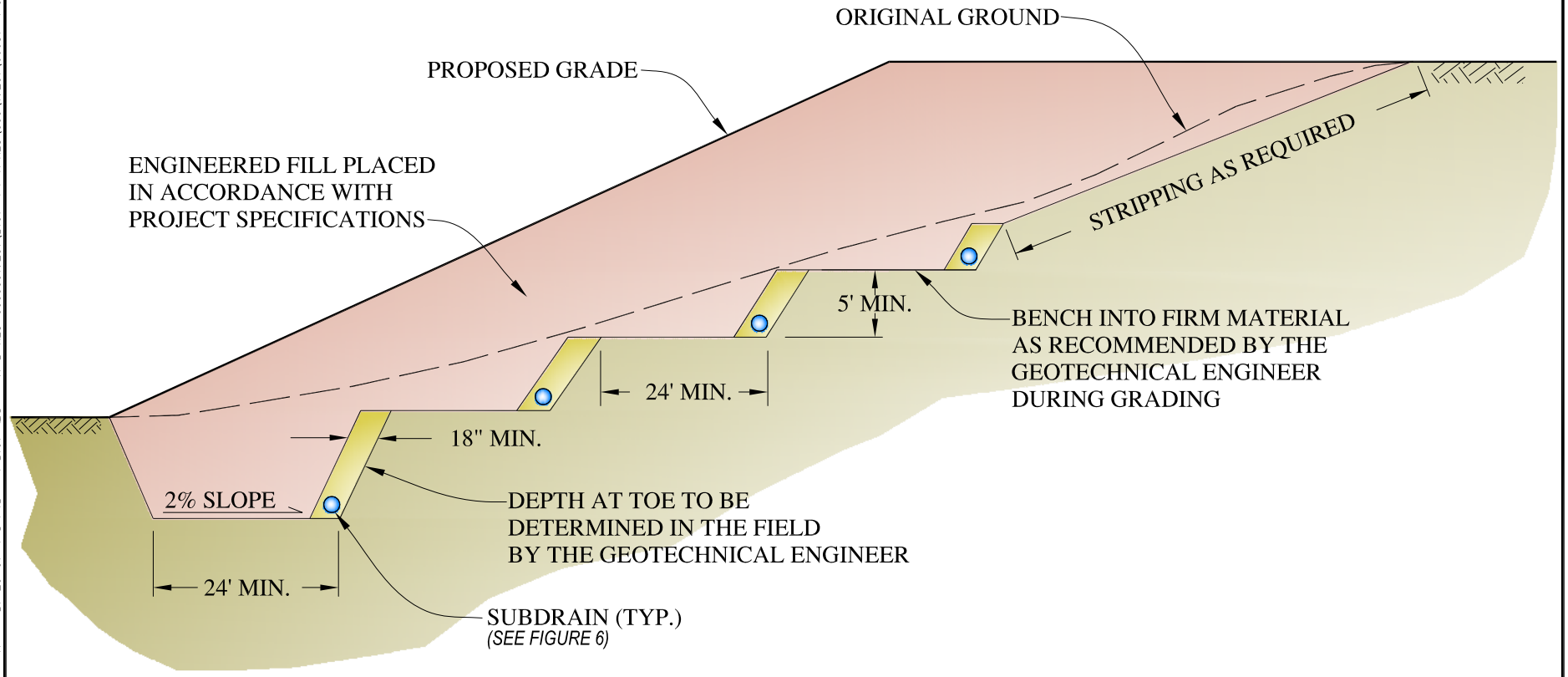

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KEYWAY SECTION
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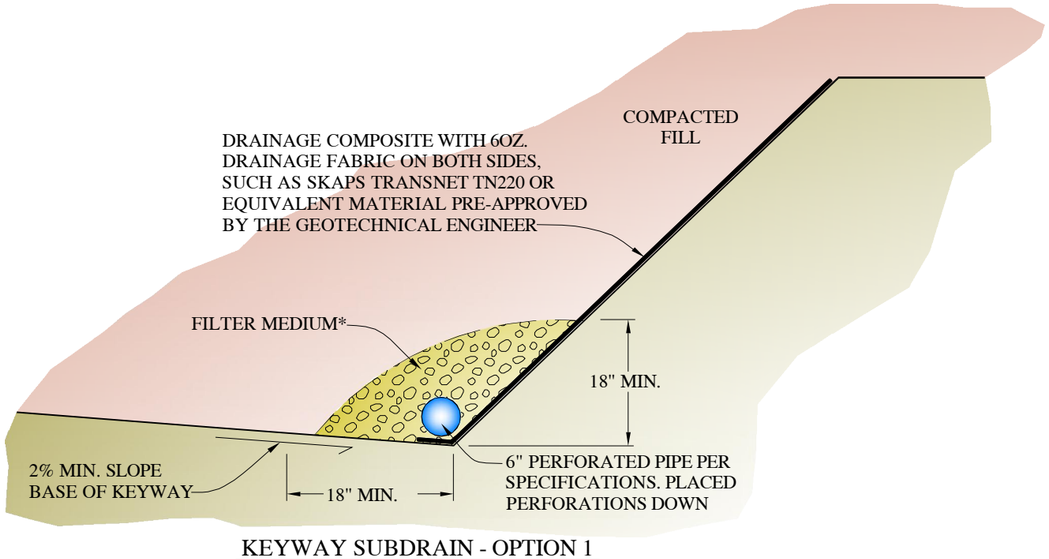
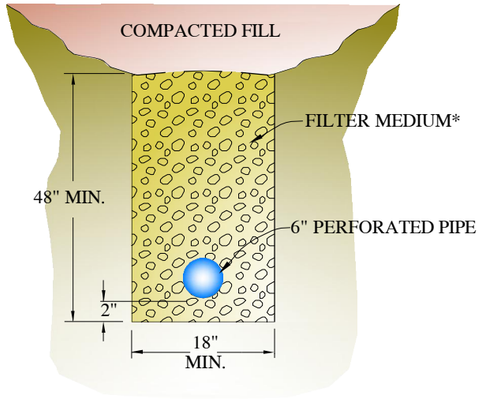
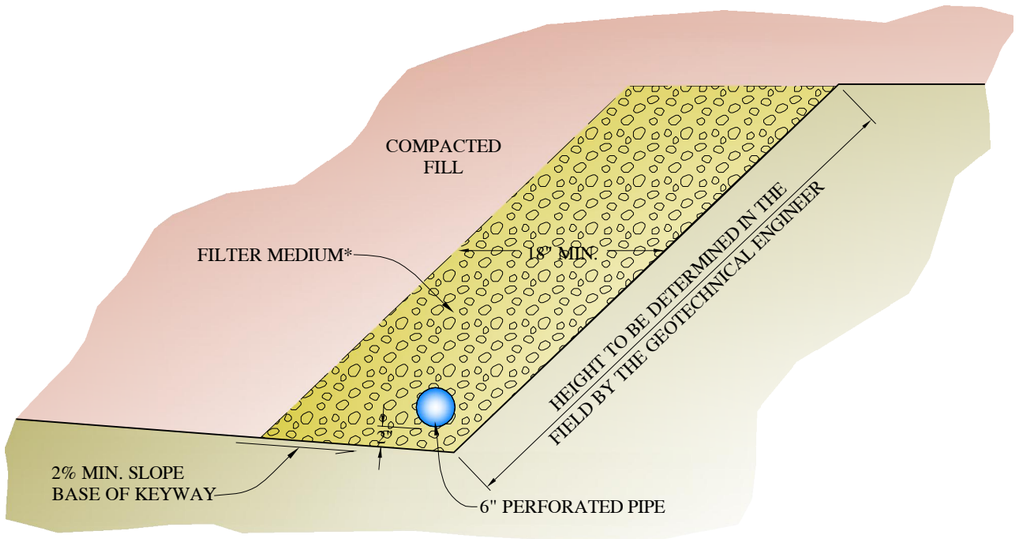


KEYWAY SUBDRAIN - OPTION 1



SWALE SUBDRAIN



KEYWAY SUBDRAIN - OPTION 2

*FILTER MEDIUM

ALTERNATIVE A

CLASS 2 PERMEABLE MATERIAL

MATERIAL SHALL CONSIST OF CLEAN, COARSE SAND AND GRAVEL OR CRUSHED STONE, CONFORMING TO THE FOLLOWING GRADING REQUIREMENTS:

SIEVE SIZE	% PASSING SIEVE
1"	100
3/4"	90–100
3/8"	40–100
#4	25–40
#8	18–33
#30	5–15
#50	0–7
#200	0–3

ALTERNATIVE B

CLEAN CRUSHED ROCK OR GRAVEL WRAPPED IN FILTER FABRIC

ALL FILTER FABRIC SHALL MEET THE FOLLOWING MINIMUM AVERAGE ROLL VALUES UNLESS OTHERWISE SPECIFIED BY ENGEO:

GRAB STRENGTH (ASTM D-4632)	180 lbs
MASS PER UNIT AREA (ASTM D-4751)	6 oz/yd^2
APPARENT OPENING SIZE (ASTM D-4751)	70-100 U.S. STD. SIEVE
FLOW RATE (ASTM D-4491)	80 gal/min/ft
PUNCTURE STRENGTH (ASTM D-4833)	80 lbs

NOTES:

1. *ALL PIPE JOINTS SHALL BE GLUED*
2. *ALL PERFORATED PIPE PLACED PERFORATIONS DOWN*
3. *1% FALL (MINIMUM) ON ALL TRENCHES AND DRAIN LINES*

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SUBDRAIN DETAILS
SOUTH CAMINO PABLO ANNEXATION
MORAGA, CALIFORNIA

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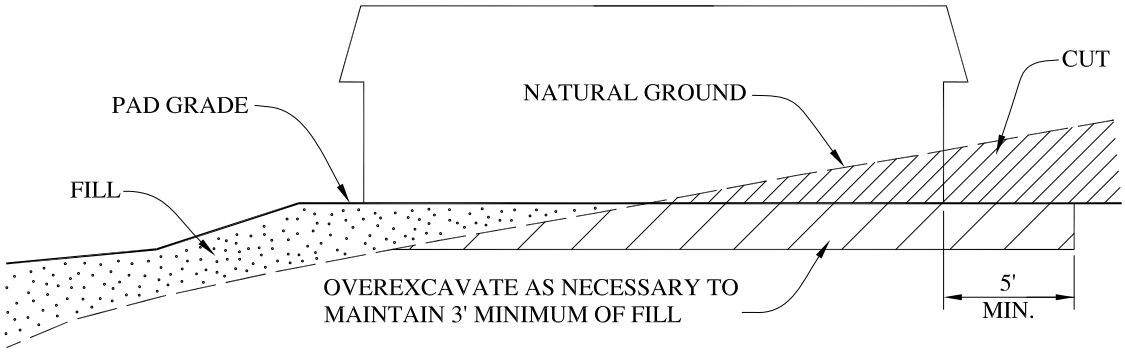
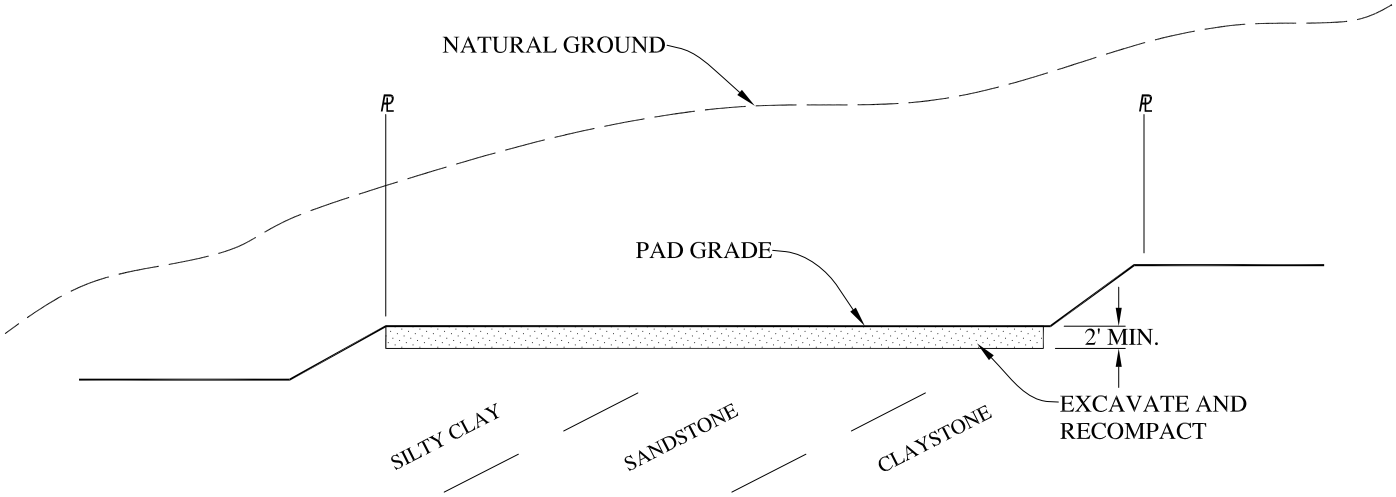


WHERE LOTS ARE PARTIALLY IN FILL, AND PARTIALLY IN CUT, THE CUT PORTION MUST BE OVEREXCAVATED AS SHOWN

CUT/FILL LOT



WHERE LOTS ARE COMPLETELY IN CUT, THE UPPER 2' SHOULD BE EXCAVATED AND RECOMPACTED AS SHOWN

CUT LOT

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CUT FILL & CUT LOT DETAILS SOUTH CAMINO PABLO ANNEXATION MORAGA, CALIFORNIA	PROJECT NO.: 10741.000.000 SCALE: NO SCALE DRAWN BY: SRP CHECKED BY: PS	FIGURE NO. 7

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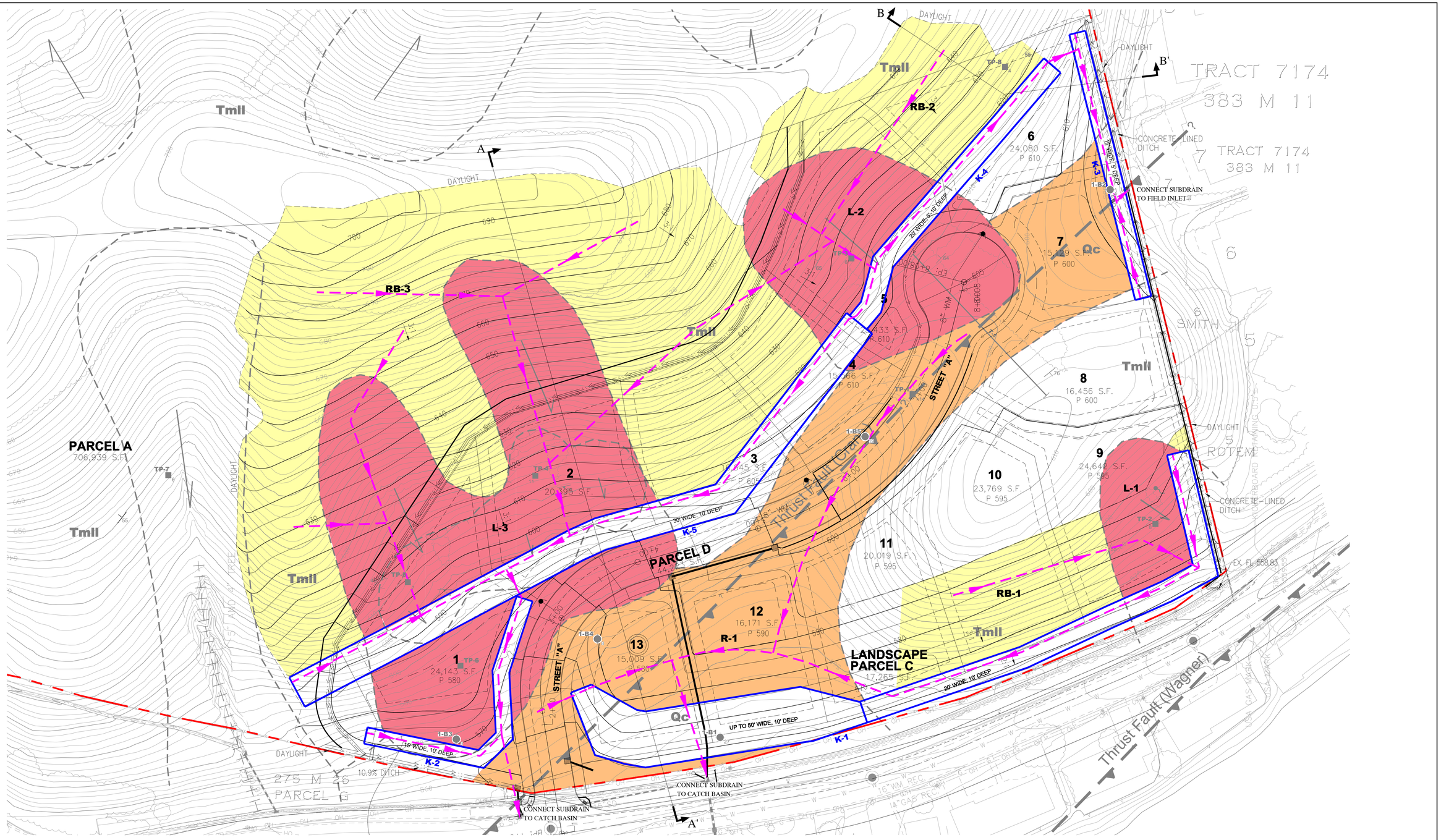

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

K-5 / 30' WIDE, 10' DEEP	PROPOSED KEYWAY, SHOWING WIDTH AND DEPTH
	PROPOSED KEYWAY SUBDRAIN
R-1	COLLUVIUM REMOVAL
RB-3	SLOPE REBUILD AREA
L-3	LANDSLIDE REMOVAL AREA
A — A'	CROSS SECTION LOCATION
Qc	COLLUVIUM
Tmll	MULHOLLAND FORMATION
	GULLY
	RECENT LANDSLIDE
	GEOLOGIC CONTACT
	SURFICIAL LANDSLIDE
	SEEPAGE AREA
1-B5 / 19	BORING, SHOWING DEPTH TO BEDROCK IN FEET (ENGEO, 2015)
TP-7 / 8	TEST PIT, SHOWING DEPTH TO BEDROCK IN FEET (ENGEO, 2014)
T-1	TRENCH (ENGEO, 2014)
65	STRIKE AND DIP OF BEDDING
19	STRIKE AND DIP OF SLIDE PLANE

N

0 FEET 40
0 METERS 20

BASE MAP SOURCE: DK ASSOCIATES

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PRELIMINARY CORRECTIVE GRADING PLAN
SOUTH CAMINO PABLO ANNEXATION
MORAGA, CALIFORNIA

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DRAWN BY: SRP	CHECKED BY: PS	

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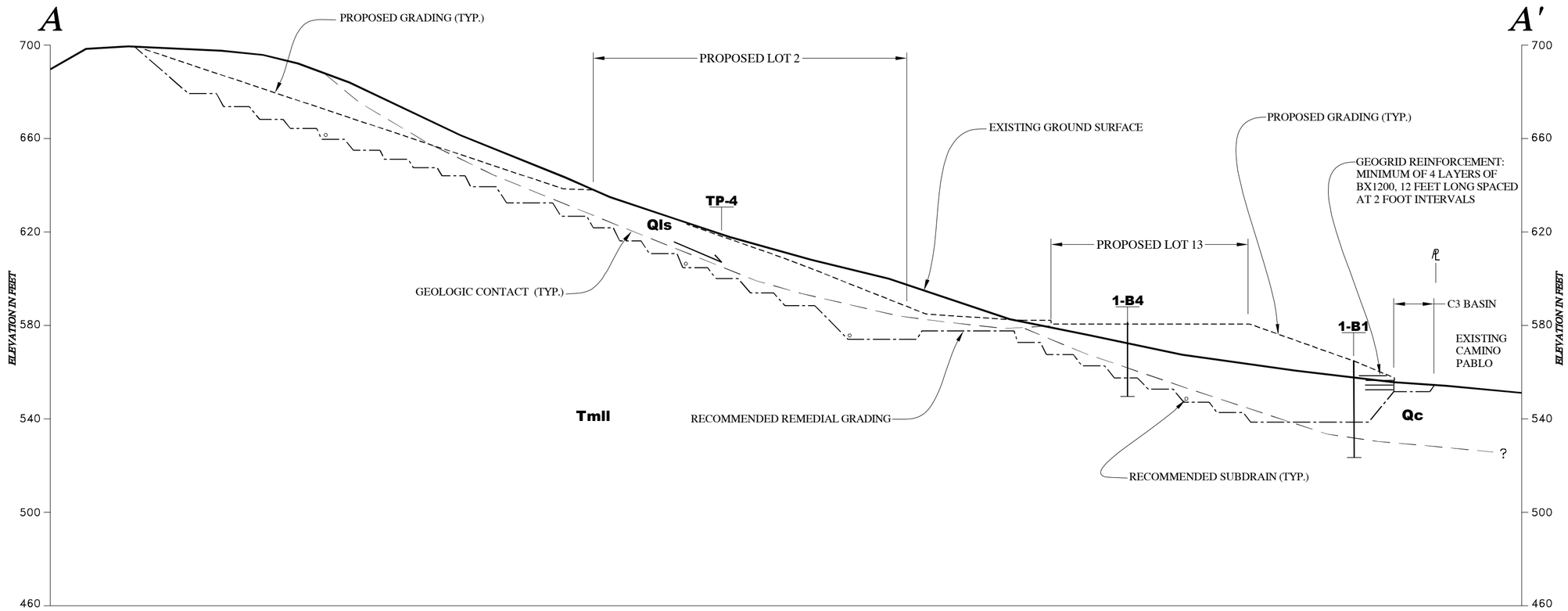

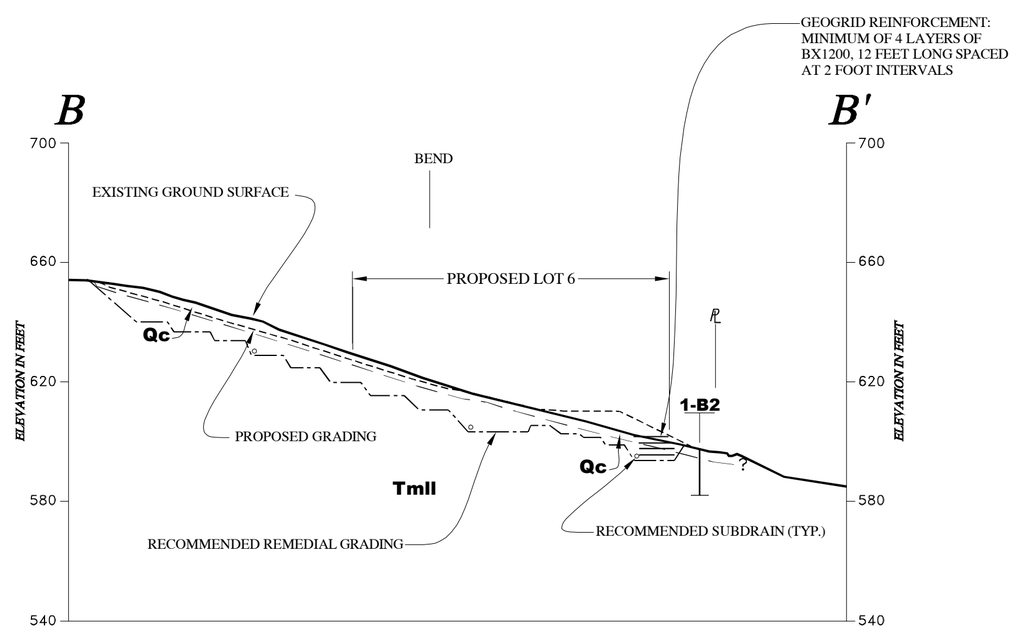

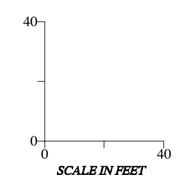

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

- **Qc** COLLUVIUM
- **Qls** LANDSLIDE
- **Tmll** MULHOLLAND FORMATION
- **1-B4** BORING
- **TP-4** TEST PIT

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CROSS SECTION A-A' AND B-B'
SOUTH CAMINO PABLO ANNEXATION
MORAGA, CALIFORNIA

PROJECT NO.: 10741.000.000	FIGURE NO. 9
SCALE: AS SHOWN	
DRAWN BY: SRP / CHECKED BY: PS	

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G:\Drafting\DRAFTING2_Dwg_10000 to 12999\10741\000\GEX Update 1015\10741000000-GEX-9-Crosssections-1015.dwg Plot Date:10-26-15 SPATTERS

APPENDIX A

Exploration Logs (ENGEO, 2015)

APPENDIX A

LOG OF BORING 1-B1

ENGEO INCORPORATED

Geotechnical Exploration
South Camino Pablo Annexation
Moraga, California
10741.000.000

DATE DRILLED: 9/23/2015
HOLE DEPTH: Approx. 35½ ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (msl): Approx. 555 ft.

LOGGED / REVIEWED BY: M. Clark / PJS
DRILLING CONTRACTOR: Britton Exploration
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			LEAN CLAY (CL), dark brown, hard, moist. (Qc)												
						16	29	15	14					4.5*	PP
5	550					18					15.9	117		3.5*	PP
			Becomes olive brown, very stiff, moist.												
10	545		Same as above.			19					18.7	112.6		2.5*	PP
15	540	NR	Becomes medium stiff.			13									
			Becomes dark olive brown, medium stiff, moist.			18					19.2	112		1.5	UC
20	535		Becomes brown mottled with grayish green, medium stiff, moist.				29	14	15	80					
25	530					39								0.5*	PP
			Becomes yellowish brown, soft, wet, with rock fragments.												

LOG OF BORING 1-B1

ENGEO INCORPORATED

Geotechnical Exploration
South Camino Pablo Annexation
Moraga, California
10741.000.000

DATE DRILLED: 9/23/2015
HOLE DEPTH: Approx. 35½ ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (msl): Approx. 555 ft.

LOGGED / REVIEWED BY: M. Clark / PJS
DRILLING CONTRACTOR: Britton Exploration
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			SILTSTONE, yellowish brown, extremely weak, very closely fractured, very thinly bedded, completely weathered, with clay. (TmII)			50/6"									
30	525					50/4" 50/2"									
35	520		Becomes grayish green, weak, completely weathered.			50/1"									
			Bottom of boring at 35.5 feet, Perched groundwater encountered at 24 feet.												

LOG OF BORING 1-B2

Geotechnical Exploration
South Camino Pablo Annexation
Moraga, California
10741.000.000

DATE DRILLED: 9/23/2015
HOLE DEPTH: Approx. 16½ ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (msl): Approx. 588 ft.

LOGGED / REVIEWED BY: M. Clark / PJS
DRILLING CONTRACTOR: Britton Exploration
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			LEAN CLAY (CL), grayish brown, hard, moist, with rock fragments. (Qc)												
	585					45					12.7	86.5		4.5*	PP
			Harder drilling at 4 feet.												
			CLAYSTONE, olive brown, extremely weak, very closely fractured, highly weathered. (Tmll)												
5						39	37	16	21		12.7	116.8			
	580		SILTSTONE, olive gray, extremely weak, very closely fractured, highly weathered.												
						50/6"									
10			Becomes weak, dark grayish brown.			50/6"									
	575														
15						50/5"									
			Bottom of boring at 16.5 feet, no groundwater encountered during drilling.												

LOG OF BORING 1-B3

ENGEO INCORPORATED

Geotechnical Exploration
South Camino Pablo Annexation
Moraga, California
10741.000.000

DATE DRILLED: 9/24/2015
HOLE DEPTH: Approx. 25 ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (msl): Approx. 567 ft.

LOGGED / REVIEWED BY: J. White / PJS
DRILLING CONTRACTOR: Britton Exploration
DRILLING METHOD: Dry Core
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			Run #1, 60 inches, 100% recovery												
	565		LEAN CLAY (CL), brown, hard, moist, few fine gravels. (Qls)											4.5*	PP
5			Brown and olive brown, with siltstone rock fragments in a clayey matrix, some fine sand, carbonate nodules. Run #2, 60 inches, 100% recovery												
	560		Same as above.												
10			SILTSTONE, olive brown, extremely weak, closely fractured, thickly bedded, highly weathered. (Tmll) Run #3, 60 inches, 100% recovery												
	555		SANDSTONE interbed, olive brown, extremely weak, very closely fractured, poorly cemented, bedding 70 degrees.												
			Fracture spacing 1/2 inch to 2 inches. Laminated, bedding 70 degrees.												
15			Very closely fractured, possible mechanical fracturing. Run #4, 60 inches, 100% recovery												
	550		Becomes brown to dark brown, weak, less weathered, laminated to thinly bedded, increasing rock quality, fracture spacing 1/2 inch to 1 feet. Parallel fractures 25 degrees.												
20			Run #5, 60 inches, 100% recovery												
	545		Bedding 71 degrees.												
			Freshly weathered, gray, fracture spacing 3 inches to 12 inches.												
25			Bottom of boring at 25 feet, no groundwater encountered during drilling.												

LOG OF BORING 1-B4

ENGEO INCORPORATED

Geotechnical Exploration
South Camino Pablo Annexation
Moraga, California
10741.000.000

DATE DRILLED: 9/24/2015
HOLE DEPTH: Approx. 21 ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (msl): Approx. 571 ft.

LOGGED / REVIEWED BY: J. White / PJS
DRILLING CONTRACTOR: Britton Exploration
DRILLING METHOD: Dry Core
HAMMER TYPE: 140 lb. Auto Trip

Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
			Run #1, 60 inches, 100% recovery												
	570		LEAN CLAY (CL), brown, medium stiff, dry, with fine gravel. (Qc)												
			Becomes dark brown, very stiff, moist, with rock fragments.											4*	PP
5			Run #2, 60 inches, 100% recovery												
	565														
			Gradational contact.												
			SILTSTONE, brown, extremely weak, very closely fractured, laminated, highly weathered. (Tmll)												
10			Run #3, 60 inches, 100% recovery												
	560		Crushed, mechanical fracturing.												
			Olive brown, numerous rotational fractures, mechanical fracturing.												
			SANDSTONE, grayish brown, extremely weak, closely fractured, moderately weathered, fine grained, bedding 68 degrees.												
15			Run #4, 60 inches, 100% recovery												
	555		SILTSTONE, grayish brown, weak, closely fractured, thinly bedded to laminated, moderately weathered, with fine sand.												
			Fracture spacing 6 inches.												
			Bedding 72 degrees.												
20			Run #5, 12 inches, 100% recovery												
	550		CLAYSTONE, dark gray, weak, closely fractured, thinly bedded, bedding 74 degrees.												
			Drilling refusal at 21 feet, no groundwater encountered during drilling.												

LOG OF BORING 1-B5

ENGEO INCORPORATED

Geotechnical Exploration
South Camino Pablo Annexation
Moraga, California
10741.000.000

DATE DRILLED: 9/23/2015
HOLE DEPTH: Approx. 22½ ft.
HOLE DIAMETER: 8.0 in.
SURF ELEV (msl): Approx. 586 ft.

LOGGED / REVIEWED BY: M. Clark / PJS
DRILLING CONTRACTOR: Britton Exploration
DRILLING METHOD: Hollow Stem Auger
HAMMER TYPE: 140 lb. Auto Trip

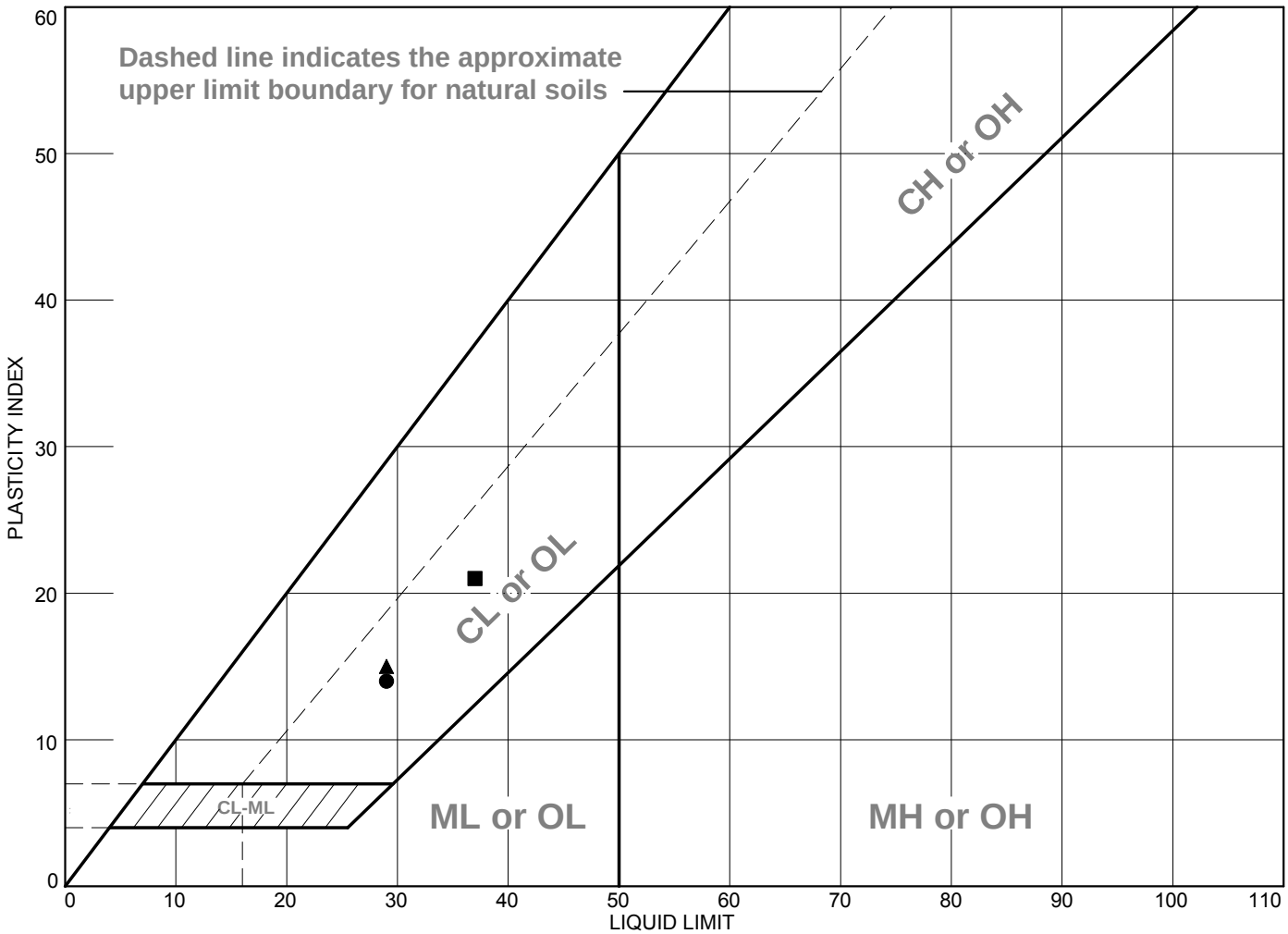
Depth in Feet	Elevation in Feet	Sample Type	DESCRIPTION	Log Symbol	Water Level	Blow Count/Foot	Atterberg Limits: Liquid Limit	Atterberg Limits: Plastic Limit	Atterberg Limits: Plasticity Index	Fines Content (% passing #200 sieve)	Moisture Content (% dry weight)	Dry Unit Weight (pcf)	Shear Strength (psf) *field approximation	Unconfined Strength (tsf) *field approximation	Strength Test Type
	585		LEAN SILT (ML), dark brown, hard, moist, with clay, with siltstone fragments. (Qc)			34					10.5	113.4		>4.5*	PP
5	580		LEAN CLAY (CL), dark brown, very stiff, moist.			24					16.5	115.6		2.5	UC
10	575		Becomes yellowish brown mottled with grayish green.			45					14.8	118.6		3*	PP
15	570		Becomes grayish green mottled with reddish brown, very stiff, moist, with siltstone fragments.			44								4*	PP
20	565		Becomes grayish green, very stiff.			50/6"									
			SILTSTONE, gray, weak, very thinly bedded to laminated, closely fractured, highly weathered. (Tmll)			83									
			Bottom of boring at 22.5 feet, no groundwater encountered during drilling.												

APPENDIX B

Laboratory Test Results (ENGEO, 2015)

APPENDIX B

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	See exploration logs	29	15	14			
■	See exploration logs	37	16	21			
▲	See exploration logs	29	14	15	96.7	80.1	CL

Project No. 10741.000.000 **Client:** Dobbins Properties, LLC

Project: 1211 Camino Pablo

●**Depth:** 3.0 feet **Sample Number:** 1-B1 @ 3

■**Depth:** 6.0 feet **Sample Number:** 1-B2 @ 6

▲**Depth:** 20.0 feet **Sample Number:** 1-B1 @ 20

Remarks:

●ASTM D4318, Wet method

■ASTM D4318, Wet method

▲PI: ASTM D4318, wet method

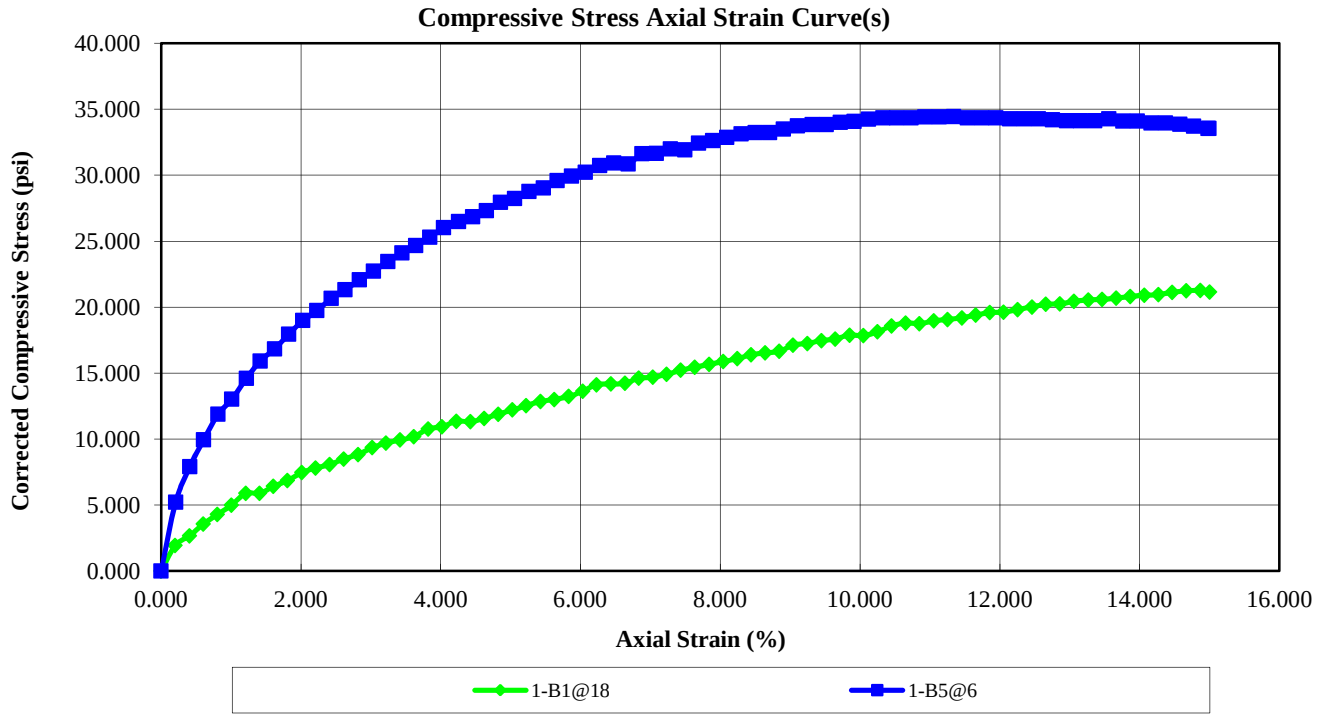
GS: ASTM D422

USCS: ASTM D2487

ENGEO INCORPORATED

Tested By: ○G. Criste □G. Criste △J. Lawton **Checked By:** D. Seibold

UNCONFINED COMPRESSION TEST REPORT
(ASTM D2166)



BEFORE TEST	SPECIMEN 1-B1@18	1-B5@6
Moisture Content (%)	19.2	16.5
Dry Density (pcf)	112.0	115.6
Saturation (%)	97.74	99.73
Void Ratio	0.54	0.46
Diameter (in)	2.382	2.405
Height (in)	5.015	4.979
Height-To-Diameter Ratio	2.105	2.070
TEST DATA		
Unconfined Compressive Strength (psf)	3062.047	4957.059
Undrained Shear Strength (psf)	1531.024	2478.530
Strain Rate (in./min.)	0.05	0.05
Specific Gravity (Assumed)	2.770	2.770
Strain at Failure (%)	14.87	11.34

Test Remarks

SPECIMEN	DESCRIPTION
1-B1@18	See exploration logs
1-B5@6	See exploration logs

PROJECT NAME: 1211 Camino Pablo
PROJECT NO: 10741.000000
CLIENT: Dobbins Properties, LLC
LOCATION: Moraga, CA
PHASE NO: 005

Test Date: 10/06/15
Tested By: G. Criste
Reviewed By: D. Seibold

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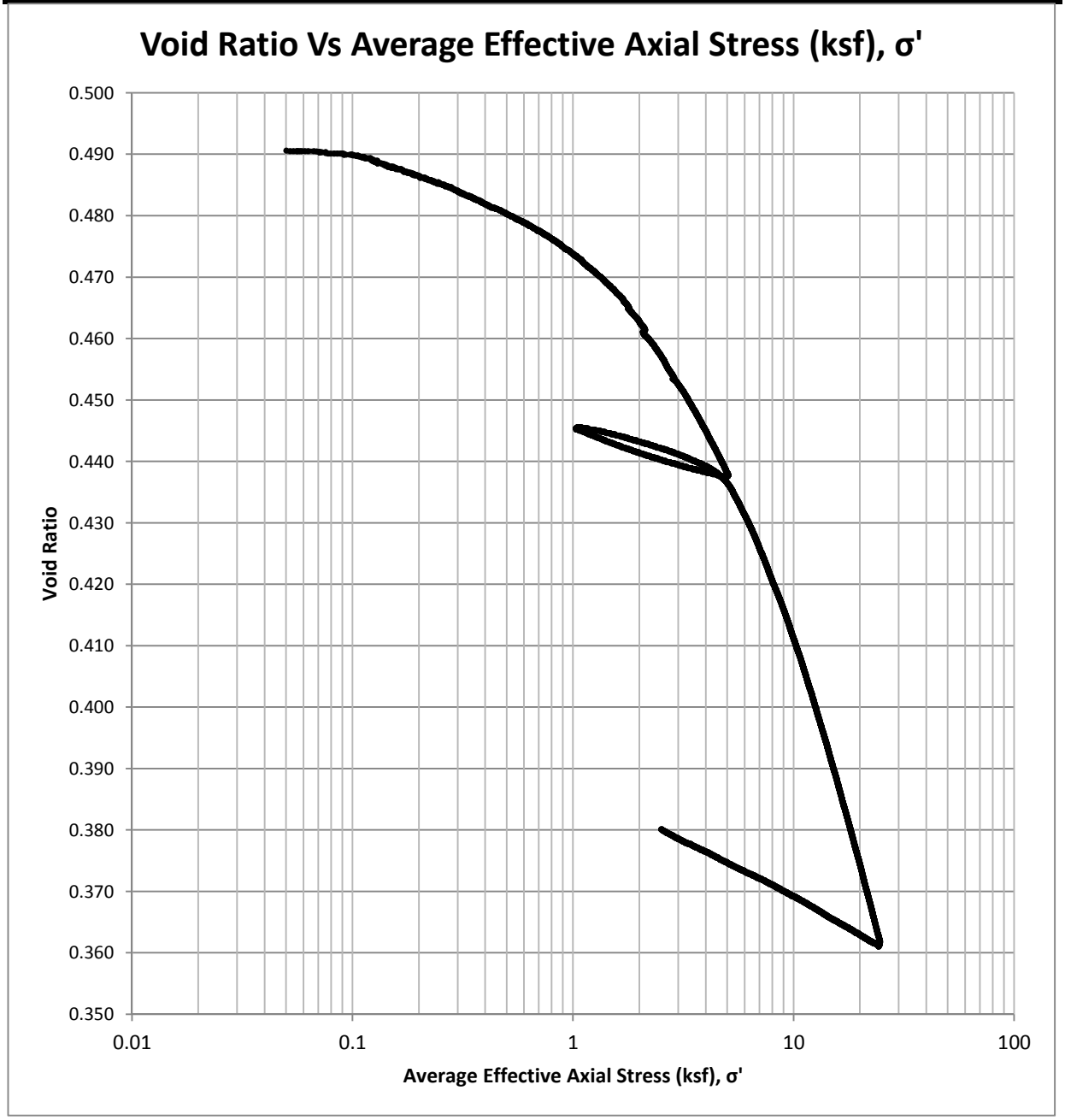
Constant Rate of Strain Consolidation
ASTM D4186



	Initial	Final
Moisture (%):	18.28%	15.79%
Dry Density (pcf):	112.44	150.50
Saturation (%):	100.27%	100.00%
Void Ratio:	0.4905	0.4246

ASTM D4318 - Wet Method	**Test Date:** 10/12/2015
Liquid Limit:	29
Plastic Limit:	14
ASTM D854 - Measured	
Specific Gravity:	2.690
Soil Description:	See exploration logs

Project Number:	10741.000.000	**Depth:**	22.0-22.5 ft
Sample Number:	1-B2@20-22.5	**Boring #:**	1-B2
Project Name:	1211 Camino Pablo		
Client:	Dobbins Properties, LLC		
Location:	Contra Costa County		
Tested By:	D. Seibold	**Reviewed By:**	P. Espinosa

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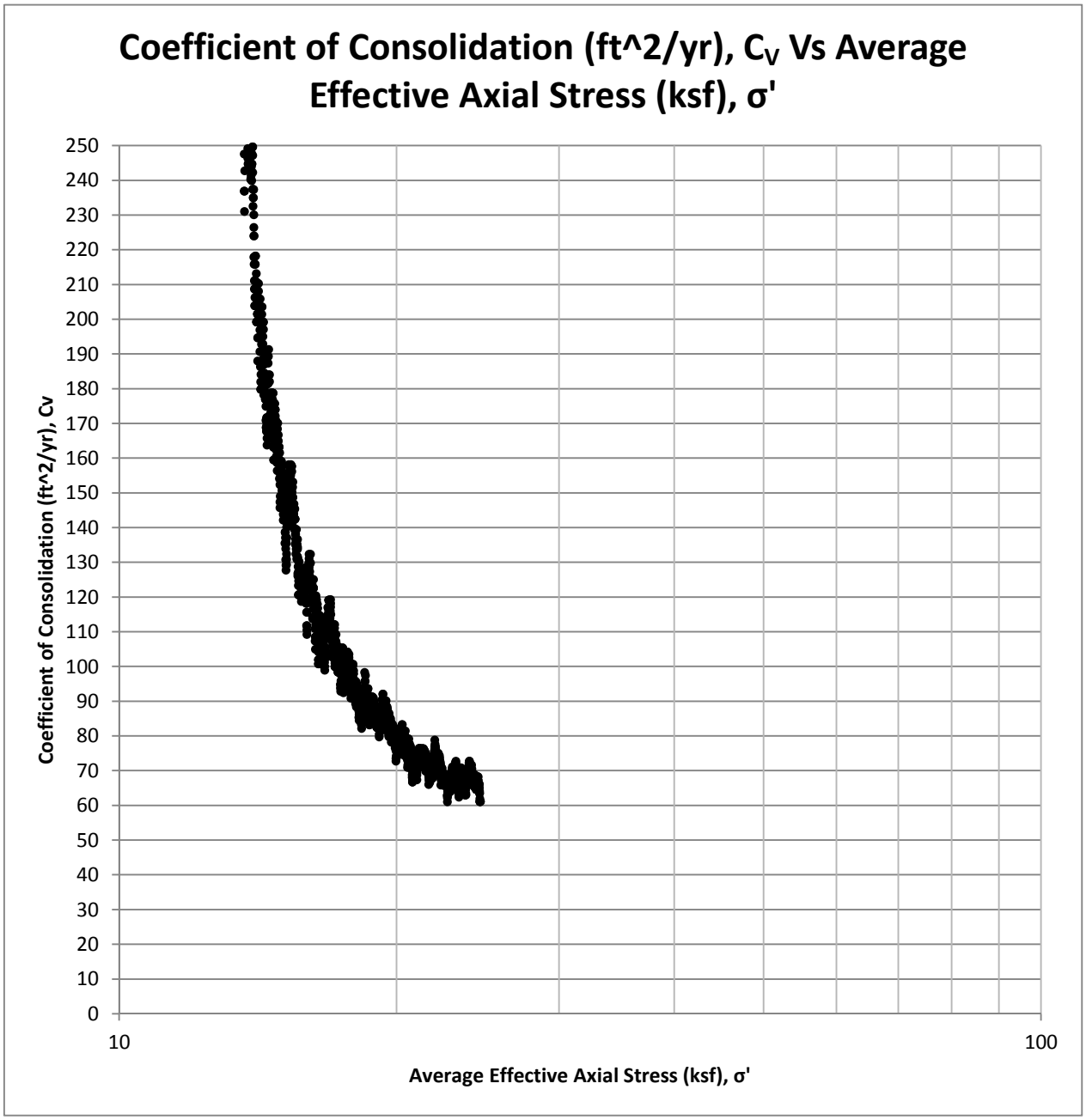
Constant Rate of Strain Consolidation
ASTM D4186



	Initial	Final	ASTM D4318 - Wet Method		Test Date: 10/12/2015
Moisture (%):	18.28%	15.79%	**Liquid Limit:**	29	
Dry Density (pcf):	112.44	150.50	**Plastic Limit:**	14	
Saturation (%):	100.27%	100.00%	**ASTM D854 - Measured**		
Void Ratio:	0.4905	0.4246	**Specific Gravity:**	2.690	
			Soil Description:	See exploration logs	

Project Number:	10741.000.000	**Depth:**	22.0-22.5 ft
Sample Number:	1-B2@20-22.5	**Boring #:**	1-B2
Project Name:	1211 Camino Pablo		
Client:	Dobbins Properties, LLC		
Location:	Contra Costa County		
Tested By:	D. Seibold	**Reviewed By:**	P. Espinosa

ENGEO Expect Excellence

Isotropic Consolidated Undrained Triaxial Test

ASTM D4767

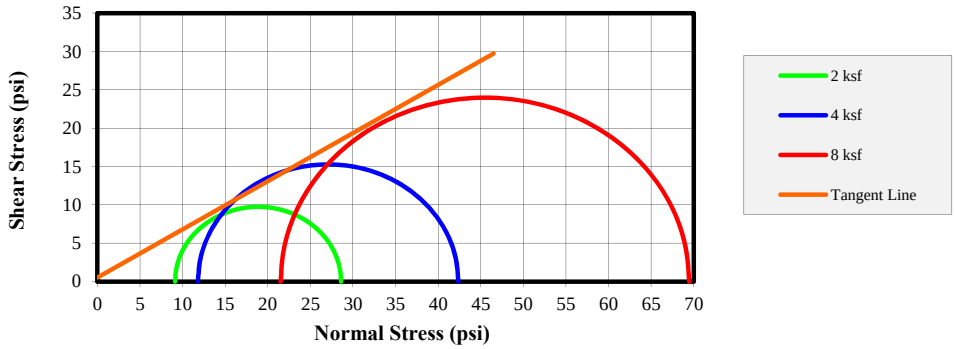
Date: 10/19/15

Checked By: P. Steuclei

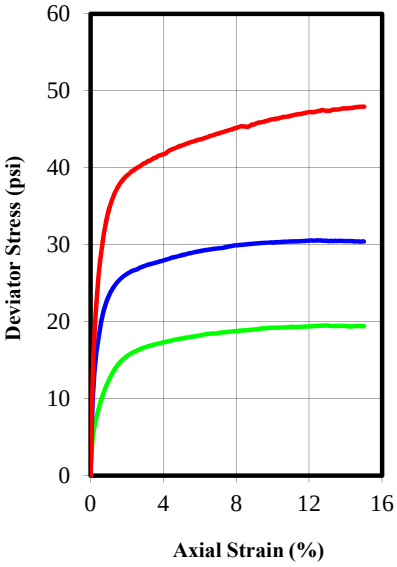
Date: 10/19/15

Tested By: D. Seibold

Effective Stress at Maximum Deviator Stress Criterion



Deviator Stress Vs. Axial Strain



Initial	2 ksf	4 ksf	8 ksf
Height-to-Diameter Ratio	2.070	2.063	2.153
Water Content (%)	20.2	17.9	17.6
Dry Density (pcf)	111.2	113.3	111.7
Saturation (%)	100.00	99.84	94.30
Void Ratio	0.508	0.480	0.500
Diameter (in)	2.869	2.869	2.870
Height (in)	5.940	5.920	6.180
ASTM D854 - Measured			
Specific Gravity	2.690	2.690	2.690
ASTM D4318 - Wet Method			
Liquid Limit	29	29	29
Plastic Limit	14	14	14
After Consolidation	**2 ksf**	**4 ksf**	**8 ksf**
Void Ratio	0.471	0.462	0.446
Water Content (%)	18.28	17.70	16.69
Dry Density (pcf)	114.13	114.87	116.11
Eff. Consol. Press. (psi)	13.91	27.82	41.64
Back Pressure (psi)	42.9	45.9	46.4
Saturation (%)	100.0	100.0	100.0
B-Value	0.96	0.96	0.96
Strain Rate (in./min.)	0.00263	0.00243	0.00190
Height-to-Diameter Ratio	2.067	2.083	2.147
After Shear	**2 ksf**	**4 ksf**	**8 ksf**
σ'1 at Failure (psi)	28.60	42.36	69.45
σ'3 at Failure (psi)	9.11	11.79	21.49
t_{50}	9.000	9.701	12.895
t_{90}	29.160	31.430	41.780
Corrected Peak Deviator Stress:	19.49	30.57	47.96

Maximium Deviator Stress Criterion	
C (psi)	1.6
C' (psi)	0.5
Ø (deg)	19.8
Ø' (deg)	31.0

Project:	1211 Camino Pablo
Location:	Contra Costa County
Project Number:	10741.000.000
Boring Number:	1-B2
Sample Number:	1-B2@20.5-22
Depth:	20.5-21 feet
Sample Type:	Undisturbed
Description:	See exploration logs
Test Type	Consolidated Undrained
Remarks	

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Isotropic Consolidated Undrained Triaxial Test

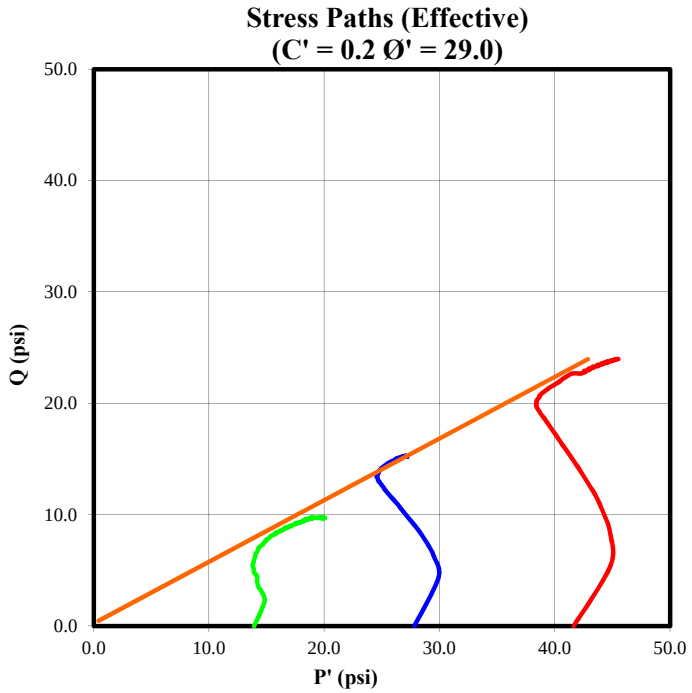
ASTM D4767

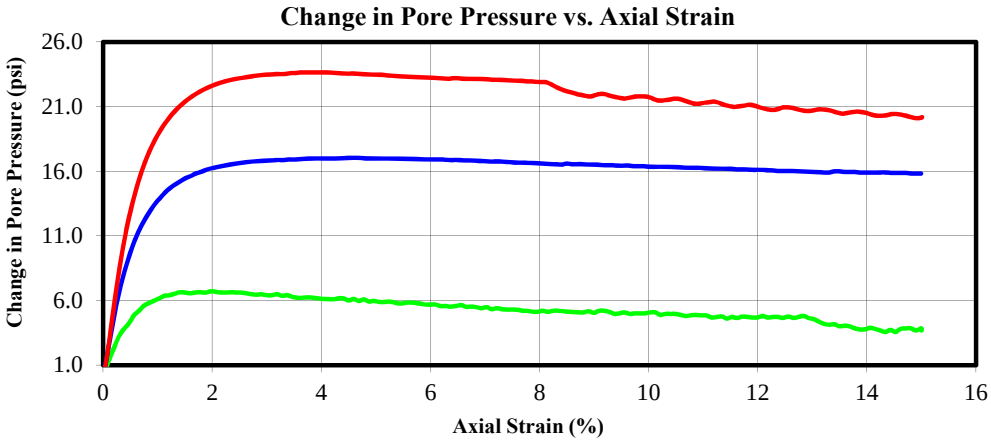
Date: 10/19/15

Checked By: P. Steuclei

Date: 10/19/15

Tested By: D. Seibold





Project:	1211 Camino Pablo
Location:	Contra Costa County
Project Number:	10741.000.000
Boring Number:	1-B2
Sample Number:	1-B2@20.5-22
Depth:	20.5-21 feet
Sample Type:	Undisturbed
Description:	See exploration logs
Test Type:	Consolidated Undrained

Remarks:

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APPENDIX C

Previous Exploration Logs (ENGEO, 2014) and Soil Tectonics report
(Dr. Glen Borchardt, dated January 20, 2014)

APPENDIX C

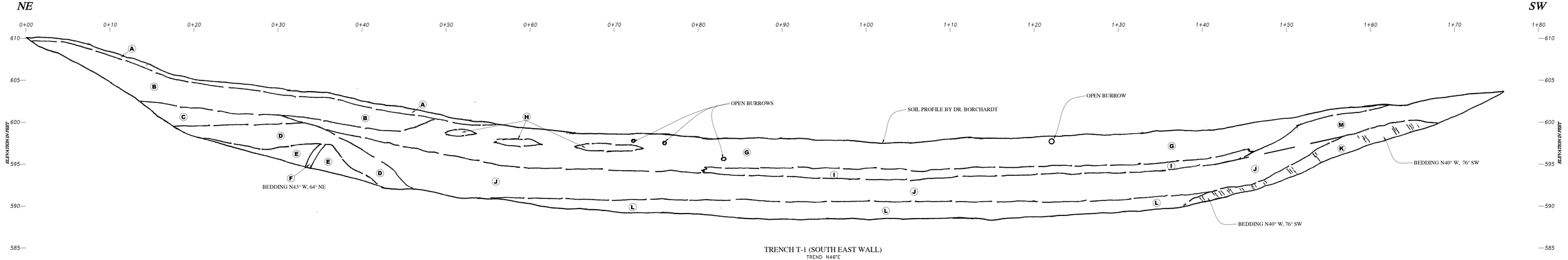
ENGEO INCORPORATED	Test Pit Logs
1211 Camino Pablo Preliminary Geologic Exploration Moraga, California 10741.000.000	Logged By: R. Skinner Logged Date: 1/13/14 and 1/14/14

Test Pit Number	Depth (Feet)	Description
TP-1	0 – 5	SILTY CLAY (CH), dark brown, very stiff, dry (Qc)
	5 - 14	SILTY CLAY (CL), brown, very stiff, moist (Qc)
		Total depth 14 feet, no free groundwater encountered
TP-2	0 – 8	SILTY CLAY (CL), brown, very stiff, dry (Qls)
	8 – 10½	Interbedded CLAYSTONE and SANDSTONE, light gray, weak, closely fractured, thinly bedded, N60W 55NE. (Mulholland Formation)
		Total depth 10½ feet, no free groundwater encountered
TP-3	0 – 4½	SILTY CLAY (CH), dark brown, hard, dry.
	4½ - 6	SILTY CLAY and ROCK FRAGMENTS (CL), light gray, stiff, moist (Qls)
	6 – 8	SILTSTONE, light gray, weak, closely fractured, thickly bedded, N65W 65NE. (Mulholland Formation)
		Total depth 8 feet, no free groundwater encountered
TP-4	0 – 10	SILTY CLAY (CL), brown, stiff, dry, with fine gravel (Qls)
	10 - 11	SILTY CLAY (CL), light gray, stiff, moist, slickensided surface at 11 feet, N20W 15W, prominent downslope striations. (Qls)
	11 - 13	CLAYSTONE, gray-brown, weak, closely fractured, thickly bedded. (Mulholland Formation)
		Total depth 13 feet, no free groundwater encountered

ENGEO INCORPORATED	Test Pit Logs
1211 Camino Pablo Preliminary Geologic Exploration Moraga, California 10741.000.000	Logged By: R. Skinner Logged Date: 1/13/14 and 1/14/14

Test Pit Number	Depth (Feet)	Description
TP-5	0 – 6½	SILTY CLAY (CL), dark brown, vert stiff,dry to moist (Qls)
	6½	Slickensided surface NS 15W
	6½– 9	CLAYSTONE, gray, weak, very closely fractured, thinly bedded, N30W 45NE (Mulholland Formation)
		Total depth 9 feet, no free groundwater encountered
TP-6	0 – 4	SILTY CLAY (CL), dark brown, hard, dry (Qls)
	4 – 7	SILTY CLAY (CL), brown, very stiff, moist, sharp contact at 7 feet. (Qls)
	7 – 8½	SANDSTONE, light gray, weak, moderately fractured, thickly bedded. (Mulholland Formation)
		Total depth 8½ feet, no free groundwater encountered
TP-7	0 – 4½	SILTY CLAY (CH), dark brown, hard, dry.
	4½ – 5½	SILTY CLAY (CL), brown with brown, very stiff, moist.
	5½ – 7	Interbedded CLAYSTONE and SILTSTONE, light gray, weak, closely fractured, thinly bedded, N50W 55NE (Mulholland Formation)
		Total depth 7 feet, no free groundwater encountered

ENGEO INCORPORATED		Test Pit Logs
1211 Camino Pablo Preliminary Geologic Exploration Moraga, California 10741.000.000		Logged By: R. Skinner Logged Date: 1/13/14 and 1/14/14
Test Pit Number	Depth (Feet)	Description
TP-8	0 – 3½ 3½– 6	SILTY CLAY (CH), dark brown, hard, dry. CLAYSTONE, gray, weak, closely fractured, thinly bedded, N45W 55NE (Mulholland) Total depth 6 feet, no free groundwater encountered

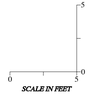


TRENCH T-1 (SOUTH EAST WALL)

TREND N46°E

EXPLANATION

- **A** silty CLAY, light gray, dry, soft, low plasticity, highly dessicated, abundant roots (relatively young slope wash, colluvium)
- **B** silty CLAY, dark gray-brown, dry to moist, very stiff, high plasticity
- **C** silty CLAY, red-brown, moist, very stiff, high plasticity, some rounded siltstone and claystone fragments
- **D** silty CLAY, light gray, moist, very stiff, abundant claystone and siltstone fragments (highly weathered bedrock)
- **E** CLAYSTONE, gray and red-brown, weak, highly fractured, thickly bedded (Mulholland formation)
- **F** SILTSTONE, gray, weak, moderately fractured, thinly bedded (Mulholland formation)
- **G** silty CLAY, light gray, dry, stiff, few small rock fragments, porous, low plasticity (Holocene colluvium)
- **H** silty CLAY, dark gray, dry, stiff, abundant rootlets, slightly porous (Holocene colluvium)
- **I** silty CLAY, dark brown, moist, stiff, low plasticity, prominent blocky ped structure, well development clay films on ped surfaces (Pleistocene colluvium)
- **J** sandy CLAY, light red-brown, moist, stiff, low plasticity, some small rock fragments (Pleistocene colluvium)
- **K** SILTSTONE with some interbeds of claystone and sandstone, light to dark gray, weak, highly fractured, thinly bedded (Mulholland formation)
- **L** sandy CLAY, gray-brown, moist, stiff, low plasticity, some small rock fragments, poorly developed ped structure with light films on ped surfaces (Pleistocene colluvium).
- **M** silty CLAY, dark brown, dry, very stiff, high plasticity



ENGEO Expect Excellence	TRENCH LOG T-1 1211 CAMINO PABLO MORAGA, CALIFORNIA	PROJECT NO.: 10741.000.000 SCALE: AS SHOWN DRAWN BY: LL CHECKED BY: MT	FIGURE NO. A1

ORIGINAL FIGURE PRINTED IN COLOR

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APPENDIX B

PEDOCHRONOLOGICAL REPORT FOR 1211 CAMINO PABLO, MORAGA, CALIFORNIA

ENGEO, Inc., San Ramon, CA 94583, Job No. 10741.000.000

2014-01-21

Soil Tectonics
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Glenn Borchardt

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PEDOCHRONOLOGICAL REPORT FOR 1211 CAMINO PABLO, MORAGA, CALIFORNIA

ENGEO, Inc., San Ramon, CA 94583, Job No. 10741.000.000

2014-01-21

Glenn Borchardt

INTRODUCTION

An assessment of seismic and landslide risk due to ground movement can be aided greatly by the techniques of pedochronology (Borchardt, 1992, 1998), soil dating. This is because the youngest geological unit overlying fault traces is generally a soil horizon. The age and relative activity of ground movement often can be estimated by evaluating the age and relative disturbance of overlying soil units, as well as buried soils called paleosols. Terms, prefixes, and suffixes are defined in the Soils Glossary at the end of this report.

Soil horizons exhibit a wide range of physical, chemical, and mineralogical properties that evolve at varying rates. Soil scientists use various terms to describe these properties. A black, highly organic "A" horizon, for example, may form within a few centuries, while a dark brown, clayey "Bt" horizon may take up to 40,000 years to form. Certain soil properties are invariably absent in young soils. For instance, soils developed in granitic alluvium of the San Joaquin Valley do not have Munsell hues redder than 10YR until they are at least 100,000 years old (Birkeland, 1999; Harden, 1982). Still other properties, such as the movement and deposition of clay-size particles and the precipitation of calcium carbonate at extraordinary depths, indicate soil formation during a climate much wetter than at present. In the absence of a radiometric age date for the material from which a particular soil formed, an estimate of its age must take into account all the known properties of the soil and the landscape and climate in which it evolved.

METHOD

The first step in studying a soil is the compilation of the data necessary for describing it (Birkeland, 1999; Borchardt, 2010). At minimum, this requires a Munsell color chart, hand lens, acid bottle, and instruments for 1:1 soil:water pH and conductivity measurements. The second step may involve collecting samples of each horizon of the soil profile column for laboratory analysis of particle size. This is done to check the textural classifications made in the field and to evaluate the genetic relationships between horizons and between different soils in the

landscape. When warranted, the clay mineralogy and chemistry of the soil also is analyzed to provide additional information on the changes undergone by the initial material from which the soil weathered. The last step is the comparison of this accumulated soil data with that for soils having developed under similar conditions, preferably in the same region. Such information is scattered in soil survey reports (e.g., Welch, 1981), soil science journals, and consulting reports. In a particular locality, there is seldom enough comparative data available for this purpose. That is why, at the very least, the study of one soil profile always makes the evaluation of the next that much easier.

RESULTS OF THIS EVALUATION

Soil Profile No. 1 was studied to assess the age of the colluvium in a swale across a mapped trace of a fault (Table 1).

Soil Profile No. 1

This profile was sampled in the middle of a colluvium-filled saddle in the Mulholland Formation. The saddle coincidently forms the crest of a ridge that slopes in opposite directions, to the SE and NW (Figure 1). Mapped as Los Osos clay loam, this particular variant is silt loam, having an especially thick solum (260 cm vs. the 81 cm of the typical Los Osos profile) (Table 1; Figure 2 and Figure 3). The mapped soil is typically on 15-30% slopes, while the sampled soil is on a flat surface formed as a colluvial fill eroded from the siltstone to the SW and NE. The 75-cm thick A horizon is has a dark grayish brown A1 overlying a very dark grayish brown A2. This color reversal seems to have occurred due to pedoturbation by ground squirrels (Figure 4). The 185-cm thick Bt horizon is dark brown to dark greyish brown silty clay with thin to thick clay films lining pores and coating peds (Figure 3). The parent material is best represented by the CB horizon, which is a greyish brown silty clay with massive to medium weak subangular blocky structure.

The pH of the soil profile generally increases with depth, with the surface being strongly acid and the subsurface being medium acid (Figure 5). This pattern is typical for soils that have been influenced by the usual acid rainfall for a long time. Aside from the A1 horizon, which may have been influenced by the addition of fertilizer, soil conductivity increased with depth until the bottom of the solum soil was reached (Figure 6). All these processes are typical of weathering in which soils tend to become acid with age, while releasing cations to the leachate and translocating fine clays from the A to the B horizon.

<u>Comparative Pedology</u>

Generally, soils this thick (260 cm) tend to have higher chromas (e.g., 7.5YR) than the 10YR chromas observed. That is because thick soils often form in coarse alluvium that has large enough pores to transport clays for long distances under high redox conditions when precipitation is plentiful. The parent material here, however, is silty clay (see CB horizon in

Table 1), which apparently allows clay translocation only through pores produced by flora and fauna. The upshot is that translocation and leaching to such great depths required a long time under a much wetter climate than at present (McFadden, 1982). Bt horizons 2 to 3 m thick are common in coarse alluvium estimated to be at 40 to 80 ka in the Livermore Valley (Borchardt, 1985). Early and Late Wisconsin soils developed in silty alluvium above the Sangamon wave-cut platform at Point Pinole also had low chromas (Borchardt, 1988).

CONCLUSIONS

1. The soil in the center of this swale is approximately 40,000 years old.
2. None of the soil boundaries in the swale were offset, folded, or warped, so we may be assured that no surface fault rupture (SFR) has occurred there during the last 40,000 years.

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Table 1. Description of Soil Profile No. 1 excavated across the mapped trace of a fault in a swale SE of Camino Pablo, Moraga, California. Abbreviations and definitions are given in Schoeneberger and others (2012) and Soil Survey Staff (1993, 1999, 2010).

Description of soil developed in colluvium by Glenn Borchardt, who measured and sampled the soil on January 14, 2014 at latitude N37.81175^{o} and longitude W122.11423^{o} at station 80' in the southeast wall of Trench T-1 at an elevation of 601' [607' (GPS)]. Mediterranean climate with mean annual precipitation of 32.02"/yr at Orinda (1948-1960). Slope 0%. Grass. Excellent drainage. Water table deep. The parent material is silt loam to silty clay. Soil pH is strongly acid in the surface, becoming medium acid in the subsoil. Mapped as: *Typic Argixerolls. Los Osos clay loam.*

Horizon	Depth, cm	Description

A1 0-38 Dark grayish brown (10YR4/2m, 6/2d) silt loam; medium to fine strong granular structure; slightly sticky and slightly plastic when wet, very friable when moist, and very hard when dry; many fine roots; many medium to fine continuous random tubular pores; abrupt irregular boundary; pH 5.3; conductivity 150 uS; Sample No. 14B001.

A2 38-75 Very dark grayish brown (10YR3/2m, 6/3d) silt loam; coarse to fine strong subangular blocky structure; sticky and slightly plastic when wet, very friable when moist, and very hard when dry; few fine roots; few fine continuous random tubular pores; gradual wavy boundary; pH 5.3; conductivity 90 uS; Sample No. 14B002.

B1t 75-101 Dark brown (10YR3/3m, 6/3d) silty clay; medium to coarse strong subangular to angular blocky structure; sticky and plastic when wet, firm when moist, and extremely hard when dry; very few fine roots; common fine continuous random tubular pores; few thin to medium thick clay films lining pores and coating peds; diffuse smooth boundary; pH 5.5; conductivity 150 uS; Sample No. 14B003.

B2t 101-166 Dark greyish brown (10YR4/2m, 5/2d) silty clay; medium to coarse strong angular blocky structure; sticky and plastic when wet, firm when moist, and very hard when dry; common fine continuous random tubular pores; many thin to medium thick clay films lining pores and coating peds; rare calcite filaments; clear smooth boundary; pH 5.5; conductivity 180 uS; Sample No. 14B004.

B3t 166-214 Dark greyish brown (10YR4/2m, 6/3d) silty clay; medium to coarse strong angular to subangular blocky structure; sticky and plastic when wet, firm to friable when moist, and very hard when dry; few fine continuous random tubular pores; many thin to

thick clay films lining pores and coating peds; clear smooth boundary; pH 5.6; conductivity 230 uS; Sample No. 14B005. Level line at 203 cm.

B4t 214-260 Very dark greyish brown (10YR3/2m, 6/3d) silty clay; medium to coarse strong subangular to angular blocky structure; sticky and plastic when wet, firm to friable when moist, and extremely hard when dry; common fine continuous random tubular pores; common thin to medium thick clay films lining pores and thick patchy coatings on peds; diffuse smooth boundary; pH 5.9; conductivity 230 uS; Sample No. 14B006.

CB 260-290+ Greyish brown (10YR5/2m, 6/3d) silty clay; massive to medium weak subangular blocky structure; sticky and plastic when wet, friable when moist, and very hard when dry; few fine continuous random tubular pores; pH 6.0; conductivity 220 uS; Sample No. 14B007.

*ESTIMATED AGE:	t_o	=	40.0	ka
	t_b	=	**0**	ka
	t_d	=	40.0	ky

---

*Pedochronological estimates based on available information. All ages should be considered subject to ±50% variation unless otherwise indicated (Borchardt, 1992). Bold dates are absolute.

t_o = date when soil formation or aggradation began, ka

t_b = date when soil or strata was buried, ka

t_d = duration of soil development or aggradation, ky

Figure 1. View SE (top) and NW (bottom) across the convex part of the swale between two outcrops of the Mulholland Formation east of Camino Pablo, Moraga, California.

Figure 2. Soil Profile No. 1 in the center of the swale showing the 75-cm thick A horizon and the upper portion of the Bt horizon. Nails mark horizon boundaries at 38, 75, and 101 cm.

Figure 3. The B2t horizon of Soil Profile No. 1 showing the angular blocky structure, medium thick to thick clay films coating peds, and the rare thin calcite filaments between 157 cm and 159 cm depths.

Figure 4. Burrow spoil piles from gopher excavations that helped to produce the 75-cm thick A horizon in the swale.

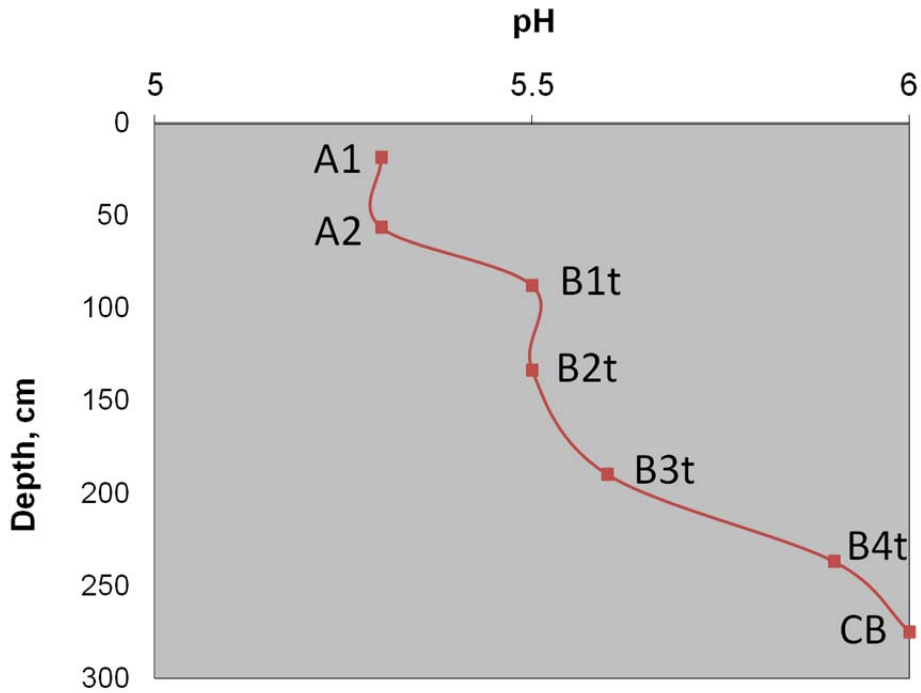


Figure 5. The pH in Soil Profile No. 1 is strongly acid in the surface, becoming medium acid in the subsoil.

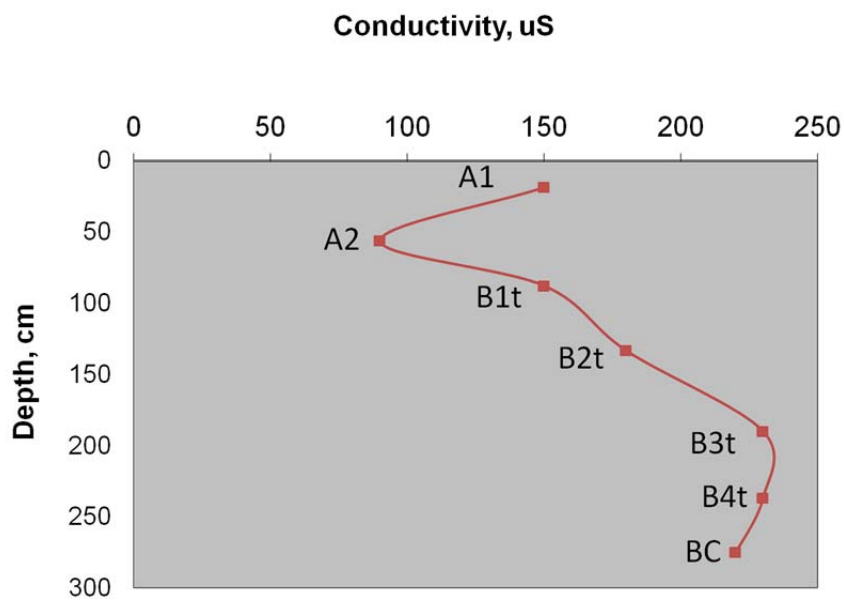


Figure 6. Soil conductivity (related to salt content) in Soil Profile No. 1 tends to increase with depth, with the maximum in the B3t and B4t. An increase in conductivity in the surface is sometimes the result of the recent application of fertilizer.

May 1, 2013

SOILS GLOSSARY

AGE. Elapsed time in calendar years. Because the cosmic production of C-14 has varied during the Quaternary, radiocarbon years (expressed as ky B.P.) must be corrected by using tree-ring and other data. Abbreviations used for corrected ages are: ka (kilo anno or years in thousands) or Ma (millions of years). Abbreviations used for intervals are: yr (years), ky (thousands of years). radiocarbon ages = yr B.P. Calibrated ages are calculated from process assumptions, relative ages fit in a sequence, and correlated ages refer to a matching unit. (See also yr B.P., HOLOCENE, PLEISTOCENE, QUATERNARY, PEDOCHRONOLOGY).

AGGRADATION. A modification of the earth's surface in the direction of uniformity of grade by deposition.

ALKALI (SODIC) SOIL. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 % or more of the total exchangeable bases), or both, that plant growth is restricted.

ALKALINE SOIL. Any soil that has a pH greater than 7.3. (See Reaction, Soil.)

ANGULAR ORPHANS. Angular fragments separated from weathered, well-rounded cobbles in colluvium derived from conglomerate.

ARGILLAN. (See Clay Film.)

ARGILLIC horizon. A horizon containing clay either translocated from above or formed in place through pedogenesis.

ALLUVIATION. The process of building up of sediments by a stream at places where stream velocity is decreased. The coarsest particles settle first and the finest particles settle last.

ANOXIC. (See also GLEYED SOIL). A soil having a low redox potential.

AQUICLUDE. A saturated body of sediment or rock that is incapable of transmitting significant quantities of water under ordinary hydraulic gradients.

AQUITARD. A body of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs but may serve as a storage unit for groundwater.

ATTERBERG LIMITS. The moisture content at which a soil passes from a semi-solid to a plastic state (plastic limit, PL) and from a plastic to a liquid state (liquid limit, LL). The plasticity index (PI) is the numerical difference between the LL and the PL.

BEDROCK. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

BISEQUUM. Two soils in vertical sequence, each soil containing an eluvial horizon and its underlying B horizon.

BOUDIN, BOUDINAGE. From a French word for sausage, describes the way that layers of rock break up under extension. Imagine the hand, fingers together, flat on the table, encased in soft clay and being squeezed from above, as being like a layer of rock. As the spreading clay moves the fingers (sausages) apart, the most mobile rock fractions are drawn or squeezed into the developing gaps.

BURIED SOIL. A developed soil that was once exposed but is now overlain by a more recently formed soil.

CALCAREOUS SOIL. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

CARBONATE MORPHOLOGY STAGES. Descriptive classes of calcite precipitation indicating increasing pedogenesis over time:

Stage	Description	Percent Carbonate
I	Bk horizon with few filaments and coatings	<10
I+	Bk with common filaments and continuous clast coatings	<10
II	Bk with continuous clast coatings, white masses, few nodules	>10
II+	Bk as above, but matrix is completely whitened, common nodules	>15
>II	K horizon that is 90% white, many nodules	>20
III+	K that is completely plugged	>40
IV	K as above, but upper part cemented and has weak platy structure	>50
V	K same as above, but laminar layer is strong with incipient brecciation	>50
VI	K brecciation and recementation, as well as pisoliths, are common	>50

CATENA. A sequence of soils of about the same age, derived from similar parent material and forming under similar climatic conditions, but having different characteristics due to variation in relief and drainage. (See also TOPOSEQUENCE.)

CEC. Cation exchange capacity. The amount of negative charge balanced by positively charged ions (cations) that are exchangeable by other cations in solution (meq/100 g soil = cmol(+)/kg soil).

CLAY. As a soil separate, the mineral soil particles are less than 0.002 mm in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

CLAY FILM. A coating of oriented clay on the surface of a sand grain, pebble, soil aggregate, or ped. Clay films also line pores or root channels and bridge sand grains. Frequency classification is based on the percent of the ped faces and/or pores that contain films: very few--<5%; few--5-25%; common--25-50%; many--50-90%; and continuous--90-100%. Thickness classification is based on visibility of sand grains: thin--very fine sand grains standout; moderately thick--very fine sand grains impart microrelief to film; thick--fine sand grains enveloped by clay and films visible without magnification. Synonyms: clay skin, clay coat, argillan, illuviation cutan.

CLAY LAMELLAE. Thin, generally wavy bands that appear as multiple micro-Bt horizons at the base of the solum in sandy Holocene deposits. The lamellae generally are 1-3 cm in thickness and 5 to 30 cm apart. There may be two to six or more clay lamellae comprising the Bt horizon of such a soil.

COBBLE. Rounded or partially rounded fragments of rock ranging from 7.5 to 25 cm in diameter.

COLLUVIUM. Any loose mass of soil or rock fragments that moves downslope largely by the force of gravity. Usually it is thicker at the base of the slope.

COLLUVIUM-FILLED SWALE. The prefailure topography of the source area of a debris flow.

COMPARATIVE PEDOLOGY. The comparison of soils, particularly through examination of features known to evolve through time.

CONCRETIONS. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

CONDUCTIVITY. The ability of a soil solution to conduct electricity, generally expressed as

the reciprocal of the electrical resistivity. Electrical conductance is the reciprocal of the resistance (1/R = 1/ohm = ohm^{-1} = mho [reverse of ohm] = siemens = S), while electrical conductivity is the reciprocal of the electrical resistivity (EC = 1/r = 1/ohm-cm = mho/cm = S/cm or mmho/cm = dS/m). EC, expressed as uS/cm, is equivalent to the ppm of salt in solution when multiplied by 0.640. Pure rain water has an EC of 0, standard 0.01 N KCl is 1411.8 uS at 25C, and the growth of salt-sensitive crops is restricted in soils having saturation extracts with an EC greater than 2,000 uS/cm. Measurements in soils are usually performed on 1:1 suspensions containing one part by weight of soil and one part by weight of distilled water.

CONSISTENCE, SOIL. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are --

Loose.--Noncoherent when dry or moist; does not hold together in a mass.

Friable.--When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.--When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.--When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.--When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.--When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.--When dry, breaks into powder or individual grains under very slight pressure.

Cemented.--Hard and brittle; little affected by moistening.

CTPOT. Easily remembered acronym for climate, topography, parent material, organisms, and time; the five factors of soil formation.

CUMULIC. A soil horizon that has undergone aggradation coincident with its active development.

CUTAN. (See Clay Film.)

DEBRIS FLOW. Incoherent or broken masses of rock, soil, and other debris that move downslope in a manner similar to a viscous fluid.

DEBRIS SLOPE. A constant slope with debris on it from the free face above.

DEGRADATION. A modification of the earth's surface by erosion.

DURIPAN. A subsurface soil horizon that is cemented by illuvial silica, generally deposited as opal or microcrystalline silica, to the degree that less than 50 percent of the volume of air-dry fragments will slake in water or HCl.

ELUVIATION. The removal of soluble material and solid particles, mostly clay and humus, from a soil horizon by percolating water.

EOLIAN. Deposits laid down by the wind, landforms eroded by the wind, or structures such as ripple marks made by the wind.

FAULT-LINE SCARP. A scarp that has been produced by differential erosion along an old fault line.

FAULTSLIDE. A landslide that shows physical evidence of its interaction with a fault.

FIRST-ORDER DRAINAGE. The most upstream, field-discernible concavity that conducts water and sediments to lower parts of a watershed.

FLOOD PLAIN. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

FOSSIL FISSURE. A buried rectilinear chamber associated with extension due to ground movement. The chamber must be oriented along the strike of the shear and must have vertical and horizontal dimensions greater than its width. It must show no evidence of faunal activity and its walls may have silt or clay coatings indicative of frequent temporary saturation with ground water. May be mistaken for an animal burrow. Also known as a paleofissure.

FRIABILITY. Term for the ease with which soil crumbles. A friable soil is one that crumbles easily.

GENESIS, SOIL. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum (A and B horizons) from the unconsolidated parent material.

GEOMORPHIC. Pertaining to the form of the surface features of the earth. Specifically, geomorphology is the analysis of landforms and their mode of origin.

GLEYED SOIL. A soil having one or more neutral gray horizons as a result of water logging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent water logging.

GRAVEL. Rounded or angular fragments of rock 2 to 75 mm in diameter. Soil textures with >15% gravel have the prefix "gravelly" and those with >90% gravel have the suffix "gravel."

HIGHSTAND. The highest elevation reached by the ocean during an interglacial period.

HOLOCENE. The most recent epoch of geologic time, extending from 10 ka to the present.

HORIZON, SOIL. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major soil horizons:

> O horizon.--The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.
>
> A horizon.--The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).
>
> E horizon -- This eluvial horizon is light in color, lying beneath the A horizon and above the B horizon. It is made up mostly of sand and silt, having lost most of its clay and iron oxides through reduction, chelation, and translocation.
>
> B horizon.--The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these.
>
> C horizon.--The relatively unweathered material immediately beneath the solum. Included are sediment, saprolite, organic matter, and bedrock excavatable with a spade. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a number precedes the letter C.
>
> R horizon.--Consolidated rock not excavatable with a spade. It may contain a few cracks filled with roots or clay or oxides. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Major horizons may be further distinguished by applying prefix Arabic numbers to designate differences in parent materials as they are encountered (e.g., 2B, 2BC, 3C) or by applying suffix numerals to designate minor changes (e.g., B1, B2).

The following is from the Natural Resources Conservation Service, except for the proposed addition of mn:

“Suffix Symbols

Lowercase letters are used as suffixes to designate specific kinds of master horizons and layers.

The term “accumulation” is used in many of the definitions of such horizons to indicate that these horizons must contain more of the material in question than is presumed to have been present in the parent material. The suffix symbols and their meanings are as follows:

a Highly decomposed organic material

This symbol is used with O to indicate the most highly decomposed organic materials, which have a fiber content of less than 17 percent (by volume) after rubbing.

b Buried genetic horizon

This symbol is used in mineral soils to indicate identifiable buried horizons with major genetic features that were developed before burial. Genetic horizons may or may not have formed in the overlying material, which may be either like or unlike the assumed parent material of the buried soil. This symbol is not used in organic soils, nor is it used to separate an organic layer from a mineral layer.

c *Concretions or nodules*

This symbol indicates a significant accumulation of concretions or nodules. Cementation is required. The cementing agent commonly is iron, aluminum, manganese, or titanium. It cannot be silica, dolomite, calcite, or more soluble salts.

co *Coprogenous earth*

This symbol, used only with L, indicates a limnic layer of coprogenous earth (or sedimentary peat).

d *Physical root restriction*

This symbol indicates noncemented, root-restricting layers in natural or human-made sediments or materials. Examples are dense basal till, plowpans, and other mechanically compacted zones.

di *Diatomaceous earth*

This symbol, used only with L, indicates a limnic layer of diatomaceous earth.

e *Organic material of intermediate decomposition*

This symbol is used with O to indicate organic materials of intermediate decomposition. The fiber content of these materials is 17 to 40 percent (by volume) after rubbing.

f *Frozen soil or water*

This symbol indicates that a horizon or layer contains permanent ice. The symbol is not

used for seasonally frozen layers or for dry permafrost.

ff *Dry permafrost*

This symbol indicates a horizon or layer that is continually colder than 0° C and does not contain enough ice to be cemented by ice. This suffix is not used for horizons or layers that have a temperature warmer than 0° C at some time of the year.

g *Strong gleying*

This symbol indicates either that iron has been reduced and removed during soil formation or that saturation with stagnant water has preserved it in a reduced state. Most of the affected layers have chroma of 2 or less, and many have redox concentrations. The low chroma can represent either the color of reduced iron or the color of uncoated sand and silt particles from which iron has been removed. The symbol g is not used for materials of low chroma that have no history of wetness, such as some slates or E horizons. If g is used with B, pedogenic change in addition to gleying is implied. If no other pedogenic change besides gleying has taken place, the horizon is designated Cg.

h *Illuvial accumulation of organic matter*

This symbol is used with B to indicate the accumulation of illuvial, amorphous, dispersible complexes of organic matter and sesquioxides if the sesquioxide component is dominated by aluminum but is present only in very small quantities. The organo-sesquioxide material coats sand and silt particles. In some horizons these coatings have coalesced, filled pores, and cemented the horizon. The symbol h is also used in combination with s as “Bhs” if the amount of the sesquioxide component is significant but the color value and chroma, moist, of the horizon are 3 or less.

i *Slightly decomposed organic material*

This symbol is used with O to indicate the least decomposed of the organic materials. The fiber content of these materials is 40 percent or more (by volume) after rubbing.

j *Accumulation of jarosite*

Jarosite is a potassium or iron sulfate mineral that is commonly an alteration product of pyrite that has been exposed to an oxidizing environment. Jarosite has hue of 2.5Y or yellower and normally has chroma of 6 or more, although chromas as low as 3 or 4 have been reported. [Note: No longer used to indicate “juvenile.”]

jj *Evidence of cryoturbation*

Evidence of cryoturbation includes irregular and broken horizon boundaries, sorted rock fragments, and organic soil materials existing as bodies and broken layers within and/or

between mineral soil layers. The organic bodies and layers are most commonly at the contact between the active layer and the permafrost.

k *Accumulation of secondary carbonates*

This symbol indicates an accumulation of visible pedogenic calcium carbonate (less than 50 percent, by volume). Carbonate accumulations exist as carbonate filaments, coatings, masses, nodules, disseminated carbonate, or other forms.

kk *Engulfment of horizon by secondary carbonates*

This symbol indicates major accumulations of pedogenic calcium carbonate. The suffix kk is used when the soil fabric is plugged with fine grained pedogenic carbonate (50 percent or more, by volume) that exists as an essentially continuous medium. The suffix corresponds to the stage III plugged horizon or higher of the carbonate morphogenetic stages (Gile et al., 1966).

m *Cementation or induration*

This symbol indicates continuous or nearly continuous cementation. It is used only for horizons that are more than 90 percent cemented, although they may be fractured. The cemented layer is physically root-restrictive. The dominant cementing agent (or the two dominant ones) may be indicated by adding defined letter suffixes, singly or in pairs. The horizon suffix km or kkm indicates cementation by carbonates; qm, cementation by silica; sm, cementation by iron; yym, cementation by gypsum; kqm, cementation by lime and silica; and zm, cementation by salts more soluble than gypsum.

ma *Marl*

This symbol, used only with L, indicates a limnic layer of marl.

mn *Mangans*

This symbol indicates an accumulation of manganese oxide, generally as ped coatings called mangans (First used by Borchardt on 20130418.)

n *Accumulation of sodium*

This symbol indicates an accumulation of exchangeable sodium.

o *Residual accumulation of sesquioxides*

This symbol indicates a residual accumulation of sesquioxides.

p *Tillage or other disturbance*

This symbol indicates a disturbance of the surface layer by mechanical means, pasturing, or similar uses. A disturbed organic horizon is designated Op. A disturbed mineral horizon is designated Ap even though it is clearly a former E, B, or C horizon.

q *Accumulation of silica*

This symbol indicates an accumulation of secondary silica.

r *Weathered or soft bedrock*

This symbol is used with C to indicate cemented layers (moderately cemented or less cemented). Examples are weathered igneous rock and partly consolidated sandstone, siltstone, or slate. The excavation difficulty is low to high.

s *Illuvial accumulation of sesquioxides and organic matter*

This symbol is used with B to indicate an accumulation of illuvial, amorphous, dispersible complexes of organic matter and sesquioxides if both the organic-matter and sesquioxide components are significant and if either the color value or chroma, moist, of the horizon is 4 or more. The symbol is also used in combination with h as "Bhs" if both the organic-matter and sesquioxide components are significant and if the color value and chroma, moist, are 3 or less.

se *Presence of sulfides*

Typically dark colors (e.g., value <4, chroma <2); may have a sulphurous odor.

ss *Presence of slickensides*

This symbol indicates the presence of slickensides. Slickensides result directly from the swelling of clay minerals and shear failure, commonly at angles of 20 to 60 degrees above horizontal. They are indicators that other vertic characteristics, such as wedge-shaped peds and surface cracks, may be present.

t *Accumulation of silicate clay*

This symbol indicates an accumulation of silicate clay that either has formed *in situ* within a horizon or has been moved into the horizon by illuviation, or both. At least some part of the horizon should show evidence of clay accumulation either as coatings on surfaces of peds or in pores, as lamellae, or as bridges between mineral grains.

u *Presence of human-manufactured materials (artifacts)*

This symbol indicates the presence of manufactured artifacts that have been created or modified by humans, usually for a practical purpose in habitation, manufacturing,

excavation, or construction activities. Examples of artifacts are processed wood products, liquid petroleum products, coal, combustion by-products, asphalt, fibers and fabrics, bricks, cinder blocks, concrete, plastic, glass, rubber, paper, cardboard, iron and steel, altered metals and minerals, sanitary and medical waste, garbage, and landfill waste.

v *Plinthite*

This symbol indicates the presence of iron-rich, humus-poor, reddish material that is firm or very firm when moist and hardens irreversibly when exposed to the atmosphere and to repeated wetting and drying.

w *Development of color or structure*

This symbol is used with B to indicate the development of color or structure, or both, with little or no apparent illuvial accumulation of material. It should not be used to indicate a transitional horizon.

x *Fragipan character*

This symbol indicates a genetically developed layer that has a combination of firmness and brittleness and commonly a higher bulk density than the adjacent layers. Some part of the layer is physically root-restrictive.

y *Accumulation of gypsum*

This symbol indicates an accumulation of gypsum (<50% by volume).

yy *Dominance of gypsum*

This symbol indicates an accumulation of gypsum (>50% by volume); light colored (e.g., value >7, chroma <4); may be pedogenically derived or inherited transformation of primary gypsum from parent material.

z *Accumulation of salts more soluble than gypsum*

This symbol indicates an accumulation of salts that are more soluble than gypsum; e.g., NaCl.

HUMUS. The well-decomposed, more or less stable part of the organic matter in mineral soils.

ILLUVIATION. The deposition by percolating water of solid particles, mostly clay or humus, within a soil horizon.

INTERFLUVE. The land lying between streams.

ISOCHRONOUS BOUNDARY. A gradational boundary between two sedimentary units

indicating that they are approximately the same age. Opposed to a nonisochronous boundary, which by its abruptness indicates that it delineates units having significant age differences.

KROTOVINA. An animal burrow filled with soil.

LEACHING. The removal of soluble material from soil or other material by percolating water.

LOWSTAND. The lowest elevation reached by the ocean during a glacial period.

MANGAN. A thin coating of manganese oxide (cutan) on the surface of a sand grain, pebble, soil aggregate, or ped. Mangans also line pores or root channels and bridge sand grains.

MODERN SOIL. The portion of a soil section that is under the influence of current pedogenetic conditions. It generally refers to the uppermost soil regardless of age.

MODERN SOLUM. The combination of the A and B horizons in the modern soil.

MORPHOLOGY, SOIL. The physical make-up of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

MOTTLING, SOIL. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance--few, common, and many; size--fine, medium, and coarse; and contrast--faint, distinct and prominent. The size measurements are these: fine, less than 5 mm in diameter along the greatest dimension; medium, from 5 to 15 mm, and coarse, more than 15 mm.

MRT (MEAN RESIDENCE TIME.) The average age of the carbon atoms within a soil horizon. Under ideal reducing conditions, the humus in a soil will have a C-14 age that is half the true age of the soil. In oxic soils humus is typically destroyed as fast as it is produced, generally yielding MRT ages no older than 300-1000 years, regardless of the true age of the soil.

MUNSELL COLOR NOTATION. Scientific description of color determined by comparing soil to a Munsell Soil Color Chart (Available from Macbeth Division of Kollmorgen Corp., 2441 N. Calvert St., Baltimore, MD 21218). For example, dark yellowish brown is denoted as 10YR3/4m in which the 10YR refers to the hue or proportions of yellow and red, 3 refers to value or lightness (0 is black and 10 is white), 4 refers to chroma (0 is pure black and white and 20 is the pure color), and m refers to the moist condition rather than the dry (d) condition.

OVERBANK DEPOSIT. Fine-grained alluvial sediments deposited from floodwaters outside of the fluvial channel.

OXIC. A soil having a high redox potential. Such soils typically are well drained, seldom being waterlogged or lacking in oxygen. Rubification in such soils tends to increase with age.

PALEO SOIL TONGUE. A soil tongue that formed during a previous soil-forming interval.

PALEOSEISMOLOGY. The study of prehistoric earthquakes through the examination of soils, sediments, and rocks.

PALEOSOL. A soil that formed on a landscape in the past with distinctive morphological features resulting from a soil-forming environment that no longer exists at the site. The former pedogenic process was either altered because of external environmental change or interrupted by burial.

PALINSPASTIC RECONSTRUCTION. Diagrammatic reconstruction used to obtain a picture of what geologic and/or soil units looked like before their tectonic deformation.

PARENT MATERIAL. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

PED. An individual natural soil aggregate, such as a granule, a prism, or a block.

PEDOCHRONOLOGY. The study of pedogenesis with regard to the determination of when soil formation began, how long it occurred, and when it stopped. Also known as soil dating. Two ages and the calculated duration are important:

t_o = age when soil formation or aggradation began, ka

t_b = age when the soil or stratum was buried, ka

t_d = duration of soil development or aggradation, ky

Pedochronological estimates are based on available information. All ages should be considered subject to $\pm$50% variation unless otherwise indicated.

PEDOCHRONOPALEOSEISMOLOGY. The study of prehistoric earthquakes by using pedochronology.

PEDOLOGY. The study of the process through which rocks, sediments, and their constituent minerals are transformed into soils and their constituent minerals at or near the surface of the earth.

PEDOGENESIS. The process through which rocks, sediments, and their constituent minerals are transformed into soils and their constituent minerals at or near the surface of the earth.

PERCOLATION. The downward movement of water through the soil.

pH VALUE. The negative log of the hydrogen ion concentration. Measurements in soils are usually performed on 1:1 suspensions containing one part by weight of soil and one part by weight of distilled water. A soil with a pH of 7.0 is precisely neutral in reaction because it is

neither acid nor alkaline. An acid or "sour" soil is one that gives an acid reaction; an alkaline soil is one that gives an alkaline reaction. In words, the degrees of acidity or alkalinity are expressed as:

Extremely acid	<4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	>9.0
Used if significant:	
Very slightly acid	6.6 to 6.9
Very mildly alkaline	7.1 to 7.3

PHREATIC SURFACE. (See Water Table.)

PLANATION. The process of erosion whereby a portion of the surface of the Earth is reduced to a fundamentally even, flat, or level surface by a meandering stream, waves, currents, glaciers, or wind.

PLEISTOCENE. An epoch of geologic time extending from 10 ka to 1.8 Ma; it includes the last Ice Age.

PROFILE, SOIL. A vertical section of the soil through all its horizons and extending into the parent material.

QUATERNARY. A period of geologic time that includes the past 1.8 Ma. It consists of two epochs--the Pleistocene and Holocene.

PROGRADATION. The building outward toward the sea of a shoreline or coastline by nearshore deposition.

RELICT SOIL. A surface soil that was partly formed under climatic conditions significantly

different from the present.

RUBIFICATION. The reddening of soils through the release and precipitation of iron as an oxide during weathering. Munsell hues and chromas of well-drained soils generally increase with soil age.

SALINE SOIL. A soil that contains soluble salts in amounts that impair the growth of crop plants but that does not contain excess exchangeable sodium.

SAND. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 mm. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

SECONDARY FAULT. A minor fault that bifurcates from or is associated with a primary fault. Movement on a secondary fault never occurs independently of movement on the primary, seismogenic fault.

SHORELINE ANGLE. The line formed by the intersection of the wave-cut platform and the sea cliff. It approximates the position of sea level at the time the platform was formed.

SILT. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 mm) to the lower limit of very find sand (0.05 mm.) Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

SLICKENSIDES. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may form along a fault plane; at the bases of slip surfaces on steep slopes; on faces of blocks, prisms, and columns undergoing shrink-swell. In tectonic slickensides the striations are strictly parallel.

SLIP RATE. The rate at which the geologic materials on the two sides of a fault move past each other over geologic time. The slip rate is expressed in mm/yr, and the applicable duration is stated. Faults having slip rates less than 0.01 mm/yr are generally considered inactive, while faults with Holocene slip rates greater than 0.1 mm/yr generally display tectonic geomorphology.

SMECTITE. A fine, platy, aluminosilicate clay mineral that expands and contracts with the absorption and loss of water. It has a high cation-exchange capacity and is plastic and sticky when moist.

SOIL. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

SOIL SEISMOLOGIST. Soil scientist who studies the effects of earthquakes on soils.

SOIL SLICKS. Curvilinear striations that form in swelling clayey soils, where there is marked change in moisture content. Clayey slopes buttressed by rigid materials may allow minor amounts of gravitationally driven plastic flow, forming soil slicks sometimes mistaken for evidence of tectonism. Soil slicks disappear with depth and the striations are seldom strictly parallel as they are when movement is major. (See also SLICKENSIDES.)

SOIL TECTONICS. The study of the interactions between soil formation and tectonism.

SOIL TONGUE. That portion of a soil horizon extending into a lower horizon.

SOLUM. Combined A and B horizons. Also called the true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

STONELINE. A thin, buried, planar layer of stones, cobbles, or bedrock fragments. Stonelines of geological origin may have been deposited upon a former land surface. The fragments are more often pebbles or cobbles than stones. A stoneline generally overlies material that was subject to weathering, soil formation, and erosion before deposition of the overlying material. Many stonelines seem to be buried erosion pavements, originally formed by running water on the land surface and concurrently covered by surficial sediment.

STRATH TERRACE. A gently sloping terrace surface bearing little evidence of aggradation.

STRUCTURE, SOIL. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are--platy (laminated), prismatic (vertical axis of aggregates longer than horizontal), columnar (prisms with rounded tops), blocky (angular or subangular), and granular. Structureless soils are either single grained (each grain by itself, as in dune sand) or massive (the particles adhering without any regular cleavage, as in many hardpans).

SUBSIDIARY FAULT. A branch fault that extends a substantial distance from the main fault zone.

TECTOTURBATION. Soil disturbance resulting from tectonic movement.

TEXTURE, SOIL. Particle size classification of a soil, generally given in terms of the USDA system which uses the term "loam" for a soil having equal properties of sand, silt, and clay. The basic textural classes, in order of their increasing proportions of fine particles are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sand clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

TOPOSEQUENCE. A sequence of kinds of soil in relation to position on a slope. (See also CATENA.)

TRANSLOCATION. The physical movement of soil particles, particularly fine clay, from one soil horizon to another under the influence of gravity.

UNIFIED SOIL CLASSIFICATION SYSTEM. The particle size classification system used by the U.S. Army Corps of Engineers and the Bureau of Reclamation. Like the ASTM and AASHO systems, the sand/silt boundary is at 80 um instead of 50 um used by the USDA. Unlike all other systems, the gravel/sand boundary is at 4 mm instead of 2 mm and the silt/clay boundary is determined by using Atterberg limits.

VERTISOL. A soil with at least 30% clay, usually smectite, that fosters pronounced changes in volume with change in moisture. Cracks greater than 1 cm wide appear at a depth of 50 cm during the dry season each year. One of the ten USDA soil orders.

WATER TABLE. The upper limit of the soil or underlying rock material that is wholly saturated with water. Also called the phreatic surface.

WAVE-CUT PLATFORM. The relatively smooth, slightly seaward-dipping surface formed along the coast by the action of waves generally accompanied by abrasive materials.

WEATHERING. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

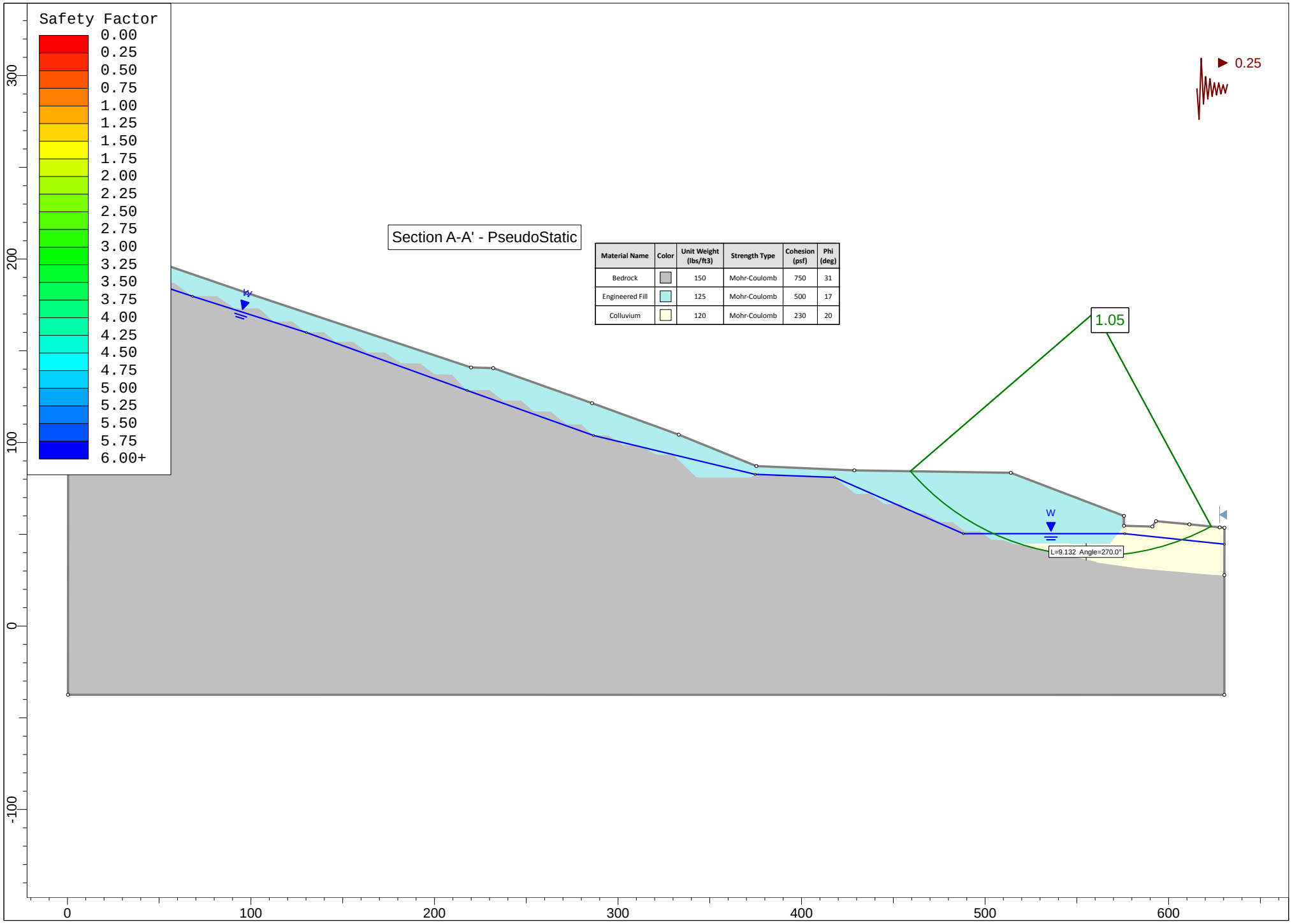
WETTING FRONT. The greatest depth affected by moisture due to precipitation.

yr B.P. Uncorrected radiocarbon age expressed in years before present, calculated from 1950. Calendar-corrected ages are expressed in ka, or, if warranted, as A.D. or B.C.

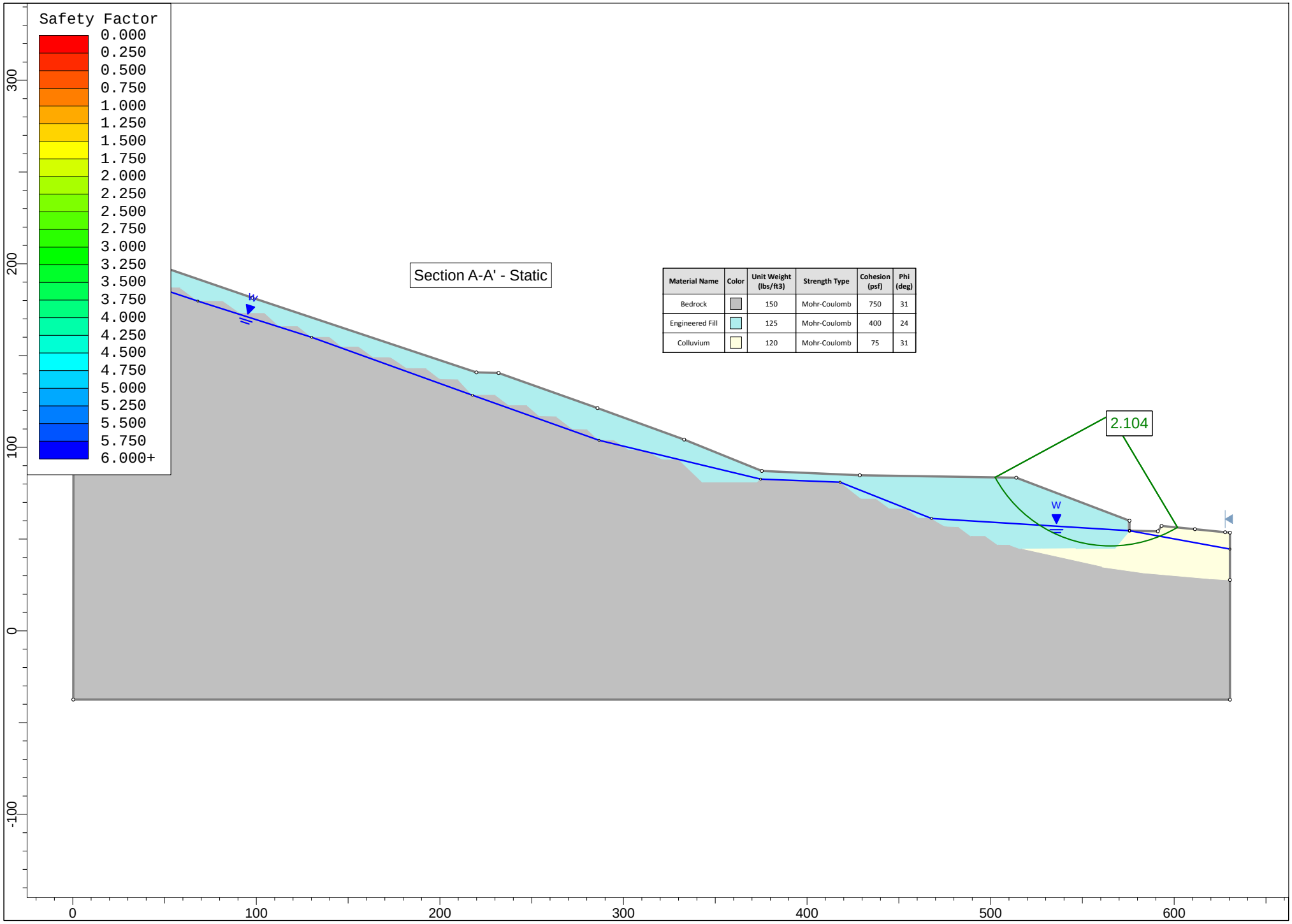
APPENDIX D

Slope Stability Analysis Results

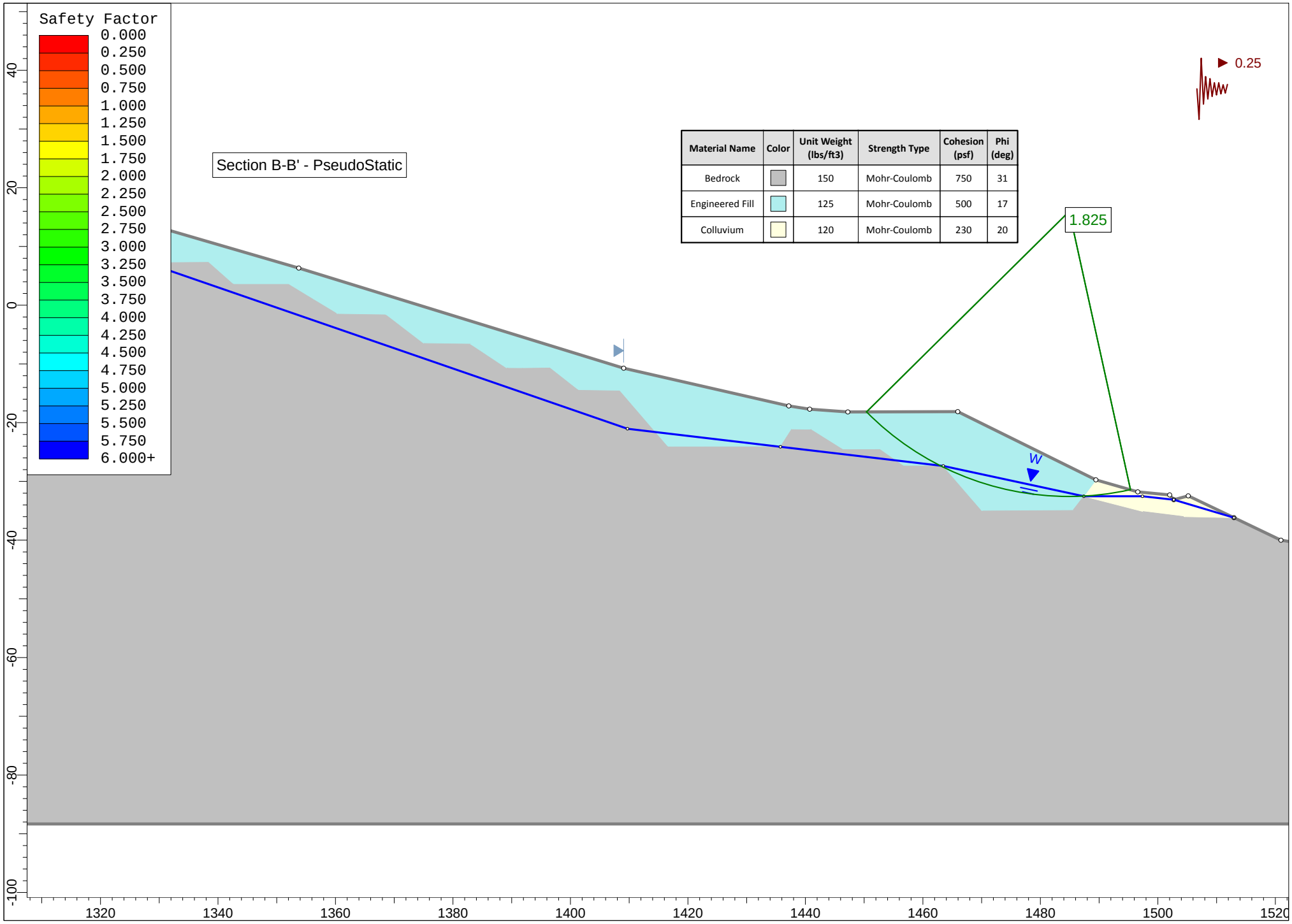
APPENDIX D



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bedrock		150	Mohr-Coulomb	750	31
Engineered Fill		125	Mohr-Coulomb	500	17
Colluvium		120	Mohr-Coulomb	230	20



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Bedrock		150	Mohr-Coulomb	750	31
Engineered Fill		125	Mohr-Coulomb	400	24
Colluvium		120	Mohr-Coulomb	75	31



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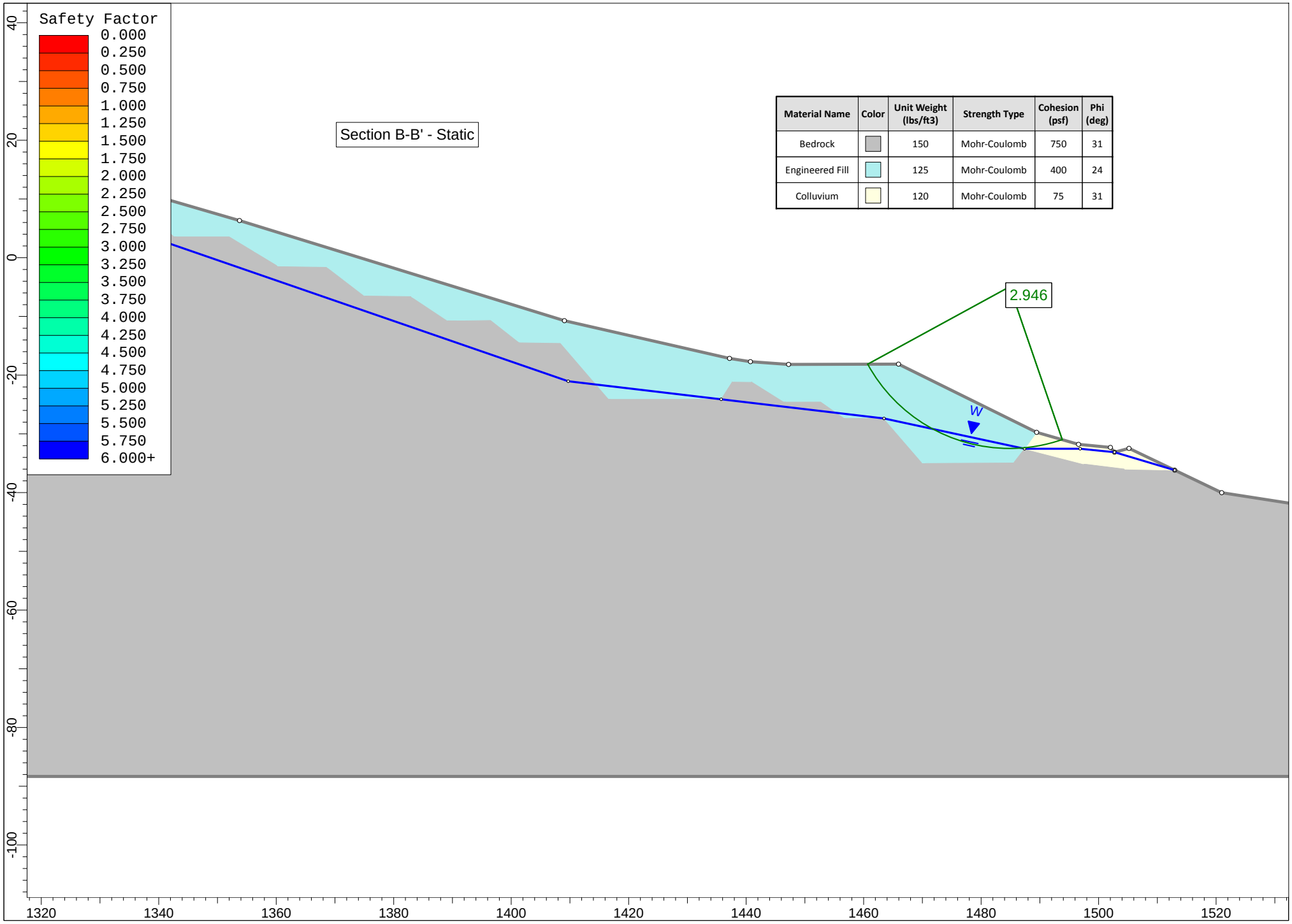

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
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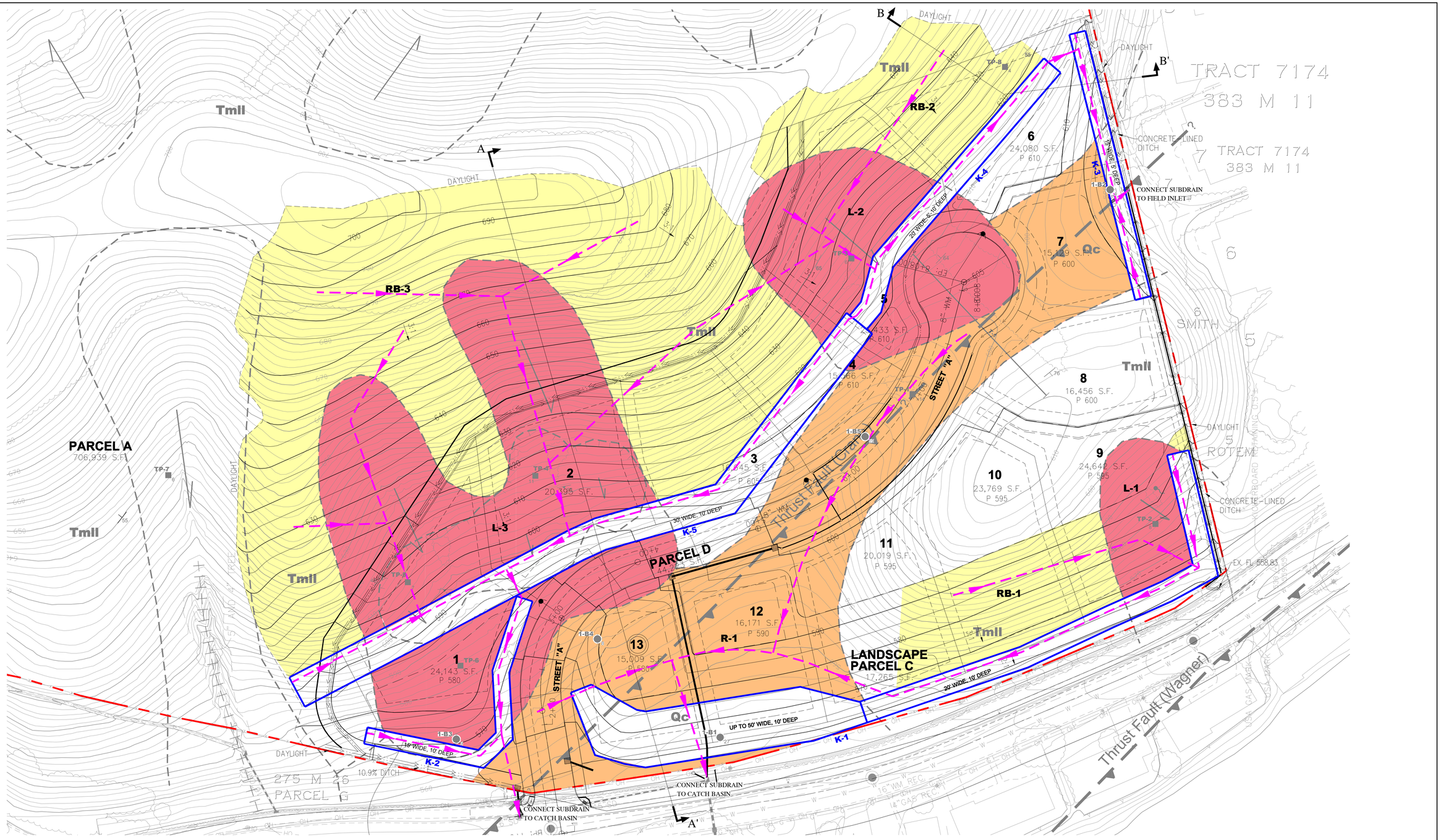

EXPLANATION

ALL LOCATIONS ARE APPROXIMATE

K-5 / 30' WIDE, 10' DEEP	PROPOSED KEYWAY, SHOWING WIDTH AND DEPTH
	PROPOSED KEYWAY SUBDRAIN
R-1	COLLUVIUM REMOVAL
RB-3	SLOPE REBUILD AREA
L-3	LANDSLIDE REMOVAL AREA
A — A'	CROSS SECTION LOCATION
Qc	COLLUVIUM
Tmll	MULHOLLAND FORMATION
	GULLY
	RECENT LANDSLIDE
	GEOLOGIC CONTACT
	SURFICIAL LANDSLIDE
	SEEPAGE AREA
1-B5 / 19	BORING, SHOWING DEPTH TO BEDROCK IN FEET (ENGEO, 2015)
TP-7 / 8	TEST PIT, SHOWING DEPTH TO BEDROCK IN FEET (ENGEO, 2014)
T-1	TRENCH (ENGEO, 2014)
65	STRIKE AND DIP OF BEDDING
19	STRIKE AND DIP OF SLIDE PLANE

N

0 FEET 40
0 METERS 20

BASE MAP SOURCE: DK ASSOCIATES

ENGEO
Expect Excellence

PRELIMINARY CORRECTIVE GRADING PLAN
SOUTH CAMINO PABLO ANNEXATION
MORAGA, CALIFORNIA

PROJECT NO.: 10741.000.000		FIGURE NO.
SCALE: AS SHOWN		8
DRAWN BY: SRP	CHECKED BY: PS	

ORIGINAL FIGURE PRINTED IN COLOR

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Project No.
10741.000.000

January 3, 2019

Mr. Matt Dobbins
Dobbins Properties, LLC
1901 W. Kettleman Lane, Suite 102
Lodi, CA 95242

Subject: South Camino Pablo Annexation Project
Subdivision 9396
Moraga, California

RESPONSE TO COMMENTS

References:

1. ENGEO Incorporated, 2015, Supplemental Geotechnical Exploration, South Camino Pablo Annexation Project – Subdivision 9396, Moraga, California, Project No. 10741.000.000, October 26, 2015.

2. ENGEO Incorporated; 2014, Preliminary Geologic Exploration, 1211 Camino Pablo Property, Moraga, California, Project No. 10741.000.000, January 14, 2014.

3. dk Consulting; 2019, General Plan Amendment, Subdivision 9396, South Camino Pablo Annexation Project, Town of Moraga, California, January, 2019

Dear Mr. Dobbins:

As requested, we have reviewed the General Plan Amendment Package, (Reference 3). ENGEO previously discussed the geotechnical aspects of the proposed site construction and grading in Reference 1. The grading plan depicted on Sheet 2 of 9 (General Development Plan) is geotechnically consistent with the proposed grading evaluated by ENGEO in Reference 1. Plan changes include slight modifications to pad elevations and the addition of small stepped upper pads on Lots 1 through 6. Based on our review of the revised plans, it is our opinion that the proposed grading and site development are substantially in conformance with the geotechnical recommendation presented in Reference 1.

If you have any questions regarding the contents of this letter, please do not hesitate to contact us.

Sincerely,

ENGEO Incorporated

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Eric Harrell, CEG

Appendix E

Hydrologic and Hydraulic Analysis

South Camino Pablo Annexation Hydrologic & Hydraulic Analysis

Prepared for:
Town of Moraga
Contra Costa County, California

Owner:
Carr Families

Job# 13-1060-10
August 10, 2015

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PLANNING · ENGINEERING · CONSTRUCTION

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APPENDIX

A Vicinity Map
B 1. Hydrology Map (1-11x17 map for quick reference and 1-full size map)
2. Off-Site Storm Exhibit (1-11x17 map for quick reference and 1-full size map)
C Contra Costa County-Runoff Coefficients
D Contra Costa County Mean Seasonal Isohyets
E Precipitation Duration-Frequency-Depth Curves
F 10 - Year Hydrology Calculations
G Contra Costa County Table of Headloss Factors
H 10 - Year Hydraulic Calculations
I Pre - Hydrology Map for PondPack Analysis (1-11x17 map for quick reference and 1-full size map)
J Post - Hydrology Map for PondPack Analysis (1-11x17 map for quick reference and 1-full size map)
K PondPack Results: Pre-Conditions
L PondPack Results: Post-Conditions

1.0 INTRODUCTION

1.1 General

This report has been prepared in accordance with the standard methods approved by Contra Costa County and the Town of Moraga (Town) for distribution to the Town and the applicant. The purpose of this report is to present hydrologic and hydraulic calculations, provide analysis, and demonstrate that the proposed conditions comply with the requirements of the Town and Contra Costa County.

1.2 Project Description

South Camino Pablo Annexation is a 23.92 acre site owned by Carr families. The project site is located on the southeast corner of the intersection of Camino Pablo and Sanders Ranch Road in the Town of Moraga. The project site consists of one parcel, which is currently agricultural land. The property is bordered to the north by Sanders Ranch Road, to the west by Camino Pablo and Sanders Ranch Road, to the south by single family residential lots, and agricultural land abuts the property to the east. The southwest portion of the site, approximately 7.69 acres, will be developed as single-family hillside homes. The remaining property, approximately 16.23 acres, will remain for agricultural uses.

2.0 PROJECT SETTING

2.1 Land Use and Topography

The project site is located at 1211 Camino Pablo, Moraga, California (see Vicinity Map in Appendix A). The existing site is currently undeveloped and is located in an area of relatively steep hillside terrain. The site is open grassland and brush that is currently used for grazing. Existing improvements appear to be limited to perimeter fencing and existing v-ditches.

2.2 Runoff Description

The pre-development site is mostly pervious. The proposed project, 7.69 acres of the total 23.92 acre site, will consist of 13 single family hillside homes, landscape buffers, and street improvements. All of the storm water runoff from the site will be treated by bioretention basins and swales as shown on the Hydrology Map (see Appendix B.1) and discharge into the proposed storm drain system before exiting into the existing storm drain system that releases into the Moraga Creek (see Appendix B.2). The remaining portion, 16.23 acres, will remain as undeveloped and will continue to discharge into an existing v-ditch, located adjacent to Camino Pablo, and finally into the existing storm drain system.

3.0 HYDROLOGIC AND HYDRAULIC ANALYSIS

The following sections discuss the analyses for the hydrology and hydraulics in depth. The analyses have been prepared to demonstrate compliance with Contra Costa County's criteria for storm drain systems. See Hydrology Map (Appendix B) for watersheds and location of storm drain systems.

3.1 Hydrologic Analysis

According to Contra Costa County Public Works Flood Control, the design storm is based on the watershed area. If the watershed area is less than 1 square mile (640 acres), then storm design for a 10-year rainfall event is required. Based on the drainage area of this project, the rational method was used to calculate the 10-year storm event quantities. The rational method uses the formula:

$$Q = CiA$$

where:
- Q = Discharge (cfs)
- C = Runoff Coefficient
- I = Rainfall Intensity (in/hr)
- A = Drainage Area (acres)

The runoff coefficients for this project were developed using the County's designated runoff coefficients (see Appendix C). The mean annual precipitation numbers were developed from the County's Isohyetal tables (see Appendix D). The rainfall intensity numbers were developed from the County's Precipitation-Duration-Frequency-Depth Curves (see Appendix E) and converted into intensities using the following formula:

i = MAP x Unit Rainfall Intensity

where:
- T = Time (min)
- D = Depth (in)
- I = Rainfall Intensity (in/hr)

Beginning at the upstream end of the proposed storm drain line, a minimum initial time of concentration of 5 minutes was used as recommended by the Highway Design Manual. With the initial time of concentration having been determined, the flows to the upstream structure were then determined and calculated using the rational method. The flows into the downstream structures on that same line were calculated using a time of concentration

developed based on the travel time of the flows within the pipe plus the initial time of concentration. This method was repeated yielding a total flow at the downstream end of the system. See Appendix F for 10-year hydrology calculations.

Storm drain structures, treatment swales, and a basin have been designed to convey the 10-year storm. Residential lots will drain into private yard drains, which will be directed into the streets via sheet flow and/or through curb drains. The runoff from the lots will be treated via treatment swales or within the basin and ultimately drain to the primary storm system.

Flow, upstream from the site (DA Curb Drain#1 as shown in Appendix B), will be siphoned to the bioretention basin on landscape Parcel C. The basin is designed to treat the first flush of rainfall. The upstream flow from DA Curb Drain #1 going into the bioretention basin was calculated using a maximum intensity of 0.2" per hour, based on guidelines from the Contra Costa Clean Water Program Stormwater C.3 Guidebook, Sixth Edition. Therefore, Curb Drain#1 diverts 0.07 cfs into the basin for treatment, where A=0.40, C= 0.90, I=0.2, and Q = CIA = 0.07 cfs. The remaining portion of the flow will bypass the reverse curb drain (Curb Drain #1) and enter catch basin (CB#1).

The existing v-ditch along the western frontage of Camino Pablo, directly adjacent to the bioretention basin, has been removed since it is not necessary to keep the existing ditch. The existing v-ditch, near the southernmost part of the property, will tie into the bioretention basin. The size of the basin has been designed to handle the upstream runoff from the existing v-ditch. See Section 3.3 of this report for more detailed information regarding the basin sizing.

3.2 Hydraulic Analysis

The hydraulic analysis of the storm drain system utilizes generally accepted backwater methodology – where:

HGL (upstream) = Hf + He + Tw
HGL = Hydraulic Grade Line
Hf = Head Loss Due to Friction
He = Head Loss Due to Entrance and Exit Configuration
Tw = Tailwater Elevation

The starting HGL at existing storm drain catch basin (EX. CB #1), located southeast of the site along Camino Pablo, was conservatively established by utilizing the upstream pipe soffit. For conservatism, the calculated HGL has been compared to the elevation of the upstream pipe soffit. The greater value of these two elevations was used as the tailwater elevation for analysis of the next upstream segment. Critical depth was assumed to be the starting tailwater elevation at the point of discharge. The entrance loss coefficients in Appendix G have been used in calculating head loss. Hydraulic computations are shown in Appendix H. Throughout the system, minimum County standards for hydraulic freeboard have been observed.

3.3 Basin Sizing - Detention

The detention analysis was completed in conformance with guidelines from Contra Costa County. The detention basin was sized to provide peak flow attenuation for the 10-year storm event since the watershed area is less than 1 square mile (640 acres). PondPack software program was utilized to model the post-development conditions and provide computations for the analysis. Within the model, the following parameters were used to identify pre- and post-project runoff rates from the site: the SCS (Soil Conservation Service) unit hydrograph, SCS Type 1a storm, and SCS Curve Number loss method per the TR-20 method.

A number of assumptions were made to approximate the actual physical conditions that would prevail at the site. These include the following:

- Watershed delineations: Contributing drainage areas were delineated at points of concentration downstream from the basin at the site for both the pre-and post-project site conditions. These delineations are displayed on Appendices I and J with their areas and other modeling parameters tabulated in Appendices K and L.
- Curve Numbers: A uniform Curve Number (CN) of 80 was assigned to the pre-condition watersheds based on USDA Natural Resources Conservation Service standard tables assuming pasture and grasslands in good condition on hydrologic group D soils. A uniform Curve Number (CN) of 87 was assigned to the post- condition watersheds based on these standard tables assuming residential districts of approximately ¼ acre lots on hydrologic group D soils.
- Time lag: Time of concentrations for all undeveloped areas were determined using the SCS Upland Method, where the time of concentration equals the flow path length divided by a velocity taken from Figure 15.2 in the SCS National Engineering Handbook, Section 4, 1972. Time of concentration through the storm drain was taken to be the piped distance divided by an average velocity of 10 feet/second plus a 10 minute initial roof-to-gutter time on the lots. Time lag was calculated by multiplying the time of concentration by 0.6.
- SCS design storms: Rainfall depth-duration tables provided in the County's Precipitation-Duration-Frequency-Depth Curves (see Appendix D) indicate that the total anticipated 10-year, 24-hour rainfall event is on the order of 5.22 inches. This rainfall was distributed in the model using the SCS Type 1a storm distribution.
- Basin volumes: Stage-storage relations for the stormwater basins were derived from grading information provided on the tentative map. A summary of the modeled basin parameters are included in Appendix L.

- Basin outflow controls: At lower water surface elevations in the basins, flow is assumed to be released through an 18″ loamy sand layer along the basin floor with an infiltration rate of 5 inches per hour and 1′ of gravel layer. Outflow orifice and riser at higher elevations in the basin provide a controlled release for higher flow rates from the basin. The outlet configuration for the basin is described in greater detailed in Appendix L.

Modeled peak outflows from the pre- and post- project watersheds for the 10-year rainfall event are summarized in Appendices I-L. Results of routing the modeled hydrographs through the proposed basins are included in Appendix L. These results indicate that the basin provides the necessary volume to attenuate the 10- year rainfall event.

4.0 DISCUSSION AND CONCLUSIONS

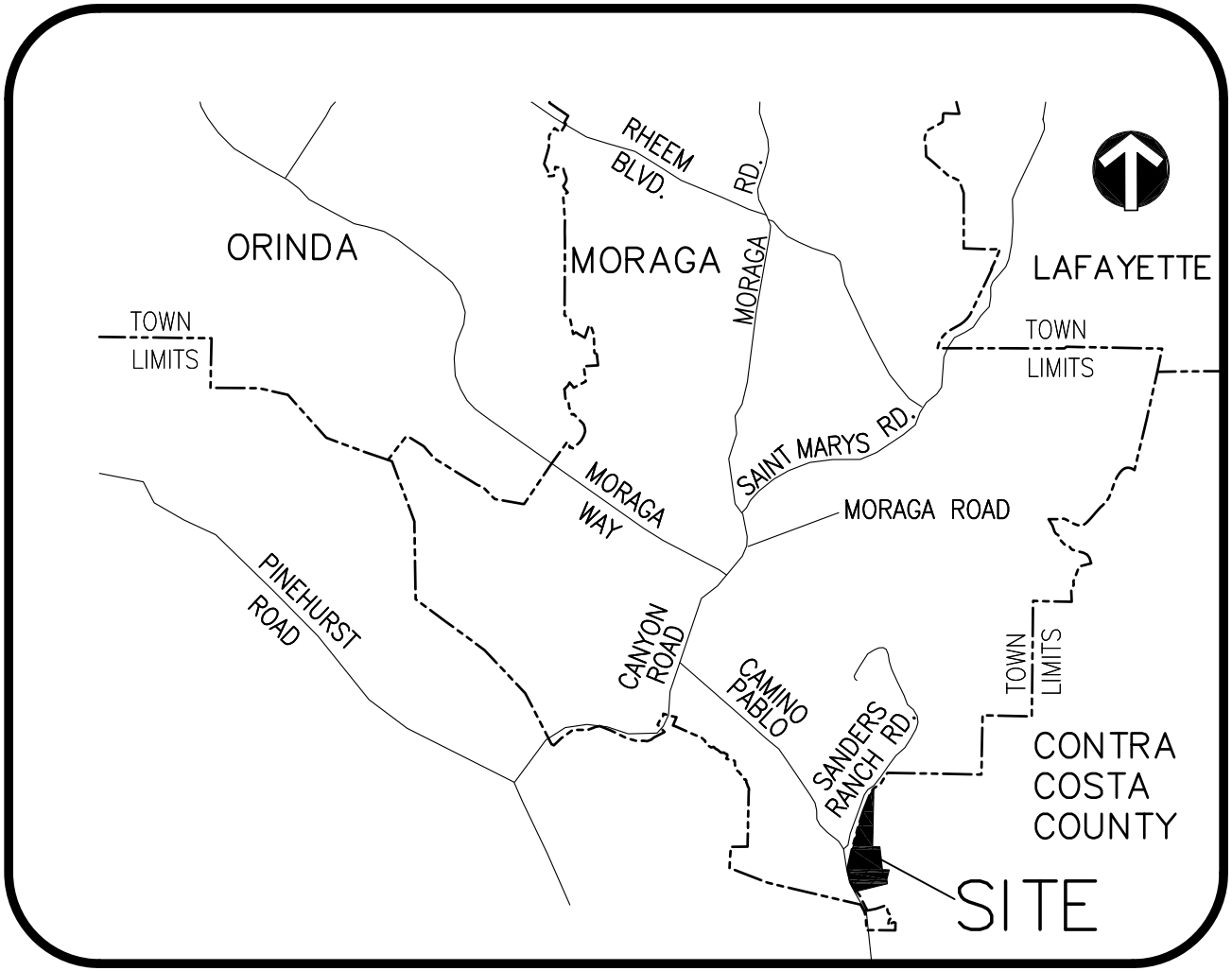
Based upon our analysis, we conclude that the storm drain system within the project can meet all of the requirements of Contra Costa County and the Town of Moraga. The analysis performed in this report can conclude that the existing downstream system is adequate to receive runoff from the development of this project.

After performing our hydraulic and hydrologic analyses, we propose the following change to the Vesting Tentative Map package dated July 2015 in order to comply with the 10-year rainfall event:

- The existing v-ditch along the western frontage of Camino Pablo, directly adjacent to the bioretention basin, will be removed. As a result, the existing v-ditch, near the southernmost part of the property, will tie into the bioretention basin.

Prior to Town consideration of project approval, the landscape plan and other appropriate plan sheets will be modified to fully reflect the storm drain system proposed in this report.

APPENDIX A
VICINITY MAP



VICINITY MAP

NOT TO SCALE

APPENDIX B

1. HYDROLOGY MAP
   (1-11x17 map for quick reference and 1-full size map)
2. OFF-SITE STORM EXHIBIT
   (1-11x17 map for quick reference and 1-full size map)

SOUTH CAMINO PABLO ANNEXATION

HYDROLOGY MAP

SUBDIVISION #9396

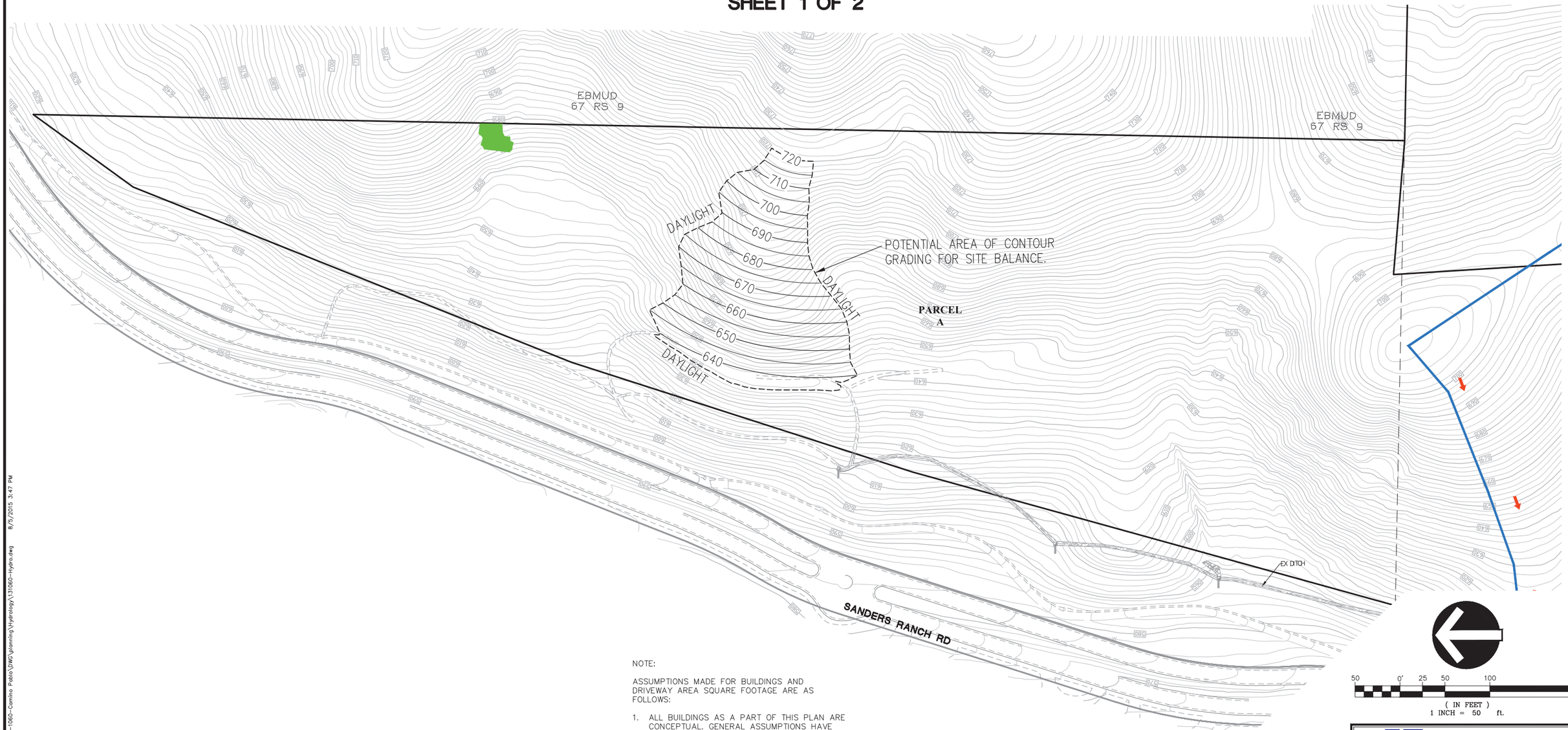
TOWN OF MORAGA, CALIFORNIA

AUGUST, 2015

SHEET 1 OF 2

LEGEND

- DRAINAGE AREA BOUNDARY
- DA — DRAINAGE AREA
- DRAINAGE DIRECTION
- PROPOSED STORM DRAIN
- EXISTING STORM DRAIN
- JURISDICTIONAL AREA



NOTE:

ASSUMPTIONS MADE FOR BUILDINGS AND DRIVEWAY AREA SQUARE FOOTAGE ARE AS FOLLOWS:

1. ALL BUILDINGS AS A PART OF THIS PLAN ARE CONCEPTUAL. GENERAL ASSUMPTIONS HAVE BEEN MADE FOR THE AVERAGE SQUARE FOOTAGE OF ALL BUILDINGS ON SITE.

2. ALL DRIVEWAYS AS A PART OF THIS PLAN ARE CONCEPTUAL. GENERAL ASSUMPTIONS WERE MADE WHICH ASSUME CONSERVATIVE AND CUSTOMIZED DRIVEWAYS LEADING TO ALL BUILDINGS ON SITE AND BASED ON LOT LINE LAYOUT.

50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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HYDROLOGY MAP
SHEET 1 OF 2

PRELIMINARY

DK JOB# 13-1060-10

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SOUTH CAMINO PABLO ANNEXATION

HYDROLOGY MAP

SUBDIVISION #9396

TOWN OF MORAGA, CALIFORNIA

AUGUST, 2015

SHEET 2 OF 2

LEGEND

- DRAINAGE AREA BOUNDARY
- DA — DRAINAGE AREA
- DRAINAGE DIRECTION
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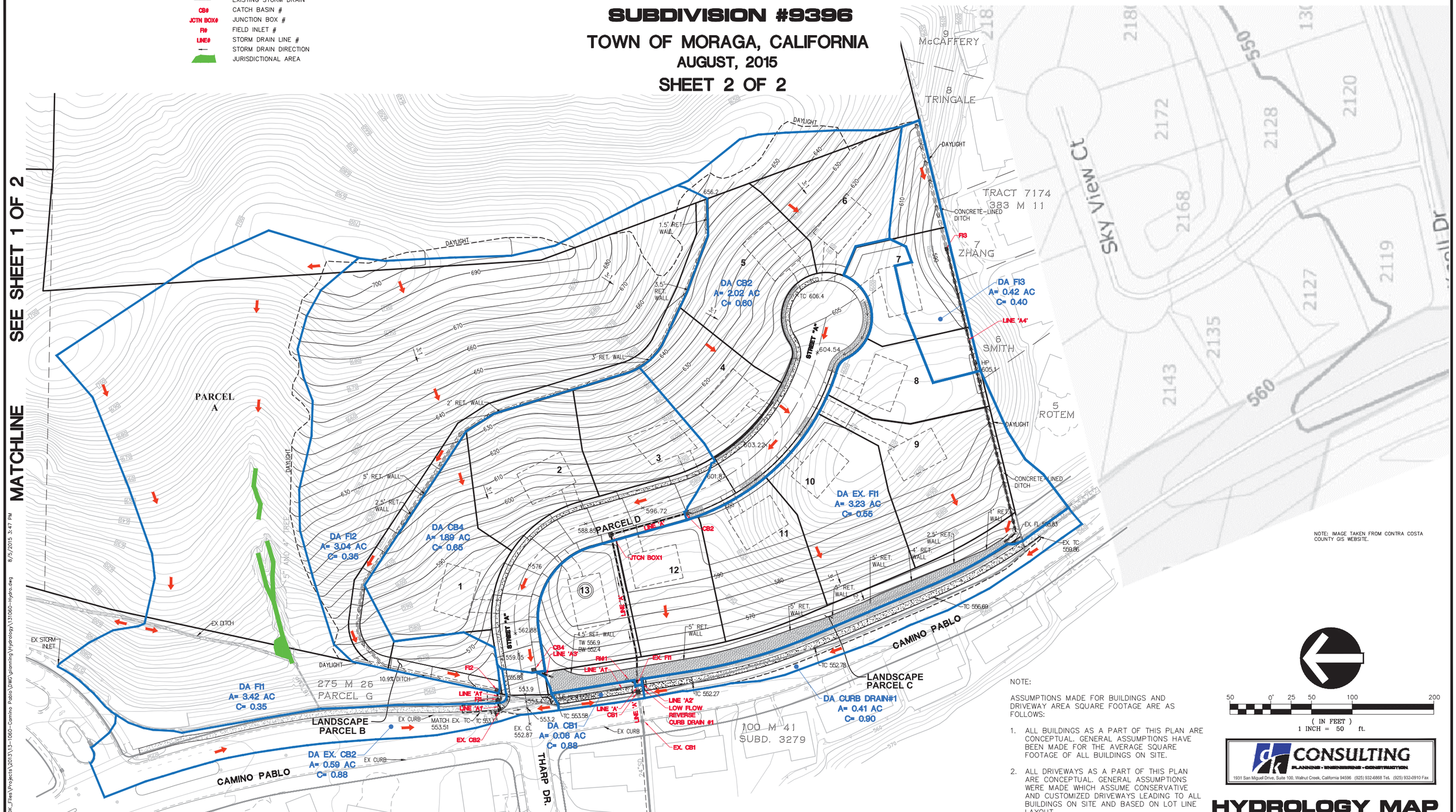
- EXISTING STORM DRAIN
- CB# — CATCH BASIN #
- JCTN BOX# — JUNCTION BOX #
- FI# — FIELD INLET #
- LINE# — STORM DRAIN LINE #
- STORM DRAIN DIRECTION
- JURISDICTIONAL AREA



SEE OFF-SITE STORM EXHIBIT

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HYDROLOGY MAP
SHEET 2 OF 2

PRELIMINARY

DK JOB# 13-1060-10

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SOUTH CAMINO PABLO ANNEXATION

OFF-SITE STORM EXHIBIT

SUBDIVISION #9396

TOWN OF MORAGA, CALIFORNIA

AUGUST, 2015

SHEET 1 OF 1

LEGEND

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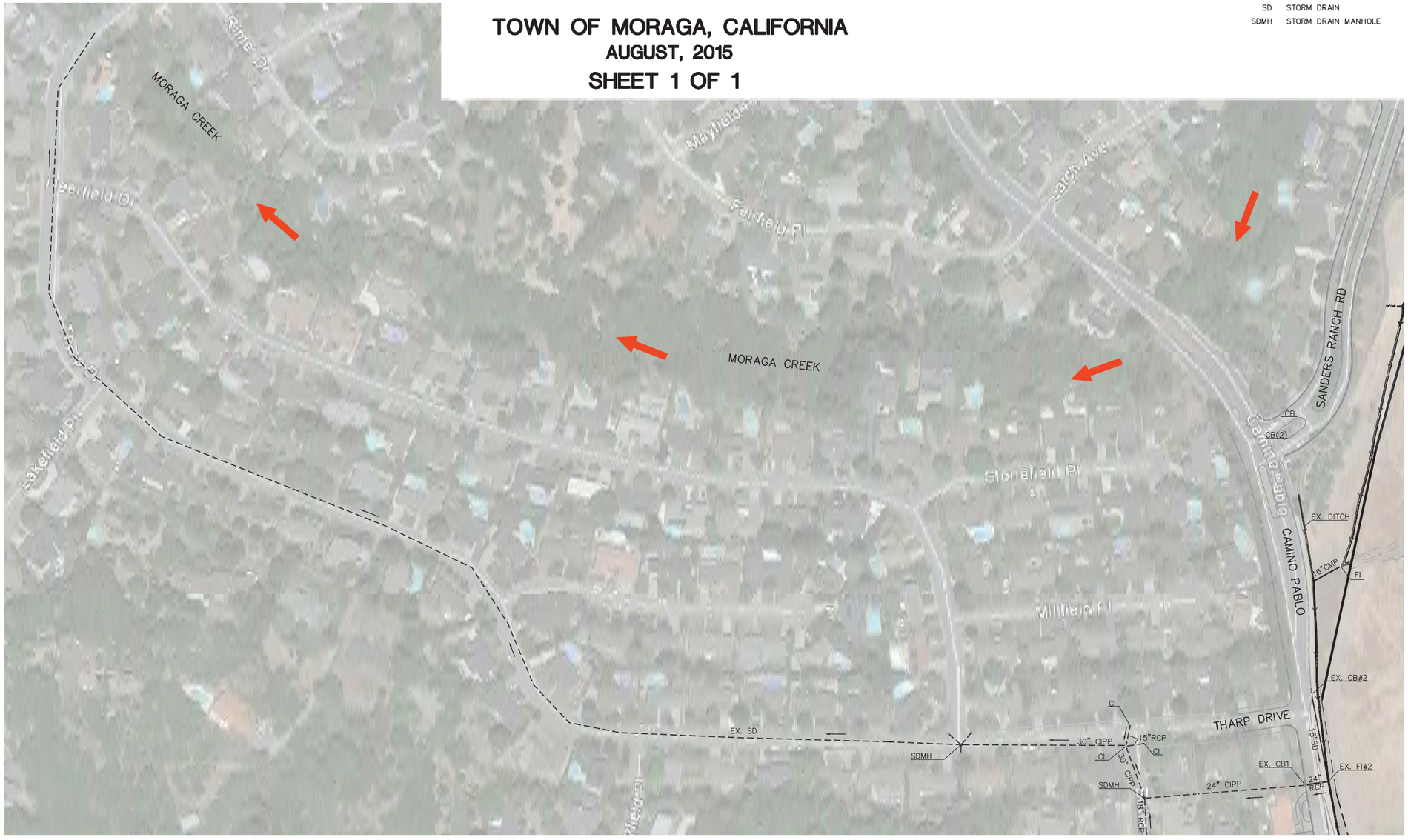
- EXISTING DITCH
- STORM DRAIN DIRECTION
- CB CATCH BASIN
- FI FIELD INLET
- SD STORM DRAIN
- SDMH STORM DRAIN MANHOLE



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(IN FEET)
1 INCH = 100 ft.

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OFF-SITE STORM EXHIBIT

SHEET 1 OF 1

PRELIMINARY

DK JOB# 13-1060-10

SOUTH CAMINO PABLO ANNEXATION

HYDROLOGY MAP

SUBDIVISION #9396

TOWN OF MORAGA, CALIFORNIA

AUGUST, 2015

SHEET 1 OF 2

LEGEND

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- DRAINAGE DIRECTION
- PROPOSED STORM DRAIN
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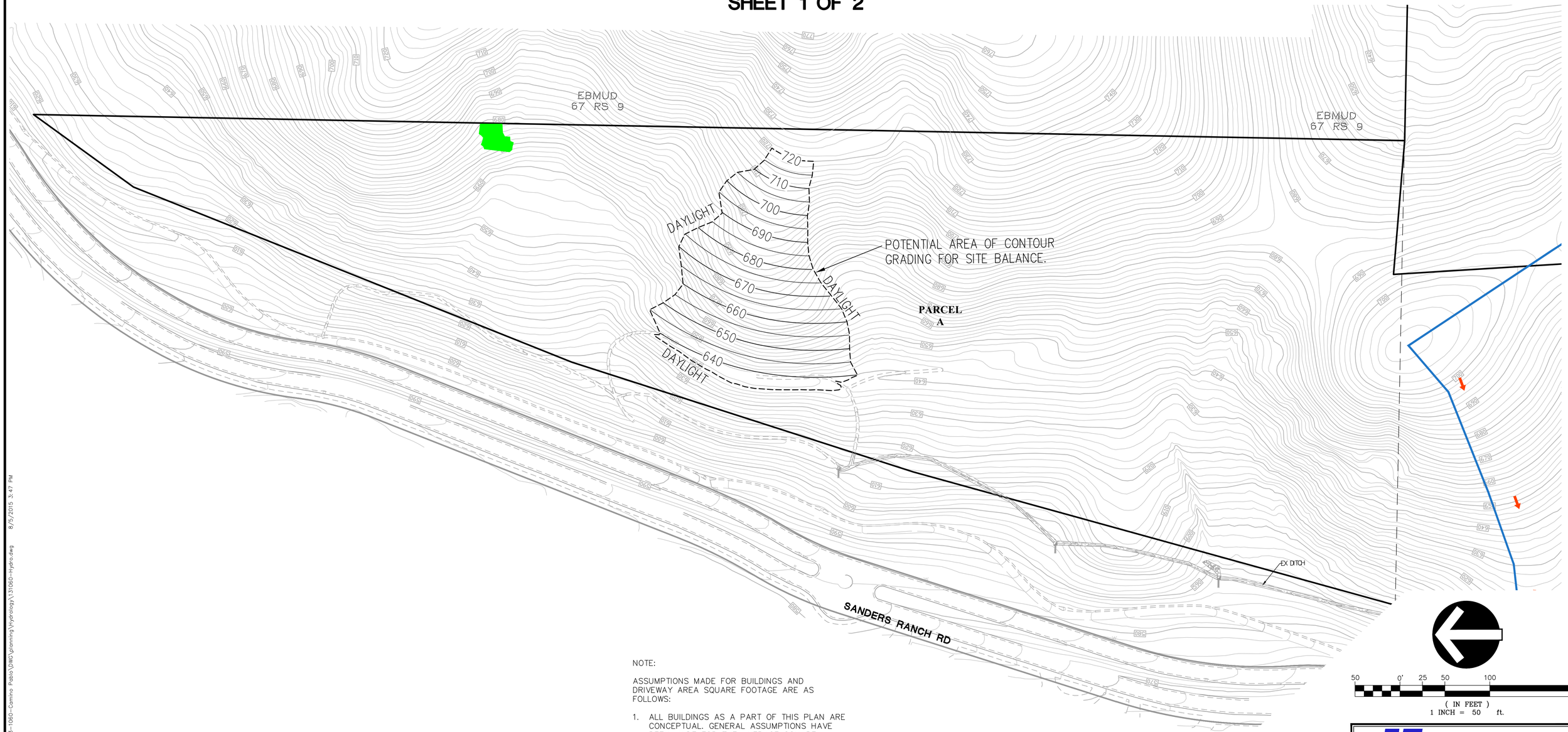
- JURISDICTIONAL AREA



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(IN FEET)
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HYDROLOGY MAP
SHEET 1 OF 2

PRELIMINARY

DK JOB# 13-1060-10

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SOUTH CAMINO PABLO ANNEXATION

HYDROLOGY MAP

SUBDIVISION #9396

TOWN OF MORAGA, CALIFORNIA

AUGUST, 2015

SHEET 2 OF 2

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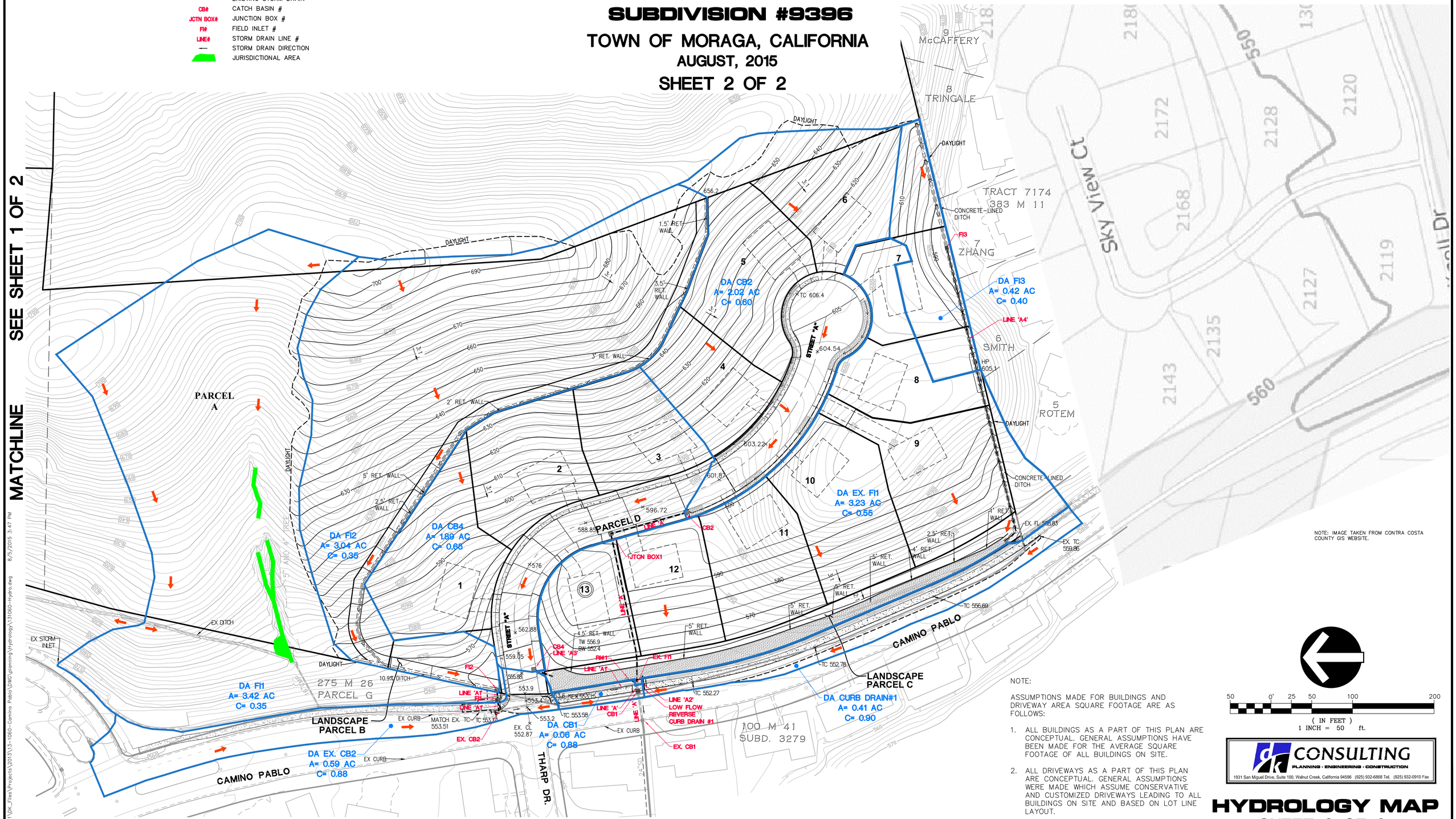

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HYDROLOGY MAP

SHEET 2 OF 2

PRELIMINARY

DK JOB# 13-1060-10

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SOUTH CAMINO PABLO ANNEXATION

OFF-SITE STORM EXHIBIT

SUBDIVISION #9396

TOWN OF MORAGA, CALIFORNIA

AUGUST, 2015

SHEET 1 OF 1

LEGEND

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OFF-SITE STORM EXHIBIT

SHEET 1 OF 1

PRELIMINARY

DK JOB# 13-1060-10

APPENDIX C
CONTRA COSTA COUNTY RUNOFF COEFFICIENTS

CCCFCD STANDARD - RUNOFF COEFFICIENTS

Rational Formula

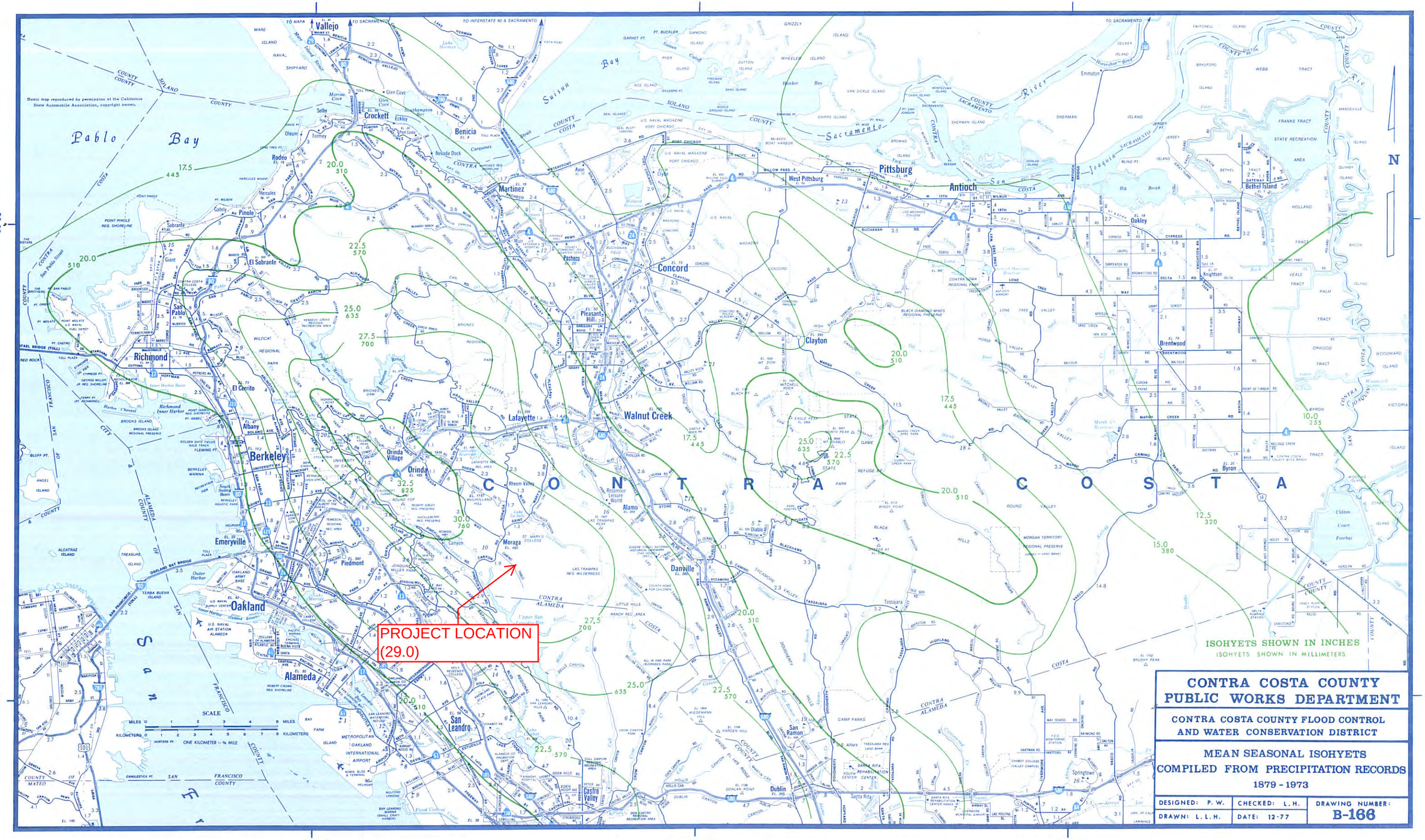
Land Use	Runoff Coefficient	Average Impervious Area (%)	Time of Concentration-Roof to Gutter (min)
Residential:			
R - 6	.50 - .70	76	3 - 5
R - 10	.45 - .60	53	5 - 7
R - 20	.40 - .50	35	6 - 8
R - 40	.35 - .45	25	8 - 10
Apartment	.60 - .80		3 - 10
Commercial	.70 - .95		3 - 8
Industrial	.60 - .90		3 - 10
Open	.20 - .40		
Street:			
Asphalt	.75 - .95		
Concrete	.80 - .95		
Drives and Walks	.80 - .95		
Roofs	.75 - .95		

Legend

R - 6 = 6,000 ft^2 Lot
R - 10 = 10,000 ft^2 Lot
R - 20 = 20,000 ft^2 Lot
R - 40 = 40,000 ft^2 Lot

Note: For Contra Costa County Land Uses use the highest runoff coefficient in the range. This more closely approximates the peak flows calculated by the Unit Hydrograph method developed for Contra Costa County and calibrated with local rainfall and runoff data.

APPENDIX D
CONTRA COSTA COUNTY MEAN SEASONAL ISOHYETS



CONTRA COSTA COUNTY PUBLIC WORKS DEPARTMENT

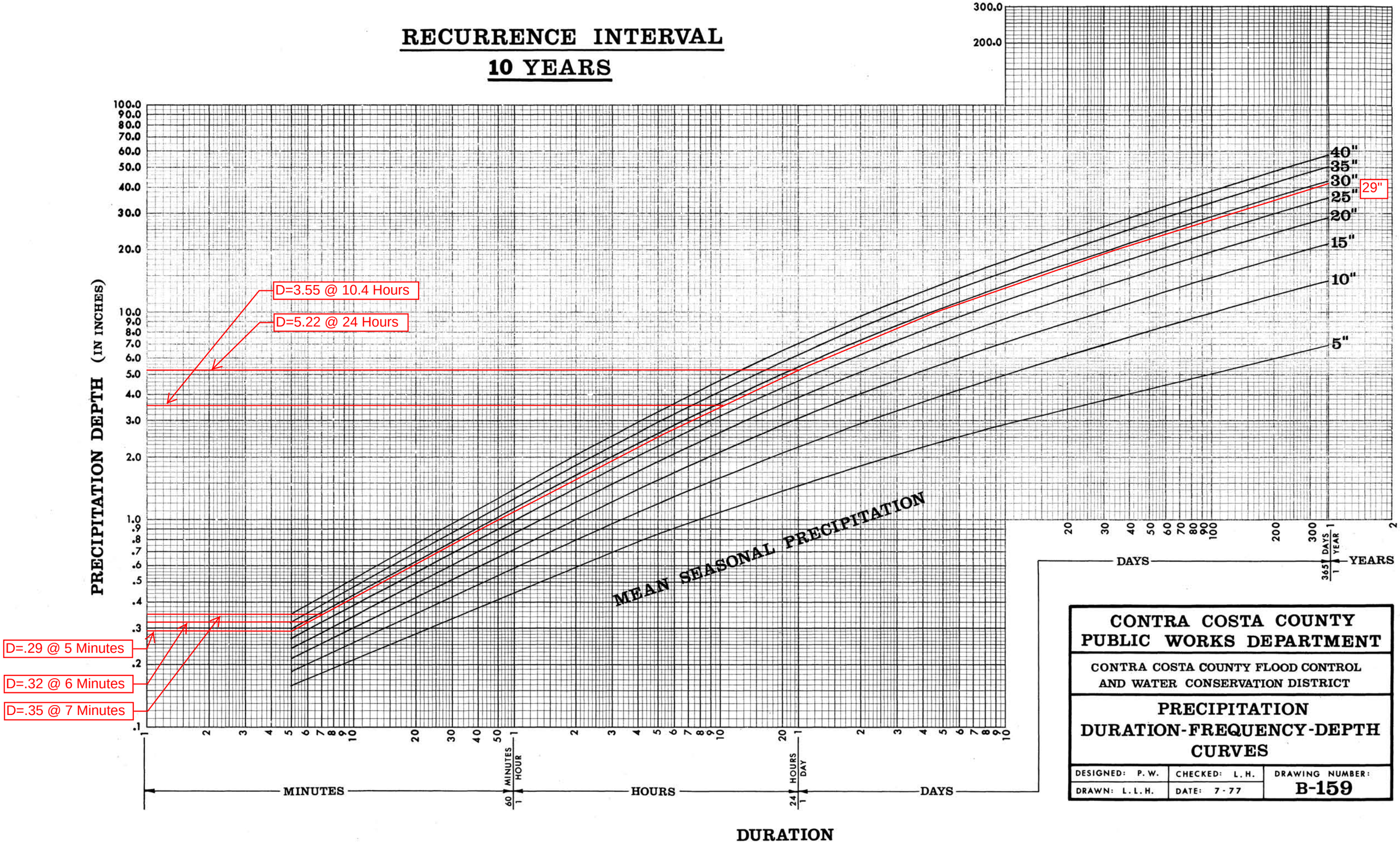
CONTRA COSTA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

MEAN SEASONAL ISOHYETS COMPILED FROM PRECIPITATION RECORDS 1879 - 1973

DESIGNED: P. W.	CHECKED: L. H.	DRAWING NUMBER:
DRAWN: L. L. H.	DATE: 12-77	B-166

APPENDIX E
PRECIPITATION DURATION - FREQUENCY- DEPTH CURVES

RECURRENCE INTERVAL
10 YEARS



CONTRA COSTA COUNTY
PUBLIC WORKS DEPARTMENT

CONTRA COSTA COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

PRECIPITATION
DURATION-FREQUENCY-DEPTH
CURVES

DESIGNED: P. W.	CHECKED: L. H.	DRAWING NUMBER:
DRAWN: L. L. H.	DATE: 7-77	B-159

APPENDIX F
10 - YEAR HYDROLOGY COMPUTATIONS

13-1060-10
DATE: 8/10/2015
REV:
BY: DIS

10 YEAR HYDROLOGY CALCULATIONS
SOUTH CAMINO PABLO ANNEXATION
POST-DEVELOPED CONDITIONS

RCP	n=	0.015	
	i^4=	29	
DESIGN STORM		10	YR

POINT	AREA DSG	AREA[1] (acres)	DESIGN COEFF.	A x C	SUM[2] A x C	TIME C. (min)	I (in/hr)	TOTAL FLOW (cfs)	PIPE DIA (in)	NO. of PIPES	VEL. (f/s)	GRATE/ RIM ELEV	INVERT UP	INVERT DOWN	PIPE SLOPE	LENGTH	D TIME (min)	PIPE CAPACITY FLOW (cfs)	PIPE (q/Q)	VEL FCTR (v/V)
A	B	C	D	E = C*D	F = E+F	G	H	I = (E or F)*H	J	JJ	K = ((R*T/((J/24)^2([T])))*JJ	L	M	N	O = (M-N)/P	P	Q =P/K/60	R = (((0.463 * ((J/12)^(8/3))*(O^0.5))/n))*JJ	S = I/R	T = ratio
LINE A																				
CB#2	DA CB2	2.02	0.60	1.21	1.21	5.00	3.48	4.22	18	1	7.35	600.17	595.15	587.25	0.0816	96.86	0.22	25.99	16%	0.50
JCTN BOX#1		0.00	0.00	0.00	1.21	5.22	3.42	4.22	18	1	10.81	592.30	580.00	547.05	0.1763	186.95	0.29	38.21	11%	0.50
EX. FI #1[3]	DA EX. FI1	3.23	0.55	1.78	7.53	624.00	0.34	4.22	24	1	3.81	551.98	546.95	546.85	0.0104	9.63	0.04	19.97	21%	0.60
CB#1	DA CB1	0.06	0.88	0.05	7.59	624.04	0.34	4.22	24	1	3.84	550.73	546.85	546.47	0.0105	36.20	0.16	20.08	21%	0.60
EX. CB#1												549.90	545.25							
LINE A-1																				
FI#2	DA FI2	3.04	0.35	1.06	1.06	5.00	3.48	3.70	15	1	7.76	555.75	550.50	549.50	0.0805	12.42	0.03	15.88	23%	0.60
FI#1	DAFI1	3.42	0.35	1.20	2.26	5.03	3.47	7.85	15	1	6.77	555.00	549.50	549.20	0.0220	13.63	0.03	8.30	94%	1.00
EX. CB2	DA EX. CB#2	0.59	0.88	0.52	2.78	5.06	3.46	9.62	15	1	4.79	552.50	548.95	547.05	0.0110	172.32	0.60	5.88	164%	1.00
EX. FI #1													546.95							
LINE A-2																				
CURB DRAIN#1[5]	DA CURB DRAIN#1	0.41	0.90	0.37	0.37	5.00	0.20	0.07	4	1	1.13	551.36	550.86	550.69	0.0100	17.34	0.25	0.16	45%	0.60
BASIN																				
EX. FI1																				
LINE A-3																				
CB#4	DA CB4	1.89	0.65	1.23	1.23	5.00	3.48	4.28	18	1	3.10	555.90	551.30	551.05	0.0101	24.83	0.13	9.13	47%	0.60
BASIN																				
EX. FI1																				
LINE A-4																				
FI#3	DA FI3	0.42	0.40	0.17	0.17	5.00	3.48	0.58	12	1	4.75	585.00	581.00	558.80	0.0584	380.00	1.33	7.46	8%	0.50
BASIN						6.33														
EX. FI1																				

Notes

1. Area represents the drainage area going into the specific structure.
2. The sum of A x C includes the A x C from the upstream pipes.
3. EX. FI#1 will also handle the upsteam flow from the following: Basin, lines 'A-1', and the flow from curb drain #1 as shown on sheet 2 of the Hydrology Map. The time of concentration to Ex. FI#1 is derived from the time to peak when runoff leaves the basin. The time to peak is 10.4 hours.
4. The isohyet was developed from the County's Mean Seasonal Isohyets map.
5. The reverse curb drain will capture the low flow of the drainage area (DA Curb Drain #1), which is equivalent to 0.2" of the first rainfall runoff, and drain into the bioretention basin. The remaining portion of the flow will bypass the curb drain and enter catch basin #1 (CB#1).

APPENDIX G
CONTRA COSTA COUNTY TABLE OF HEADLOSS FACTORS

CONTRA COSTA COUNTY
TABLE OF HEADLOSS FACTORS
THROUGH STRUCTURES

TYPE OF STRUCTURE	K
1. Straight run with change in pipe size	0.25
2. Straight run with same pipe size	0.17
3. 0° - 45° deflection with change in pipe size	0.50
4. 0° - 45° deflection with same pipe size	0.42
5. 45° - 90° deflection with change in pipe size	0.75
6. 45° - 90° deflection with same pipe size	0.75
7. Approaching 90° deflection	1.00
8. 90° deflection	1.25
9. Drop manhole	1.25
10. Short radius curves (50' and shorter)	0.35

Notes:

County freeboard requirement is 1.25' (15") to grate (not TOC).

CCC uses Manning's "n" values of 0.015 for RCP, and 0.024 for CMP.

Contributing Watershed (Square Miles)	Design Event
0 to 1	10-year
1 to 4	25-year
Greater than 4 square miles	100-year

APPENDIX H
10 - YEAR HYDRAULIC COMPUTATIONS

13-1060-10	**10 -YEAR HYDRAULIC CALCULATIONS**
DATE: 8/10/2015	SOUTH CAMINO PABLO ANNEXATION
REV:	POST-DEVELOPED CONDITIONS
BY: DIS	

CONSULTING

RCP	n=	0.015	
	i=	29	
	DESIGN STORM	10	YR

LOW POINT	HIGH POINT	DESIGN FLOW Q	PIPE DIA D	VELOCITY V	LENGTH L	FRICTION SLOPE Sf	JUNCT FACTOR K	JUNCT LOSS Hj	FRICTION LOSS Hl	TOTAL LOSS Ht	PIPE INV UP	PIPE INV DOWN	PIPE SLOPE	WATER SURFACE HGL	HEAD WTR D+INV SOF	GRATE/ RIM ELEV.	FREE-BOARD
LINE A																	
	EX. CB#1													546.70			
EX. CB#1	CB#1	4.22	24	1.34	36.20	0.0005	0.42	0.01	0.02	0.03	546.85	546.47	0.0105	548.85	548.85	550.73	1.88
CB#1	EX. FI#1	4.22	24	1.34	9.63	0.0005	0.17	0.00	0.00	0.01	546.95	546.85	0.0104	548.95	548.95	551.98	3.03
EX. FI#1	JCTN BOX#1	4.22	18	2.39	186.95	0.0021	0.50	0.04	0.40	0.45	580.00	547.05	0.1763	581.50	581.50	592.30	10.80
JCTN BOX#1	CB#2	4.22	18	2.39	96.86	0.0021	1.25	0.11	0.21	0.32	595.15	587.25	0.0816	596.65	596.65	600.17	3.52
CB#2																	
LINE A-1																	
	EX. FI #1													548.95			
EX. FI #1	EX. CB2	4.22	15	3.44	172.32	0.0057	1.25	0.23	0.98	1.21	548.95	547.05	0.0110	550.20	550.20	552.50	2.30
EX. CB2	FI#1	7.85	15	6.39	13.63	0.0196	0.75	0.48	0.27	0.74	549.50	549.20	0.0220	550.94	550.75	555.00	4.06
FI#1	FI#2	3.70	15	3.02	12.42	0.0044	0.17	0.02	0.05	0.08	550.50	549.50	0.0805	551.75	551.75	555.75	4.00
FI#2																	
LINE A-2																	
	EX. FI1													548.95			
EX. FI1	CURB DRAIN#1	0.07	4	0.85	17.34	0.0020	1.25	0.01	0.03	0.05	550.86	550.69	0.0100	551.19	551.19	551.36	0.17
CURB DRAIN#1																	
LINE A-3																	
	EX. FI1													548.95			
EX. FI1	CB#4	4.28	18	2.42	24.83	0.0022	1.25	0.11	0.05	0.17	551.30	551.05	0.0101	552.80	552.80	555.90	3.10
CB#4																	
LINE A-4																	
	EX. FI1													548.95			
EX. FI1	FI#3	0.58	12	0.74	380.00	0.0004	1.25	0.01	0.14	0.15	581.00	558.80	0.0584	582.00	582.00	585.00	3.00
FI#3																	

APPENDIX I

PRE - HYDROLOGY MAP FOR PONDPACK ANALYSIS

(1-11x17 map for quick reference and 1-full size map)

SOUTH CAMINO PABLO ANNEXATION

PRE HYDROLOGY MAP FOR PONDPACK ANALYSIS

SUBDIVISION #9396

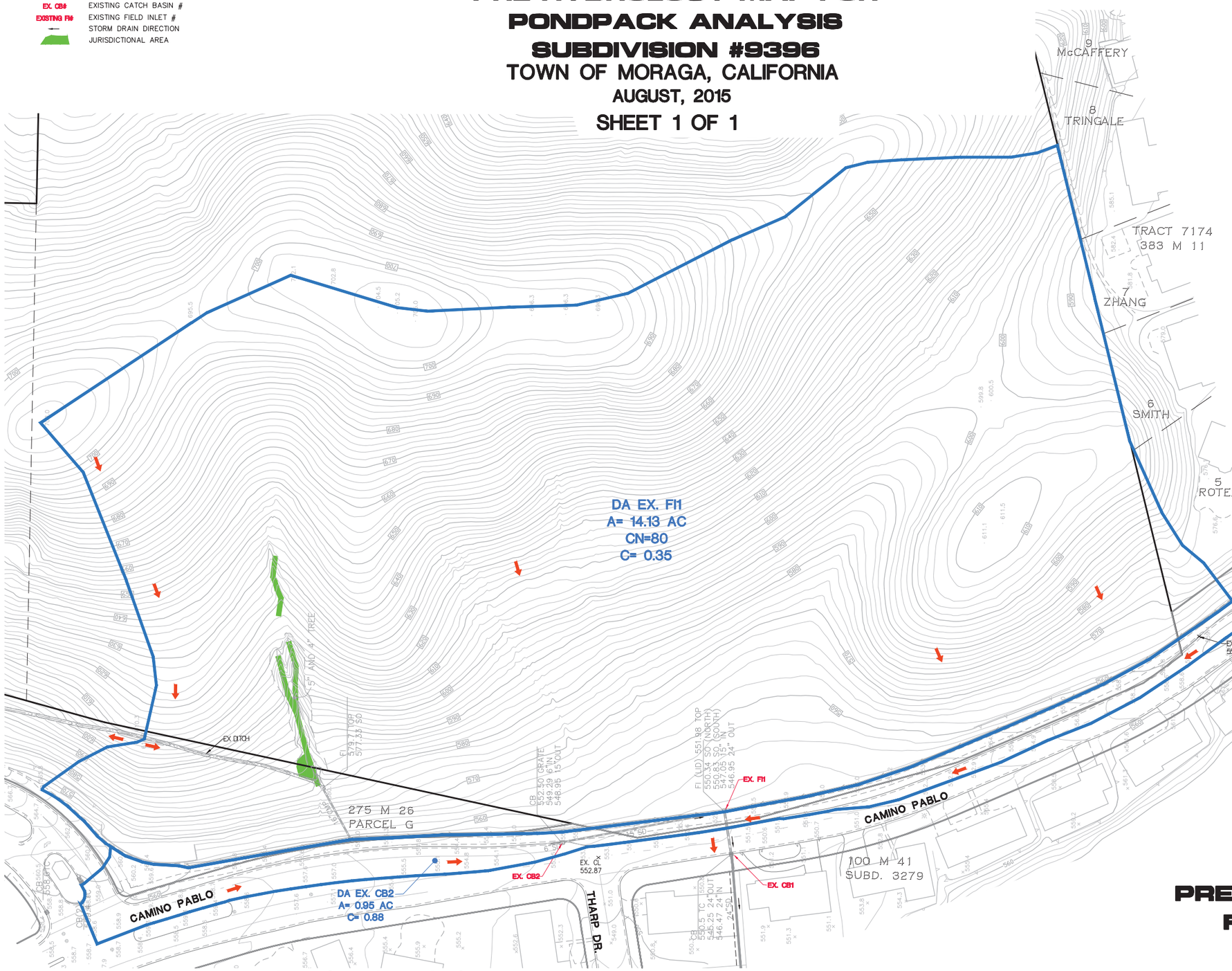
TOWN OF MORAGA, CALIFORNIA

AUGUST, 2015

SHEET 1 OF 1

LEGEND

- DRAINAGE AREA BOUNDARY
- DA — DRAINAGE AREA
- DRAINAGE DIRECTION
- EXISTING STORM DRAIN
- EX. CB# — EXISTING CATCH BASIN #
- EXISTING FI# — EXISTING FIELD INLET #
- STORM DRAIN DIRECTION
- JURISDICTIONAL AREA



50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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1931 San Miguel Drive, Suite 100, Walnut Creek, California 94596 (925) 932-6868 Tel. (925) 932-0910 Fax

PRE HYDROLOGY MAP FOR PONDPACK ANALYSIS

SHEET 1 OF 1

SEE OFF-SITE STORM EXHIBIT IN APPENDIX B

PRELIMINARY

DK JOB# 13-1060-10

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SOUTH CAMINO PABLO ANNEXATION

PRE HYDROLOGY MAP FOR PONDPACK ANALYSIS

SUBDIVISION #9396

TOWN OF MORAGA, CALIFORNIA

AUGUST, 2015

SHEET 1 OF 1

LEGEND

- DRAINAGE AREA BOUNDARY
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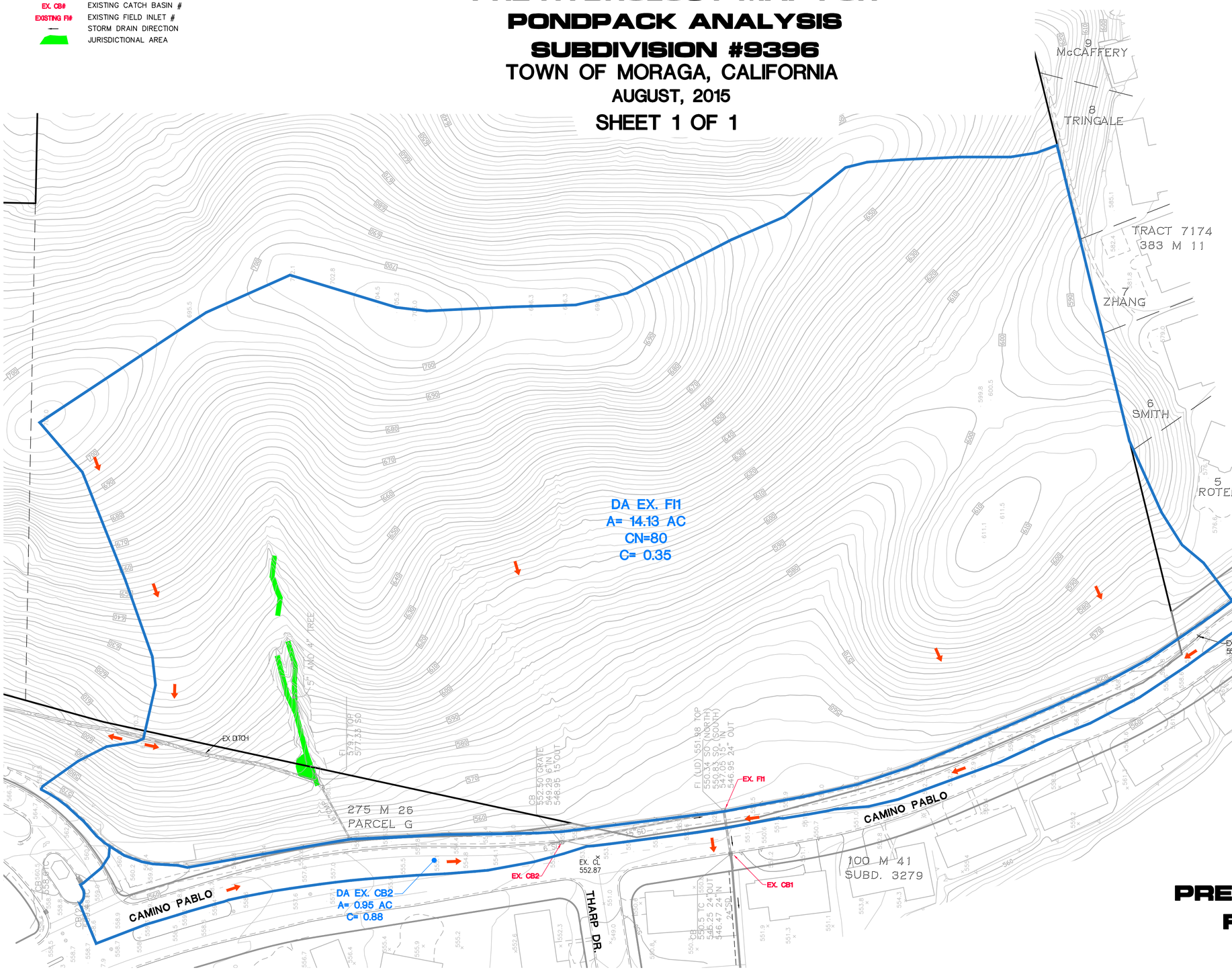
- EX. CB# — EXISTING CATCH BASIN #
- EXISTING FI# — EXISTING FIELD INLET #
- STORM DRAIN DIRECTION
- JURISDICTIONAL AREA



SEE OFF-SITE STORM EXHIBIT IN APPENDIX B

50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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PRE HYDROLOGY MAP FOR PONDPACK ANALYSIS

SHEET 1 OF 1

PRELIMINARY

DK JOB# 13-1060-10

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APPENDIX J

POST HYDROLOGY MAP FOR PONDPACK ANALYSIS

(1-11x17 map for quick reference and 1-full size map)

SOUTH CAMINO PABLO ANNEXATION

POST HYDROLOGY MAP FOR FOR PONDPACK ANALYSIS

SUBDIVISION #9396

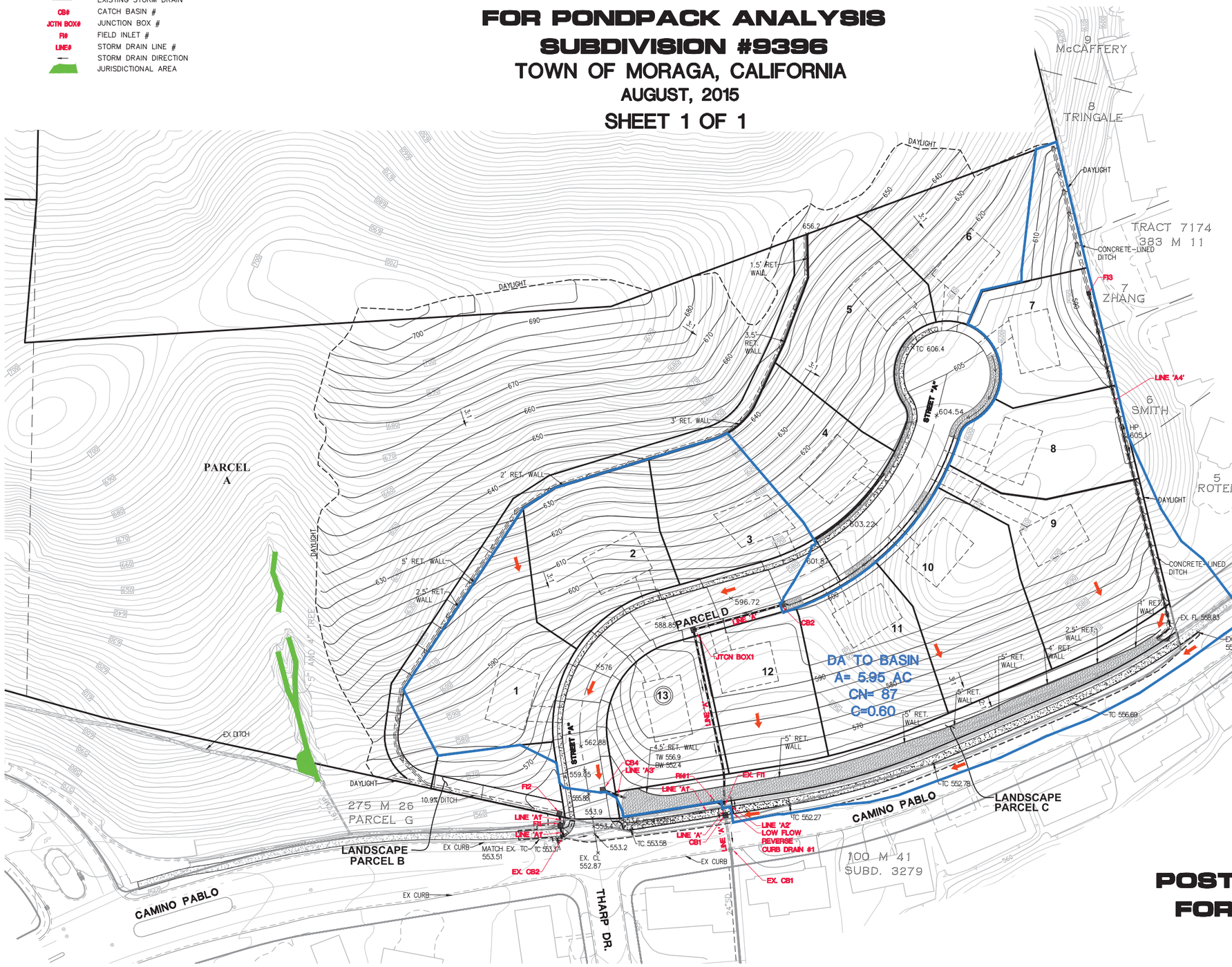
TOWN OF MORAGA, CALIFORNIA

AUGUST, 2015

SHEET 1 OF 1

LEGEND

- DRAINAGE AREA BOUNDARY
- DA — DRAINAGE AREA
- DRAINAGE DIRECTION
- PROPOSED STORM DRAIN
- EXISTING STORM DRAIN
- CB# — CATCH BASIN #
- JCTN BOX# — JUNCTION BOX #
- FI# — FIELD INLET #
- LINE# — STORM DRAIN LINE #
- STORM DRAIN DIRECTION
- JURISDICTIONAL AREA



NOTE:

ASSUMPTIONS MADE FOR BUILDINGS AND DRIVEWAY AREA SQUARE FOOTAGE ARE AS FOLLOWS:

1. ALL BUILDINGS AS A PART OF THIS PLAN ARE CONCEPTUAL. GENERAL ASSUMPTIONS HAVE BEEN MADE FOR THE AVERAGE SQUARE FOOTAGE OF ALL BUILDINGS ON SITE.
2. ALL DRIVEWAYS AS A PART OF THIS PLAN ARE CONCEPTUAL. GENERAL ASSUMPTIONS WERE MADE WHICH ASSUME CONSERVATIVE AND CUSTOMIZED DRIVEWAYS LEADING TO ALL BUILDINGS ON SITE AND BASED ON LOT LINE LAYOUT.

50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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POST HYDROLOGY MAP FOR FOR PONDPACK ANALYSIS

SHEET 1 OF 1

PRELIMINARY

DK JOB# 13-1060-10

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SOUTH CAMINO PABLO ANNEXATION

POST HYDROLOGY MAP FOR FOR PONDPACK ANALYSIS

SUBDIVISION #9396

TOWN OF MORAGA, CALIFORNIA

AUGUST, 2015

SHEET 1 OF 1

LEGEND

- DRAINAGE AREA BOUNDARY
- DA — DRAINAGE AREA
- DRAINAGE DIRECTION
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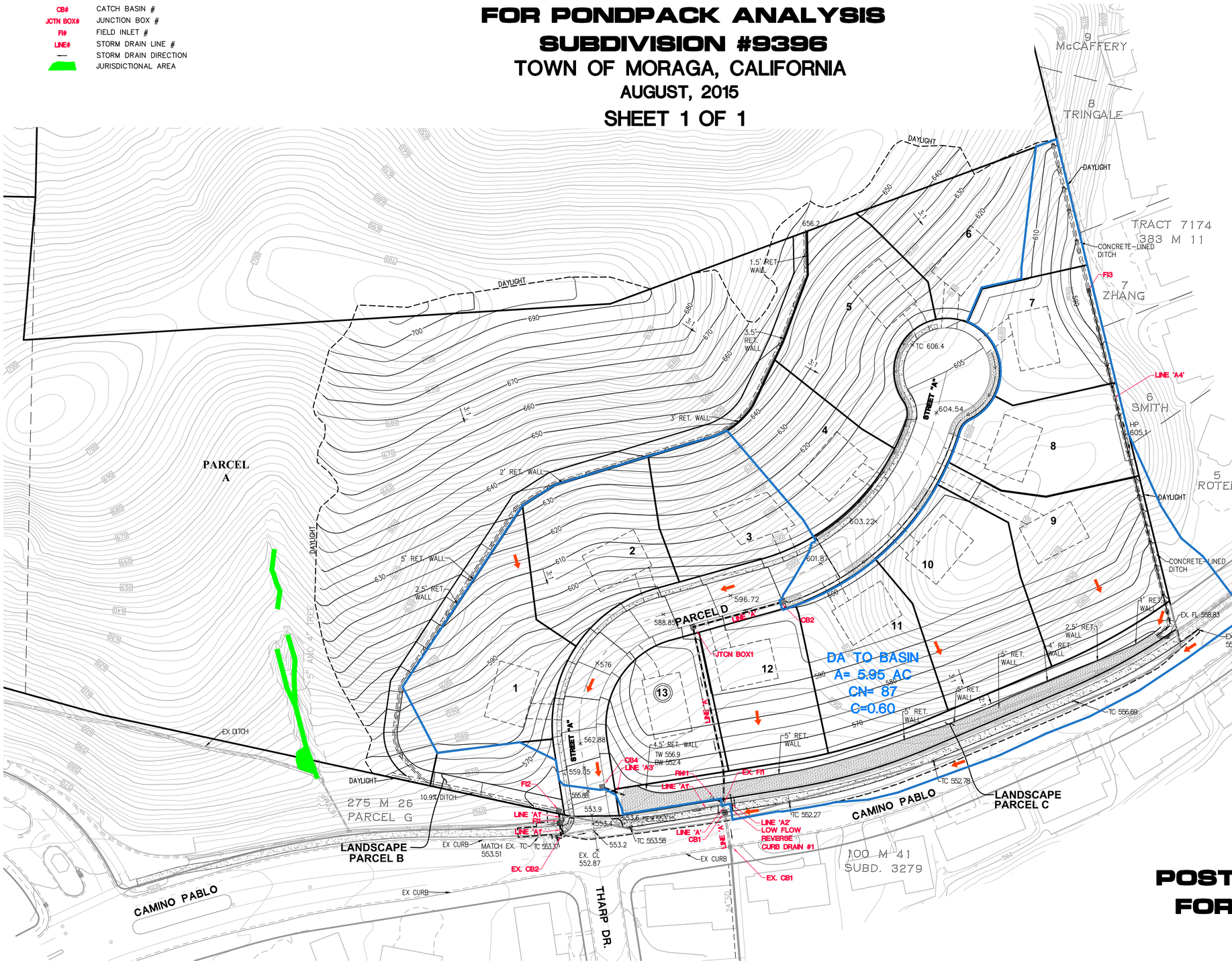
- LINE# — STORM DRAIN LINE #
- STORM DRAIN DIRECTION
- JURISDICTIONAL AREA



NOTE:

ASSUMPTIONS MADE FOR BUILDINGS AND DRIVEWAY AREA SQUARE FOOTAGE ARE AS FOLLOWS:

1. ALL BUILDINGS AS A PART OF THIS PLAN ARE CONCEPTUAL. GENERAL ASSUMPTIONS HAVE BEEN MADE FOR THE AVERAGE SQUARE FOOTAGE OF ALL BUILDINGS ON SITE.
2. ALL DRIVEWAYS AS A PART OF THIS PLAN ARE CONCEPTUAL. GENERAL ASSUMPTIONS WERE MADE WHICH ASSUME CONSERVATIVE AND CUSTOMIZED DRIVEWAYS LEADING TO ALL BUILDINGS ON SITE AND BASED ON LOT LINE LAYOUT.

50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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POST HYDROLOGY MAP FOR FOR PONDPACK ANALYSIS

SHEET 1 OF 1

PRELIMINARY

DK JOB# 13-1060-10

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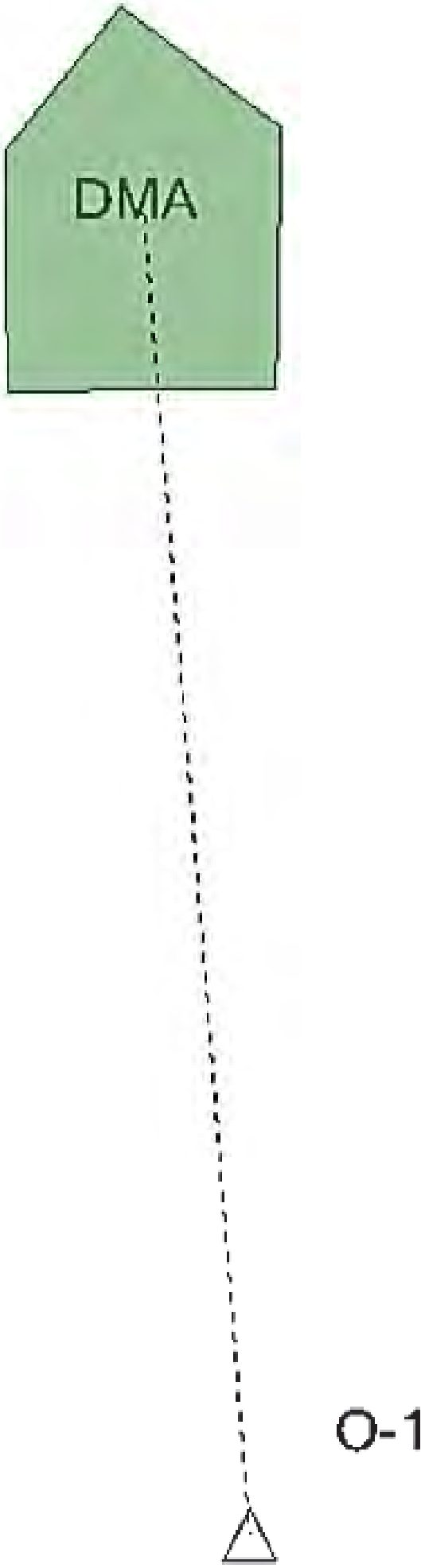
APPENDIX K
PONDPACK RESULTS: PRE - CONDITIONS


DMA
O-1

Scenario Calculation Summary

Scenario Summary	
ID	67
Label	Pre-Development Contra Costa County, 10 yrs
Notes	
Active Topology	Pre-Development Active Topology
Hydrology	Pre-Development Hydrology
Rainfall Runoff	Contra Costa County, 10 yrs
Physical	Pre-Development Physical
Initial Condition	Pre-Development Initial Condition
Boundary Condition	Pre-Development Boundary Condition
Infiltration and Inflow	Pre-Development Infiltration and Inflow
Output	Pre-Development Output
User Data Extensions	Pre-Development User Data Extensions
PondPack Engine Calculation Options	Base Calculation Options

Output Summary			
Output Increment	0.050 hours	Duration	24.000 hours

Rainfall Summary			
Return Event Tag	10	Rainfall Type	Time-Depth Curve
Total Depth	4.7901 in	Storm Event	Type I, 24hr (4.79in)

Executive Summary (Nodes)

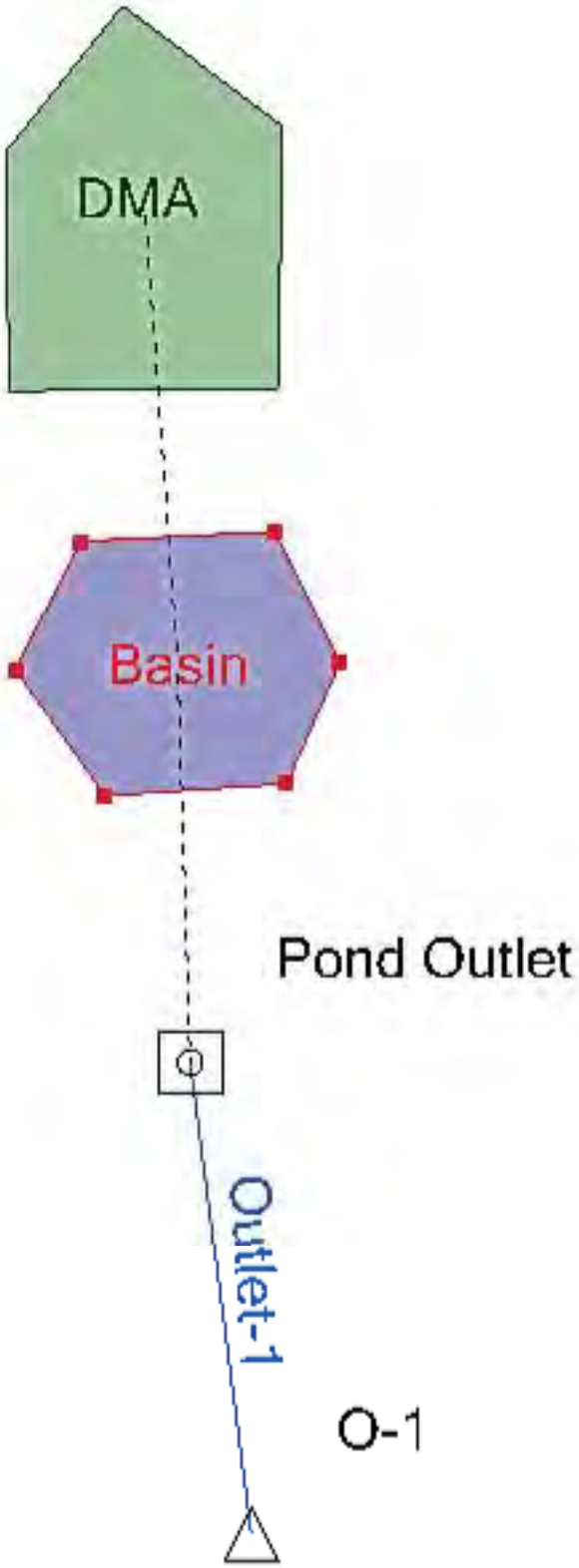
Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
DMA	Pre-Development Contra Costa County, 10 yrs	10	None	3.187	9.900	29.19	(N/A)	(N/A)
O-1	Pre-Development Contra Costa County, 10 yrs	10	None	3.187	9.900	29.19	(N/A)	(N/A)

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ac-ft)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction

Messages

APPENDIX L
PONDPACK RESULTS: POST - CONDITIONS


DMA
Basin
Pond Outlet
Outlet-1
O-1

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
DMA	Post-Development Contra Costa County, 10 yrs	10	1.869	9.950	17.01
DMA	Pre-Development Contra Costa County, 10 yrs	10	3.629	9.900	33.53

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
O-1	Post-Development Contra Costa County, 10 yrs	10	0.321	10.400	2.31
O-1	Pre-Development Contra Costa County, 10 yrs	10	3.629	9.900	33.53

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Basin (IN)	Post-Development Contra Costa County, 10 yrs	10	1.869	9.950	17.01	(N/A)	(N/A)
Basin (OUT)	Post-Development Contra Costa County, 10 yrs	10	0.321	10.400	2.31	551.13	0.567

Storm Event	Type I, 24hr (5.22 in)
Return Event	10 years
Duration	24.000 hours
Depth	5.2201 in
Time of Concentration (Composite)	0.106 hours
Area (User Defined)	5.950 acres

Computational Time Increment	0.014 hours
Time to Peak (Computed)	9.931 hours
Flow (Peak, Computed)	17.39 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	9.950 hours
Flow (Peak Interpolated Output)	17.01 ft^3/s

Drainage Area	
SCS CN (Composite)	87.000
Area (User Defined)	5.950 acres
Maximum Retention (Pervious)	1.4943 in
Maximum Retention (Pervious, 20 percent)	0.2989 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	3.7750 in
Runoff Volume (Pervious)	1.872 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1.869 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.106 hours
Computational Time Increment	0.014 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	63.90 ft^3/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.070 hours
Unit receding limb, Tr	0.281 hours
Total unit time, Tb	0.352 hours

Summary for Hydrograph Addition at 'O-1'

Upstream Link	Upstream Node
Outlet-1	Basin

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-1	0.321	10.400	2.31
Flow (In)	O-1	0.321	10.400	2.31

Summary for Hydrograph Addition at 'O-1'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	DMA

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	DMA	3.629	9.900	33.53
Flow (In)	O-1	3.629	9.900	33.53

Requested Pond Water Surface Elevations	
Minimum (Headwater)	548.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	551.75 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir - 1	Forward	RI#1 to EX. FI#1	550.75	551.75
Stand Pipe	Riser#1 (RI#1)	Forward	RI#1 to EX. FI#1	551.00	551.75
Orifice-Circular	Orifice - 1	Forward	RI#1 to EX. FI#1	550.50	551.75
Culvert-Circular	RI#1 to EX. FI#1	Forward	TW	547.16	551.75
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Riser#1 (RI#1)
Structure Type: Stand Pipe

Number of Openings	1
Elevation	551.00 ft
Diameter	36.0 in
Orifice Area	7.1 ft²
Orifice Coefficient	0.600
Weir Length	9.42 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: RI#1 to EX. FI#1
Structure Type: Culvert-Circular

Number of Barrels	1
Diameter	10.0 in
Length	13.60 ft
Length (Computed Barrel)	13.60 ft
Slope (Computed)	0.010 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.040
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.091
T2 ratio (HW/D)	1.192
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	548.07 ft	T1 Flow	1.74 ft^3/s
T2 Elevation	548.15 ft	T2 Flow	1.99 ft^3/s

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	550.50 ft
Orifice Diameter	4.5 in
Orifice Coefficient	0.600

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	550.75 ft
Weir Length	2.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft^3/s
Flow Tolerance (Maximum)	10.000 ft^3/s

Subsection: Composite Rating Curve
Label: Outlet

Return Event: 10 years
Storm Event: Type I, 24hr (5.22 in)

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
548.00	0.00	(N/A)	0.00
548.50	0.00	(N/A)	0.00
549.00	0.00	(N/A)	0.00
549.50	0.00	(N/A)	0.00
550.00	0.00	(N/A)	0.00
550.50	0.00	(N/A)	0.00
550.75	0.11	(N/A)	0.00
551.00	1.05	(N/A)	0.00
551.50	5.95	(N/A)	0.00
551.75	6.14	(N/A)	0.00

Contributing Structures
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
Orifice - 1,RI#1 to EX. FI#1 (no Q: Weir - 1,Riser#1 (RI#1))
Weir - 1,Orifice - 1,RI#1 to EX. FI#1 (no Q: Riser#1 (RI#1))
Riser#1 (RI#1),RI#1 to EX. FI#1 (no Q: Weir - 1,Orifice - 1)
Riser#1 (RI#1),RI#1 to EX. FI#1 (no Q: Weir - 1,Orifice - 1)

Subsection: Elevation-Volume-Flow Table (Pond)
Label: Basin

Return Event: 10 years
Storm Event: Type I, 24hr (5.22 in)

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	5.0000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	548.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (acres)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
548.00	0.00	0.000	0.179	0.00	0.00	0.00
548.50	0.00	0.089	0.179	0.90	0.90	44.22
549.00	0.00	0.179	0.179	0.90	0.90	87.54
549.50	0.00	0.268	0.179	0.90	0.90	130.86
550.00	0.00	0.358	0.179	0.90	0.90	174.17
550.50	0.00	0.447	0.179	0.90	0.90	217.49
550.75	0.11	0.493	0.188	0.95	1.06	239.86
551.00	1.05	0.542	0.198	1.00	2.04	264.17
551.50	5.95	0.643	0.204	1.03	6.98	318.20
551.75	6.14	0.694	0.204	1.03	7.17	343.08

PondMaker Worksheet Detailed Report: Worksheet (Basin)

Element Details

ID	92
Label	Worksheet (Basin)
Select Pond to Design	Basin
Flow Allowed Below Target	100.0
Flow Allowed Above Target	0.0
Flow Allowed Below Target	100.0
Flow Allowed Above Target	0.0
Volume Allowed Below Target	100.0
Volume Allowed Above Target	0.0
Tolerance Display	Display numerical values for tolerance fields

Notes

Volume

Pond Type	Elevation-Area	Use Void Space?	False

Elevation-Area

Pond Elevation (ft)	Pond Area (acres)
548.00	0.179
549.00	0.179
550.50	0.179
551.17	0.204
551.75	0.204

Infiltration

Infiltration Method	Average Infiltration Rate	Infiltration Rate (Average)	5.0000 in/h

Output

Detention Time	Compute All Methods

Initial Conditions

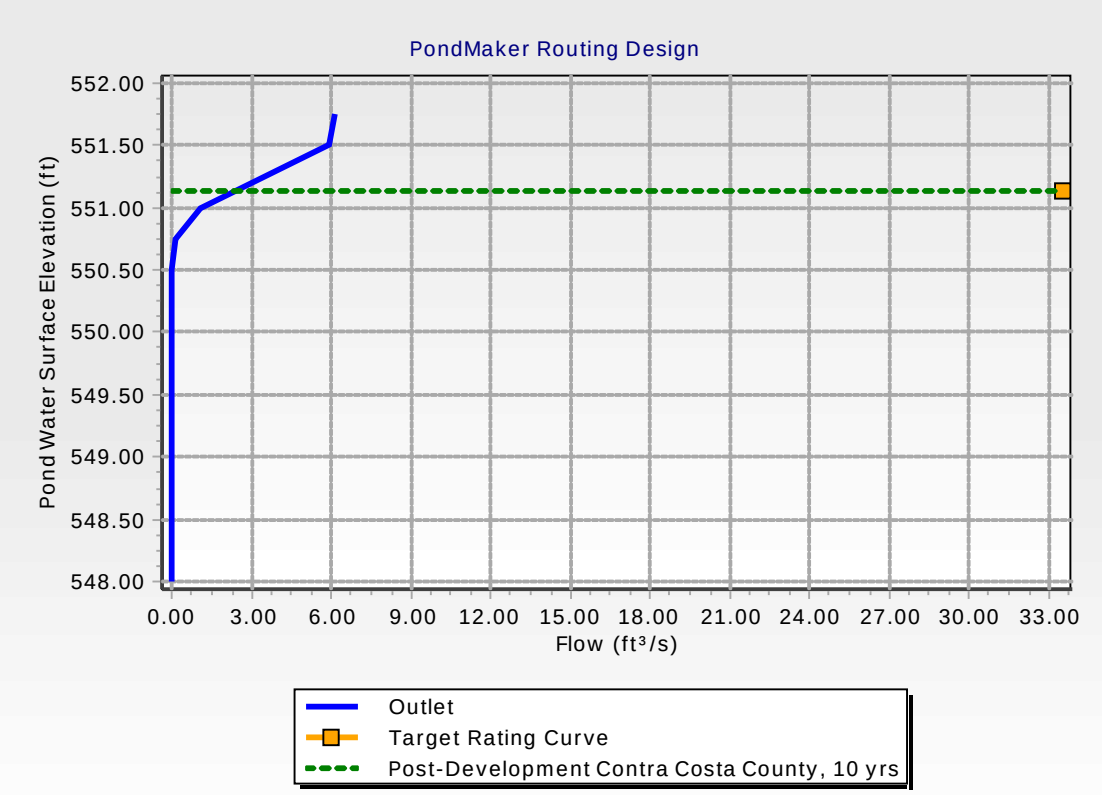
Is Outflow Averaging On?	False	Define Starting Water Surface Elevation	Pond Invert

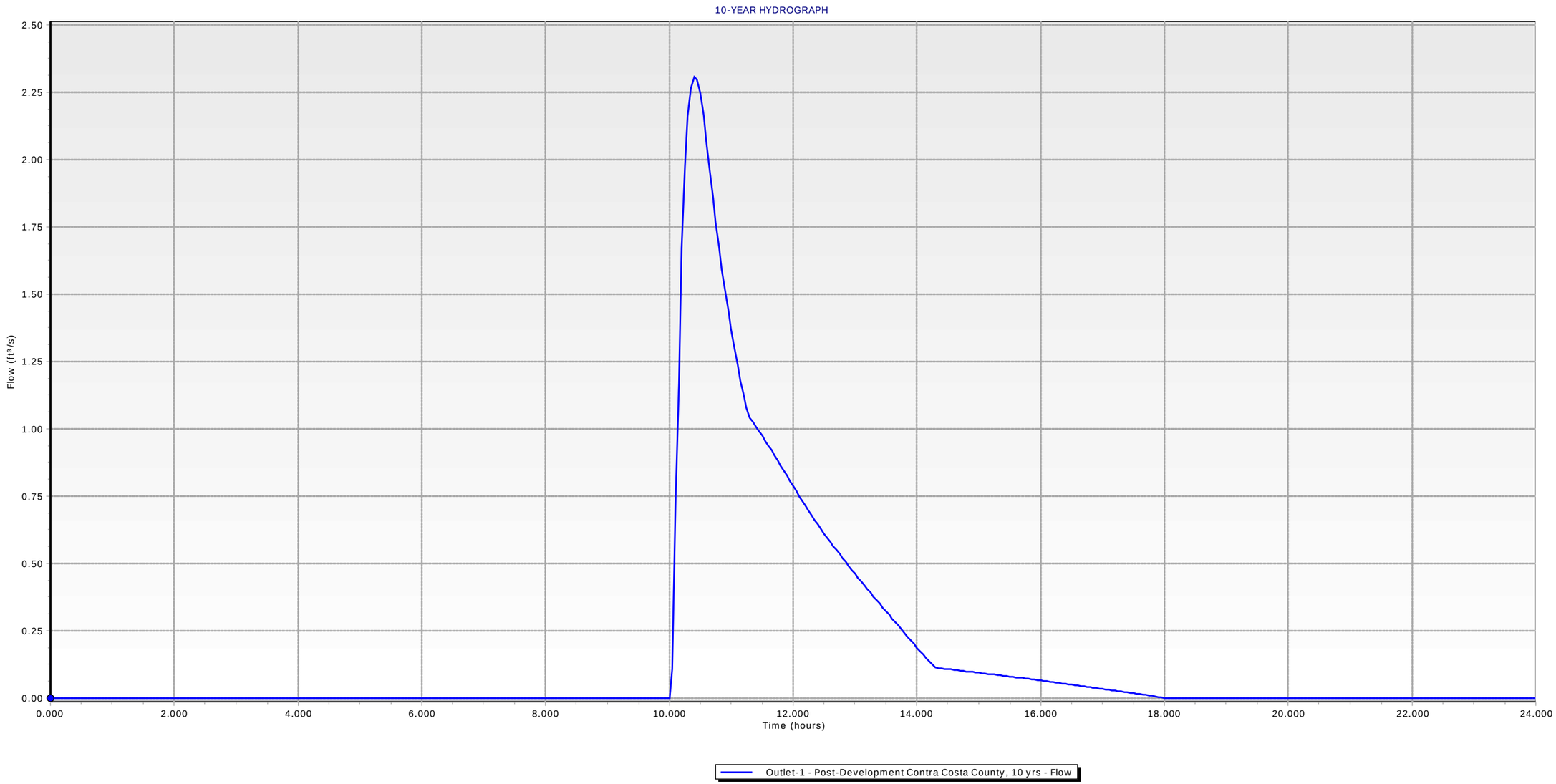
PondMaker Worksheet Detailed Report: Worksheet (Basin)

PondMaker Worksheet (Routing Design)

Design Scenario	Design Return Event	Target Peak Outflow (ft³/s)	Computed Peak Outflow (ft³/s)	Computed Peak Outflow vs. Target (ft³/s)	Target Outflow Volume (ac-ft)
Post-Development Contra Costa County, 10 yrs	10	33.53	2.31	-31.22	3.629

Computed Volume Outflow (ac-ft)	Computed Outflow Volume vs. Target (ac-ft)	Routing Outlet Structure	Computed Max Water Elevation (ft)	Freeboard Depth (ft)	Maximum Storage (ac-ft)
0.321	-3.307	Outlet	551.13	0.62	0.567




10-YEAR HYDROGRAPH
Flow (ft³/s)
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0.000
2.000
4.000
6.000
8.000
10.000
12.000
14.000
16.000
18.000
20.000
22.000
24.000
Time (hours)
Outlet-1 - Post-Development Contra Costa County, 10 yrs - Flow

South Camino Pablo Annexation
Hydrologic & Hydraulic Analyses

Developer:
Dobbins Properties, LLC

Job# 13-1060-12
January 2019

Prepared for:
Town of Moraga

dk CONSULTING
PLANNING · ENGINEERING · CONSTRUCTION

1931 San Miguel Drive, Suite 100, Walnut Creek, California 94596 / (925) 932-6868
www.dkconsultinginc.com

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A Vicinity Map
B 1. Hydrology Map (1-11x17 map for quick reference and 1-full size map)
2. Off-Site Storm Exhibit (1-11x17 map for quick reference and 1-full size map)
C Contra Costa County-Runoff Coefficients
D Contra Costa County Mean Seasonal Isohyets
E Precipitation Duration-Frequency-Depth Curves
F 10 - Year Hydrology Calculations
G Contra Costa County Table of Head loss Factors
H 10 - Year Hydraulic Calculations
I Pre - Hydrology Map for PondPack Analysis (1-11x17 map for quick reference and 1-full size map)
J Post - Hydrology Map for PondPack Analysis (1-11x17 map for quick reference and 1-full size map)
K PondPack Results: Pre-Conditions
L PondPack Results: Post-Conditions

1.0 INTRODUCTION

1.1 General

This report has been prepared in accordance with the standard methods approved by Contra Costa County and the Town of Moraga (Town) for distribution to the Town and the applicant. The purpose of this report is to present hydrologic and hydraulic calculations, provide analyses, and demonstrate that the proposed conditions comply with the requirements of the Town and Contra Costa County.

1.2 Project Description

South Camino Pablo Annexation is a 23.90-acre site owned by Dobbins Properties, Carr, and Hoover. The project site is located on the southeast corner of the intersection of Camino Pablo and Sanders Ranch Road in the Town of Moraga. The project site consists of one parcel, which is currently agricultural land. The property is bordered to the north by Sanders Ranch Road, to the west by Camino Pablo and Sanders Ranch Road, to the south by single family residential lots, and agricultural land abuts the property to the east. The southwest portion of the site, approximately 7.69 acres, will be developed as single-family hillside homes with a road. Approximately 0.57 acres will consist of landscape parcels, and 0.24 acres will be dedicated to the Town of Moraga. The remaining property, approximately 15.40 acres, will remain for agricultural uses.

2.0 PROJECT SETTING

2.1 Land Use and Topography

The project site is located at 1211 Camino Pablo, Moraga, California (see Vicinity Map in Appendix A). The existing site is currently undeveloped and is located in an area of relatively steep hillside terrain. The site is open grassland and brush that is currently used for grazing. Existing improvements appear to be limited to perimeter fencing and existing v-ditches.

2.2 Runoff Description

The pre-development site is mostly pervious. The proposed project, 8.5 acres of the total 23.90 acre site, will consist of 13 single family hillside homes, landscape buffers, and street improvements. Most of the storm water runoff from the site will be treated by bioretention basins and swales as shown on the Hydrology Map (see Appendix B.1) and discharge into the proposed storm drain system before exiting into the existing storm drain system that releases into the Moraga Creek (see Appendix B.2). The remaining portion will remain as undeveloped and will continue to discharge into an existing v-ditch, located adjacent to Camino Pablo, and finally into the existing storm drain system.

3.0 HYDROLOGIC AND HYDRAULIC ANALYSES

The following sections discuss the analyses for the hydrology and hydraulics in depth. The analyses have been prepared to demonstrate compliance with Contra Costa County's criteria for storm drain systems. See Hydrology Map (Appendix B) for watersheds and location of storm drain systems.

3.1 Hydrologic Analysis

According to Contra Costa County Public Works Flood Control, the design storm is based on the watershed area. If the watershed area is less than 1 square mile (640 acres), then storm design for a 10-year rainfall event is required. Based on the drainage area of this project, the rational method was used to calculate the 10-year storm event quantities. The rational method uses the formula:

$$Q = CiA$$

where:
- Q = Discharge (cfs)
- C = Runoff Coefficient
- I = Rainfall Intensity (in/hr)
- A = Drainage Area (acres)

The runoff coefficients for this project were developed using the County's designated runoff coefficients (see Appendix C). The mean annual precipitation numbers were developed from the County's Isohyetal tables (see Appendix D). The rainfall intensity numbers were developed from the County's Precipitation-Duration-Frequency-Depth Curves (see Appendix E) and converted into intensities using the following formula:

i = MAP x Unit Rainfall Intensity

where:
- T = Time (min)
- D = Depth (in)
- I = Rainfall Intensity (in/hr)

Beginning at the upstream end of the proposed storm drain line, a minimum initial time of concentration of 5 minutes was assumed as recommended by the Highway Design Manual. This value was compared to the calculated time of concentration based upon the TR-55 method which analyzes overland flow times. As a result, the calculated times of concentration that reached longer than 5 minutes were used for several structures. In addition, inlets

downstream of the LID facility, located in Parcel C, used the calculated time to reach peak flow from the basin. (See Section 3.3 and Appendix L of this report for more detailed information regarding the basin sizing.) With the initial time of concentration having been determined, the flows to the upstream structure were then calculated using the rational method. The flows into the downstream structures on that same line were calculated using a time of concentration developed based on the travel time of the flows within the pipe plus the initial time of concentration. This method was repeated yielding a total flow at the downstream end of the system. See Appendix F for 10-year hydrology calculations.

Storm drain structures, treatment swales, and a basin have been designed to convey the 10-year storm. Residential lots will drain into private yard drains, which will be directed into the proposed storm drain system or into the streets via sheet flow and/or through curb drains. The runoff from the lots will be treated via treatment swales or within the basin and ultimately drain to the primary storm system.

Flow, upstream from the site (DA Reverse Curb Drain#1 as shown in Appendix B), will be siphoned to the bioretention basin on landscape Parcel C. The basin is designed to treat the first flush of rainfall. The upstream flow from DA Reverse Curb Drain #1 (Curb Drain #1) going into the bioretention basin was calculated using a maximum intensity of 0.2" per hour, based on guidelines from the Contra Costa Clean Water Program Stormwater C.3 Guidebook, Seventh Edition. Therefore, Curb Drain#1 diverts 0.06 cfs into the basin for treatment, where A=0.33, C= 0.90, I=0.2, and Q = CIA = 0.06 cfs. The remaining portion of the flow will bypass the reverse curb drain and enter catch basin (CB#1).

3.2 Hydraulic Analysis

The hydraulic analysis of the storm drain system utilizes stormwater studio and the generally accepted backwater methodology – where:

HGL (upstream) = Hf + He + Tw
HGL = Hydraulic Grade Line
Hf = Head Loss Due to Friction
He = Head Loss Due to Entrance and Exit Configuration
Tw = Tailwater Elevation

The starting HGL at existing storm drain catch basin (EX. CB #1), located southeast of the site along Camino Pablo, was conservatively established by utilizing the upstream pipe soffit. For conservatism, the calculated HGL has been compared to the elevation of the upstream pipe soffit. The greater value of these two elevations was used as the tailwater elevation for analysis of the next upstream segment. Critical depth was assumed to be the starting tailwater elevation at the point of discharge. The entrance loss coefficients in Appendix G have been used in calculating head loss. Hydraulic computations are shown in Appendix H.

The existing 15" pipe along Camino Pablo (connecting EX. CB2 and EX. FI1) as shown in Appendix B is flowing full during the 10-year storm event. The upstream structure (EX. CB2) has 1.89' of hydraulic freeboard, well above the County minimum of 1.25' allowing for some factor of safety in the proposed design. Throughout the system, minimum County standards for hydraulic freeboard have been observed.

3.3 Basin Sizing - Detention

The detention analysis was completed in conformance with guidelines from Contra Costa County. The detention basin was sized to provide peak flow attenuation for the 10-year storm event since the watershed area is less than 1 square mile (640 acres). PondPack software program was utilized to model the post-development conditions and provide computations for the analysis. Within the model, the following parameters were used to identify pre- and post-project runoff rates from the site: the SCS (Soil Conservation Service) unit hydrograph, SCS Type 1a storm, and SCS Curve Number loss method per the TR-20 method.

Several assumptions were made to approximate the actual physical conditions that would prevail at the site. These include the following:

- Watershed delineations: Contributing drainage areas were delineated at points of concentration downstream from the basin at the site for both the pre-and post-project site conditions. These delineations are displayed on Appendices I and J with their areas and other modeling parameters tabulated in Appendices K and L.
- Curve Numbers: A uniform Curve Number (CN) of 80 was assigned to the pre-condition watersheds based on USDA Natural Resources Conservation Service standard tables assuming pasture and grasslands in good condition on hydrologic group D soils. A uniform Curve Number (CN) of 87 was assigned to the post- condition watersheds based on these standard tables assuming residential districts of approximately ¼ acre lots on hydrologic group D soils.
- Time lag: Time of concentrations for all undeveloped areas were determined using the SCS Upland Method, where the time of concentration equals the flow path length divided by a velocity taken from Figure 15.2 in the SCS National Engineering Handbook, Section 4, 1972. Time of concentration through the storm drain was taken to be the piped distance divided by the average velocity in the pipe. Time lag was calculated by multiplying the time of concentration by 0.6.
- SCS design storms: Rainfall depth-duration tables provided in the County's Precipitation-Duration-Frequency-Depth Curves (see Appendix D) indicate that the total anticipated 10-year, 24-hour rainfall event is on the order of 5.22 inches. This rainfall was distributed in the model using the SCS Type 1a storm distribution.
- Basin volumes: Stage-storage relations for the stormwater basins were derived from grading information provided on the tentative map. A summary of the modeled basin parameters is included in Appendix L.
- Basin outflow controls: At lower water surface elevations in the basins, flow is assumed to be released through an 18" loamy sand layer along the basin floor with an infiltration rate of 5 inches per hour and 1' of gravel layer. Outflow orifice and riser at

higher elevations in the basin provide a controlled release for higher flow rates from the basin. The outlet configuration for the basin is described in greater detailed in Appendix L.

Modeled peak outflows from the pre- and post- project watersheds for the 10-year rainfall event are summarized in Appendices I-L. Results of routing the modeled hydrographs through the proposed basins are included in Appendix L. These results indicate that the basin provides the necessary volume to attenuate the 10- year rainfall event.

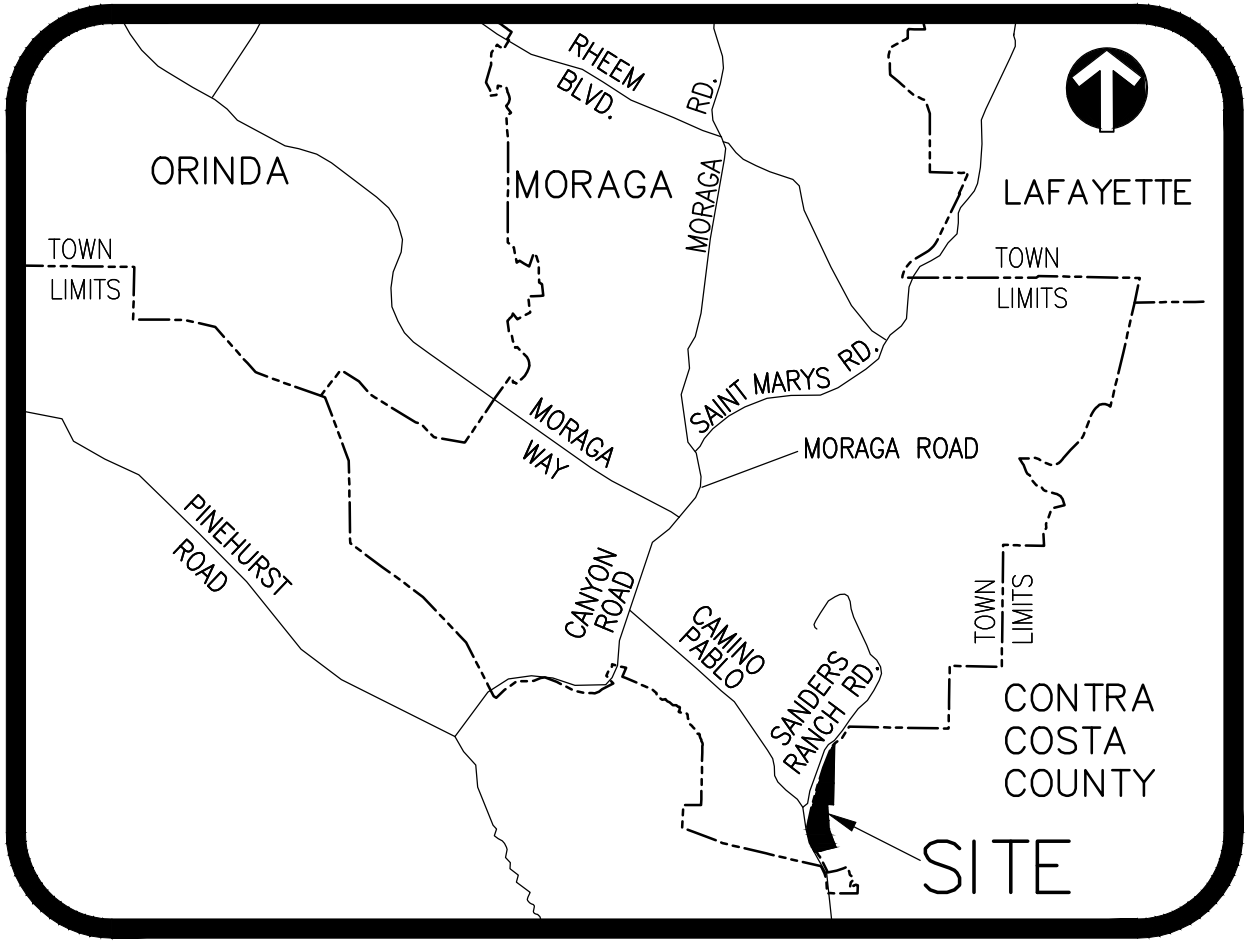
4.0 DISCUSSION AND CONCLUSIONS

Based upon our analysis, we conclude that the storm drain system within the project can meet the requirements of Contra Costa County and the Town of Moraga. The analysis performed in this report can conclude that the existing downstream system is adequate to receive runoff from the development of this project.

In order to reduce post-development flows to pre-development levels, an outlet structure has been designed for the basin in Parcel C. At lower water surface elevations, flow is assumed to be released through a 4.5-inch diameter orifice at an invert elevation of 549.00. A weir is designed to provide a controlled release for higher flow rates from the basin. These are built into a 36-inch standpipe with a top elevation of 551.00, providing for 0.62 feet of freeboard. The outlet configuration is described in more detail in Appendix L.

If the outlets of the system were clogged or overwhelmed and flows escaped through the top of the system, the designed overland release route is through the project site's proposed road and/or downstream to Camino Pablo.

APPENDIX A
VICINITY MAP

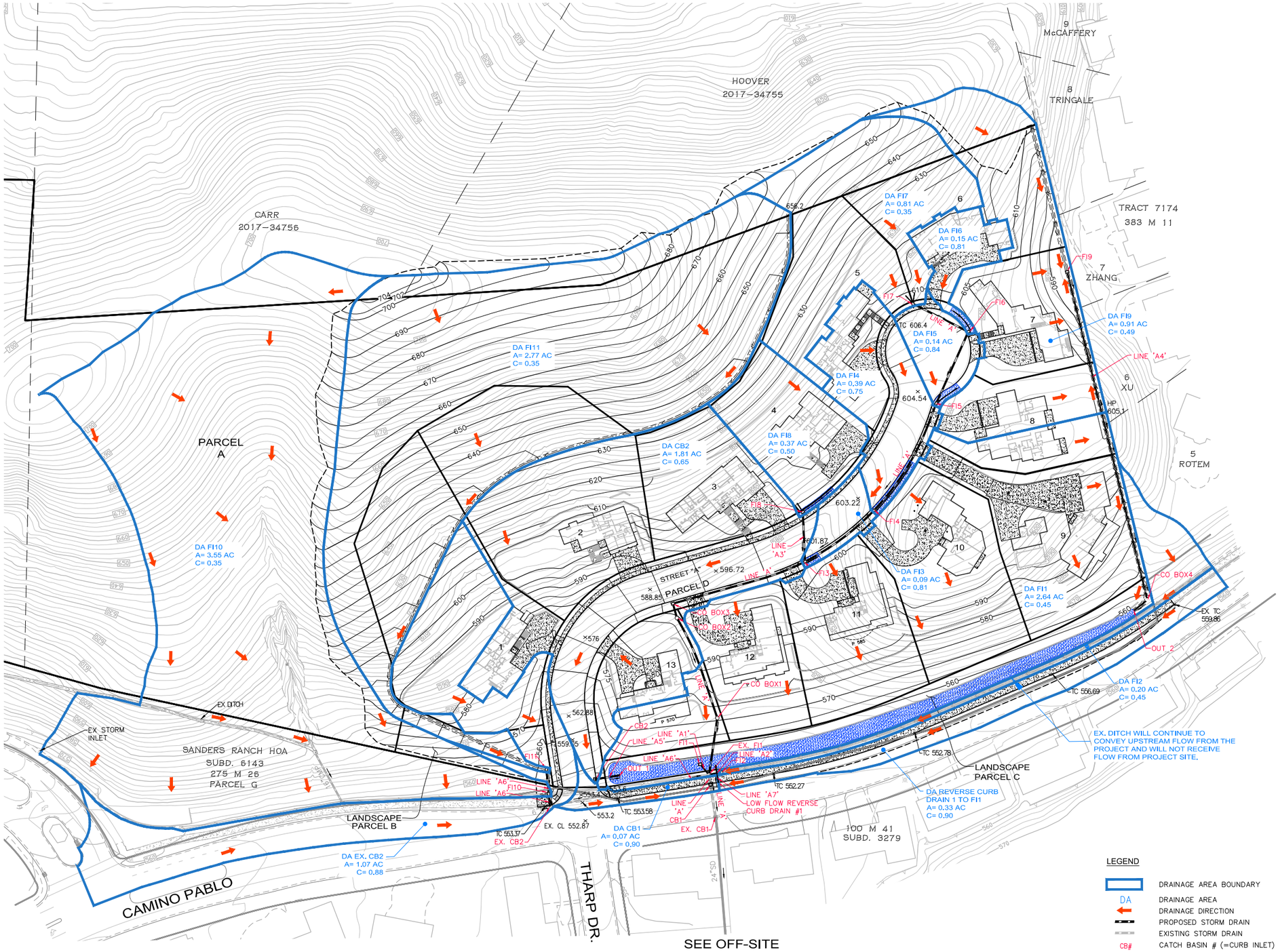


VICINITY MAP

NOT TO SCALE

APPENDIX B

1. HYDROLOGY MAP
   (1-11x17 map for quick reference and 1-full size map)
2. OFF-SITE STORM EXHIBIT
   (1-11x17 map for quick reference and 1-full size map)



NOTE:
ALL BUILDINGS AND DRIVEWAYS AS A PART OF THIS PLAN ARE CONCEPTUAL.

LEGEND

	DRAINAGE AREA BOUNDARY
DA	DRAINAGE AREA
	DRAINAGE DIRECTION
	PROPOSED STORM DRAIN
	EXISTING STORM DRAIN
CB#	CATCH BASIN # (=CURB INLET)
CO BOX#	CLEANOUT BOX #
FI#	FIELD INLET #
LINE#	STORM DRAIN LINE #
OUT	OUTFALL AT BIORETENTION FILTER
	STORM DRAIN DIRECTION

50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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SOUTH CAMINO PABLO ANNEXATION

HYDROLOGY MAP

TOWN OF MORAGA, CALIFORNIA
JANUARY, 2019

\\fs1\DK_Files\Projects\2013\13-1060-Camino Pablo\DWG\PLANNING\HYDROLOGY\Hydro-1360.dwg

dk JOB# 13-1060-12

100 0' 50 100 200 400

(IN FEET)
1 INCH = 100 ft.

LEGEND

- DRAINAGE DIRECTION
- EXISTING STORM DRAIN
- EXISTING DITCH
- STORM DRAIN DIRECTION
- CB CATCH BASIN
- FI FIELD INLET
- SD STORM DRAIN
- SDMH STORM DRAIN MANHOLE

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SOUTH CAMINO PABLO ANNEXATION

OFF SITE STORM EXHIBIT

TOWN OF MORAGA, CALIFORNIA
JANUARY, 2019

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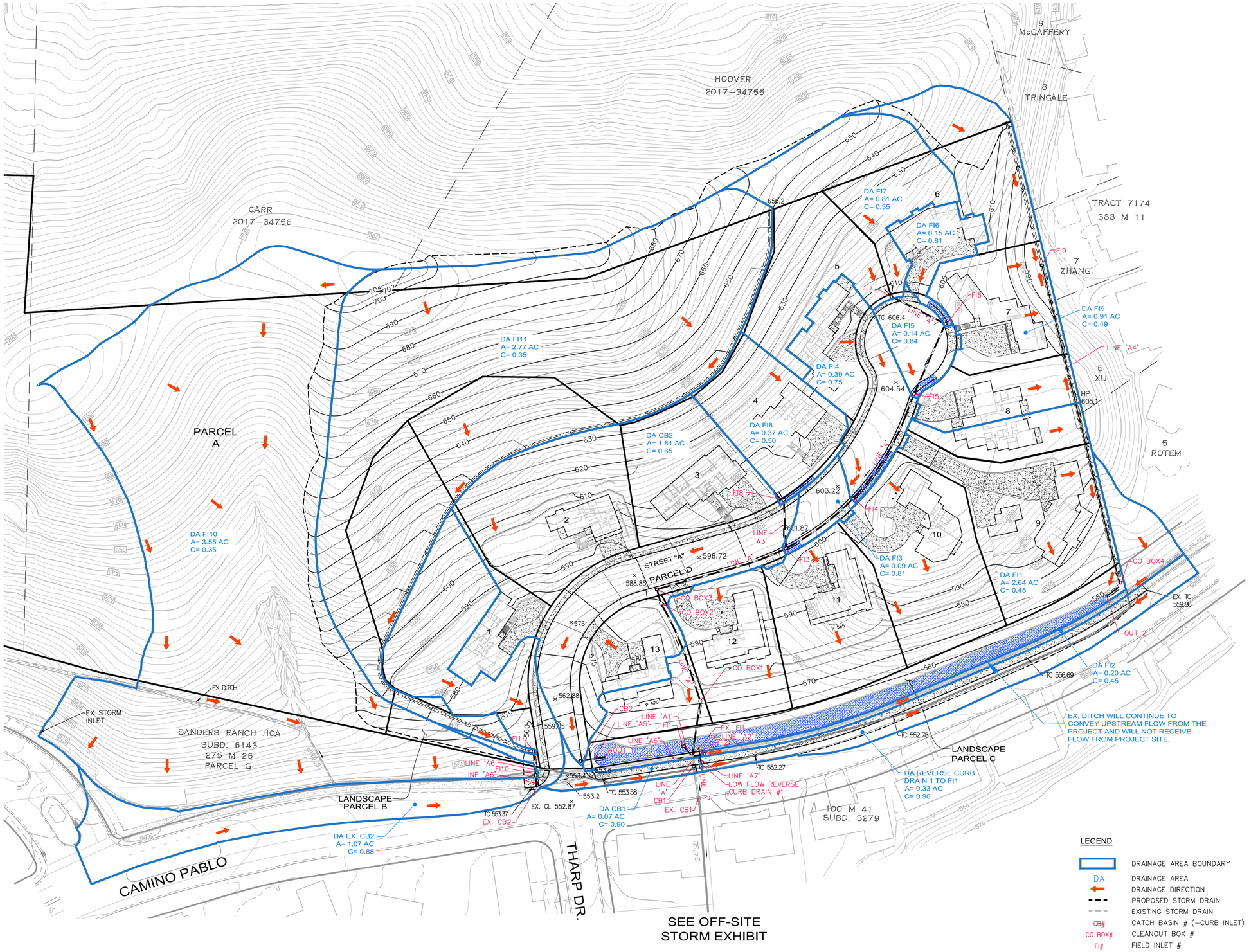
dk JOB# 13-1060-12



NOTE:
ALL BUILDINGS AND DRIVEWAYS AS A PART OF THIS PLAN ARE CONCEPTUAL.

LEGEND

	DRAINAGE AREA BOUNDARY
DA	DRAINAGE AREA
	DRAINAGE DIRECTION
	PROPOSED STORM DRAIN
	EXISTING STORM DRAIN
CB#	CATCH BASIN # (=CURB INLET)
CO BOX#	CLEANOUT BOX #
FI#	FIELD INLET #
LINE#	STORM DRAIN LINE #
OUT	OUTFALL AT BIORETENTION FILTER
	STORM DRAIN DIRECTION

50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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SOUTH CAMINO PABLO ANNEXATION

HYDROLOGY MAP

TOWN OF MORAGA, CALIFORNIA
JANUARY, 2019

dk JOB# 13-1060-12

SHEET 1 OF 1

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100 0' 50 100 200 400

(IN FEET)
1 INCH = 100 ft.

LEGEND

	DRAINAGE DIRECTION
	EXISTING STORM DRAIN
	EXISTING DITCH
	STORM DRAIN DIRECTION
CB	CATCH BASIN
FI	FIELD INLET
SD	STORM DRAIN
SDMH	STORM DRAIN MANHOLE

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SOUTH CAMINO PABLO ANNEXATION

OFF SITE STORM EXHIBIT

TOWN OF MORAGA, CALIFORNIA
JANUARY, 2019

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dk JOB# 13-1060-12

SHEET 1 OF 1

APPENDIX C
CONTRA COSTA COUNTY RUNOFF COEFFICIENTS

CCCFCD STANDARD - RUNOFF COEFFICIENTS

Rational Formula

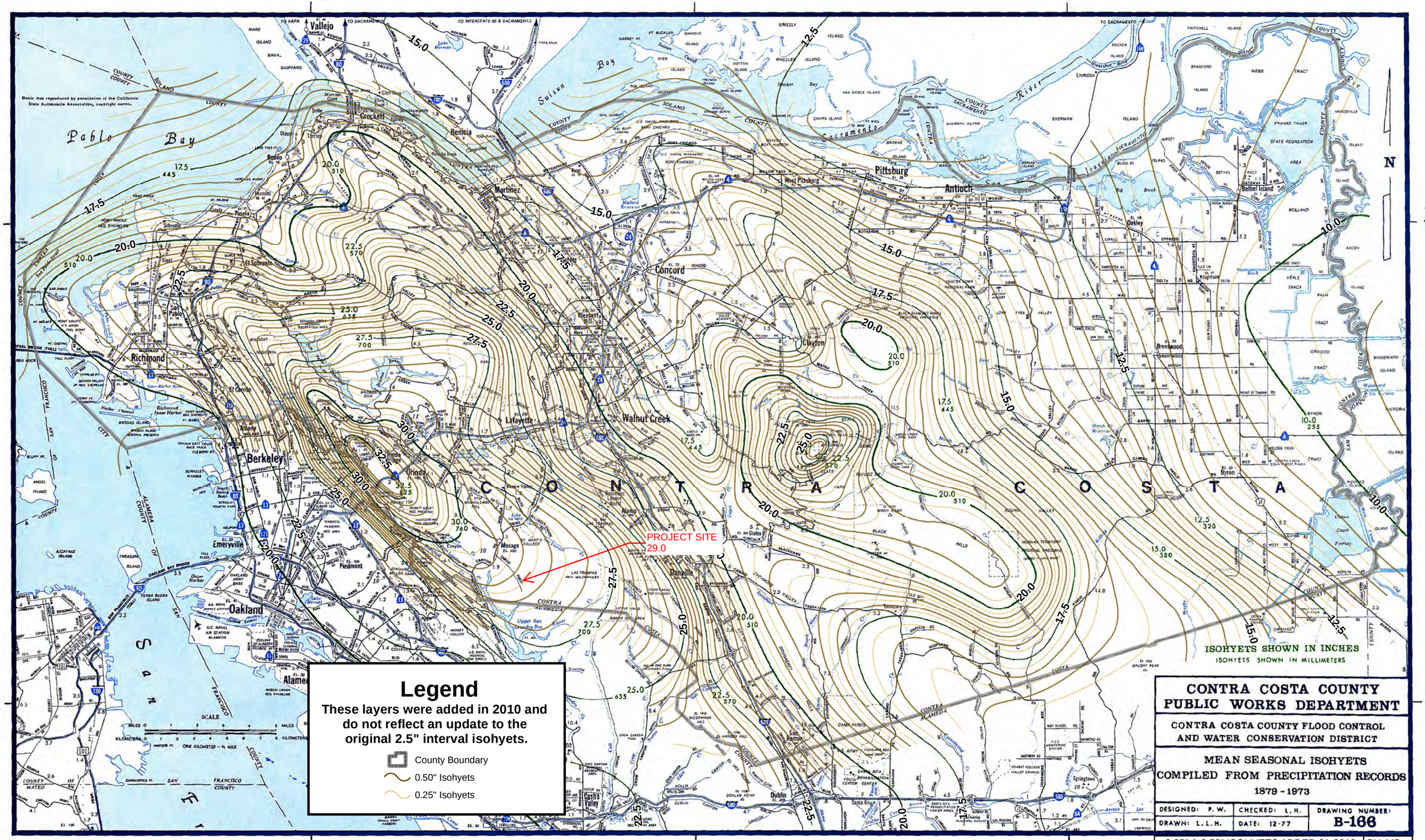
Land Use	Runoff Coefficient	Average Impervious Area (%)	Time of Concentration-Roof to Gutter (min)
Residential:			
R - 6	.50 - .70	76	3 - 5
R - 10	.45 - .60	53	5 - 7
R - 20	.40 - .50	35	6 - 8
R - 40	.35 - .45	25	8 - 10
Apartment	.60 - .80		3 - 10
Commercial	.70 - .95		3 - 8
Industrial	.60 - .90		3 - 10
Open	.20 - .40		
Street:			
Asphalt	.75 - .95		
Concrete	.80 - .95		
Drives and Walks	.80 - .95		
Roofs	.75 - .95		

Legend

R - 6 = 6,000 ft^2 Lot
R - 10 = 10,000 ft^2 Lot
R - 20 = 20,000 ft^2 Lot
R - 40 = 40,000 ft^2 Lot

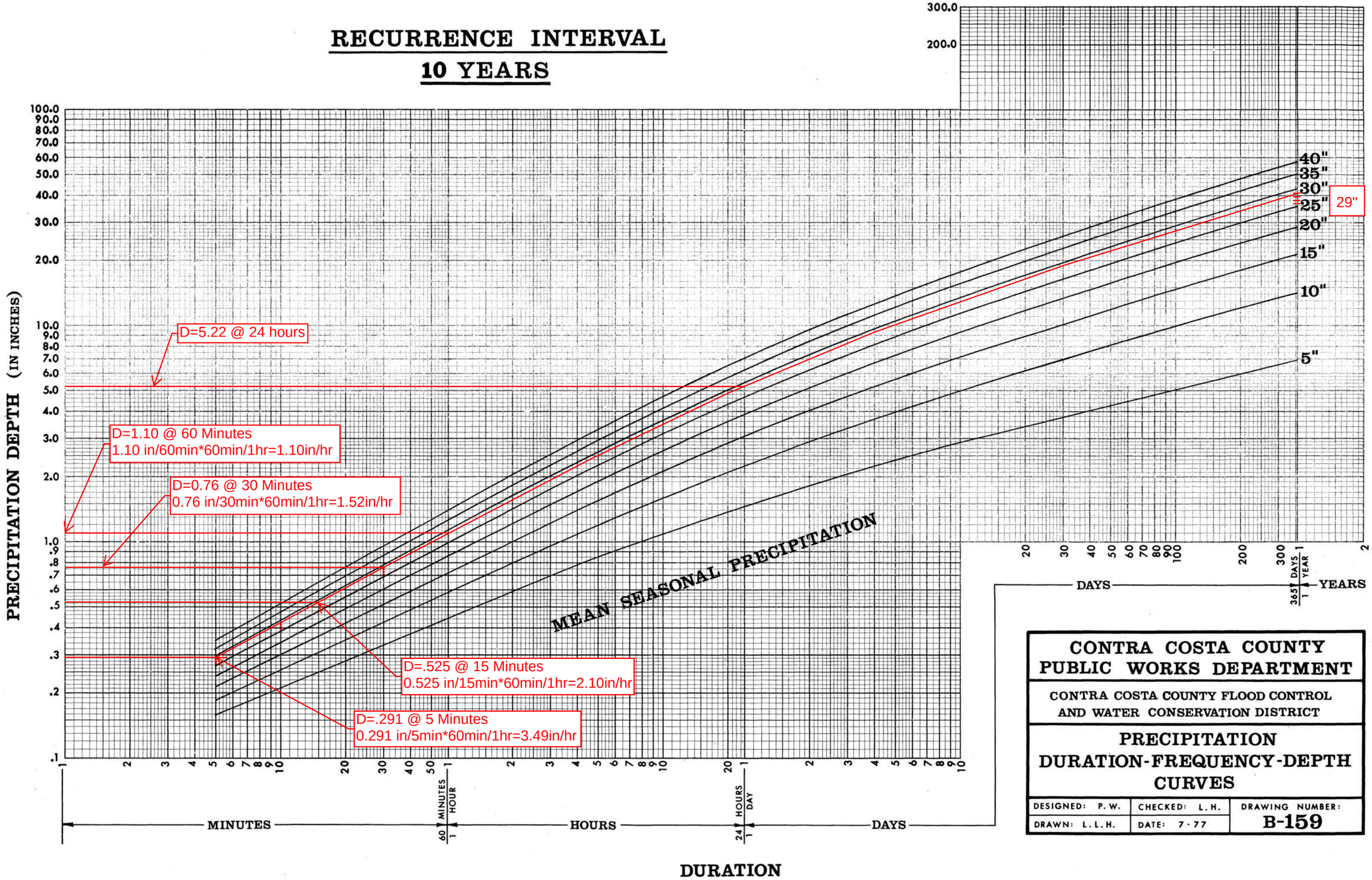
Note: For Contra Costa County Land Uses use the highest runoff coefficient in the range. This more closely approximates the peak flows calculated by the Unit Hydrograph method developed for Contra Costa County and calibrated with local rainfall and runoff data.

APPENDIX D
CONTRA COSTA COUNTY MEAN SEASONAL ISOHYETS


122°15′
122°00′
121°45′
38°00′
37°45′
Pablo Bay
Suisun Bay
Sacramento River
San Joseph River
Vallejo
Crockett
Benicia
Martinez
Pittsburg
Antioch
West Pittsburg
Concord
Pleasant Hill
Walnut Creek
Lafayette
Orinda
Moraga
Danville
San Ramon
Dublin
Castro Valley
Alameda
Oakland
Emeryville
Berkeley
Albany
Richmond
El Cerrito
San Pablo
Pinole
Hercules
Rodeo
Clayton
Brentwood
Oakley
Knightsen
Byron
Bethel Island
Emmaton
Rio Vista
Antioch
PROJECT SITE
29.0
C O N T R A C O S T A
ISOHYETS SHOWN IN INCHES
ISOHYETS SHOWN IN MILLIMETERS
Legend
These layers were added in 2010 and do not reflect an update to the original 2.5" interval isohyets.
County Boundary
0.50" Isohyets
0.25" Isohyets
CONTRA COSTA COUNTY
PUBLIC WORKS DEPARTMENT
CONTRA COSTA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
MEAN SEASONAL ISOHYETS
COMPILED FROM PRECIPITATION RECORDS
1879 - 1973
DESIGNED: P. W.
CHECKED: L. H.
DRAWING NUMBER:
B-166
DRAWN: L. L. H.
DATE: 12-77
0.25" & 0.50" ISOHYETS ADDED 01-2010
BY: MB

APPENDIX E
PRECIPITATION DURATION - FREQUENCY- DEPTH CURVES

RECURRENCE INTERVAL
10 YEARS



CONTRA COSTA COUNTY
PUBLIC WORKS DEPARTMENT

CONTRA COSTA COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

PRECIPITATION
DURATION-FREQUENCY-DEPTH
CURVES

DESIGNED: P. W.	CHECKED: L. H.	DRAWING NUMBER:
DRAWN: L. L. H.	DATE: 7-77	B-159

APPENDIX F
10 - YEAR HYDROLOGY COMPUTATIONS

Pipe Comps Report

Stormwater Studio 2018 v 2.0.0.63

Project Name: Camino Pablo

12-21-2018

Line No.	Inlet ID	Line ID	Area ID	Drain Area (ac)	Runoff Coeff (C)	Incr CxA	Total C x A	Total Area (ac)	Tc (min)	i Syst (in/hr)	Flow Rate (cfs)	Line Size (in)	Vel Ave (ft/s)	Grnd/Rim Elev Up (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (ft/ft)	Line Length (ft)	Line Eff (q/Q)	Vel Factor (v/V)	Pipe Travel (min)	Capac. Full (cfs)	Cover Up (ft)
23	FI11	LINE 'A6'	DA FI11	2.77	0.25	0.69	0.69	2.77	5.7	3.28	2.27	15	2.39	558.00	550.50	549.50	0.0387	25.87	21%	0.27	0.18	11.00	6.25
22	FI10	LINE 'A6'	DA FI10	3.55	0.25	0.89	1.58	6.32	10.0	2.53	4.00	15	3.26	555.00	549.50	549.00	0.0364	13.72	37%	0.37	0.07	10.68	4.25
21	EX CB2	LINE 'A6'	DA EX CB2	1.07	0.88	0.94	2.52	7.39	10.1	2.52	6.36	15	5.18	552.50	548.92	547.05	0.0108	172.42	109%	1.09	0.55	5.83	2.33
20	CB2	LINE 'A5'	DA CB2	1.81	0.65	1.18	1.18	1.81	5.0	3.49	4.10	18	2.33	556.00	552.50	552.40	0.0038	26.59	74%	0.74	0.19	5.58	2.00
19	FI9	LINE 'A4'	DA FI9	0.91	0.49	0.45	0.45	0.91	5.0	3.49	1.55	12	5.64	585.00	581.00	558.89	0.0617	358.63	20%	0.58	2.11	7.66	3.00
18	CO BOX 4	LINE 'A4'		0.00	0.00	0.00	0.45	0.91	7.1	2.97	1.32	12	1.71	562.50	558.89	558.80	0.0049	18.27	61%	0.62	0.18	2.17	2.61
17	FI8	LINE 'A3'	DA FI8	0.37	0.50	0.19	0.19	0.37	5.0	3.49	0.65	18	1.56	602.89	593.83	591.19	0.05	52.76	3%	0.14	0.56	20.36	7.56
16	FI 2	LINE 'A2'	DA FI2	0.20	0.45	0.09	0.09	0.20	6.4	3.12	0.28	18	1.17	551.85	548.85	547.45	0.1037	13.50	1%	0.07	0.19	29.31	1.50
15	FI 1	LINE 'A1'	DA FI1	5.69	0.55	3.13	3.13	5.69	624.0	0.37	1.15	18	1.98	552.00	549.00	547.20	0.1224	14.70	4%	0.11	0.12	31.85	1.50
14	FI7	LINE 'A'	DA FI7	0.81	0.35	0.28	0.28	0.81	5.0	3.49	0.99	18	3.44	608.96	598.57	597.25	0.02	65.86	8%	0.47	0.44	12.88	8.89
13	FI6	LINE 'A'	DA FI6	0.15	0.81	0.12	0.41	0.96	5.4	3.35	1.36	18	2.80	603.86	597.15	596.32	0.01	83.33	15%	0.54	0.50	9.08	5.21
12	FI5	LINE 'A'	DA FI5	0.14	0.84	0.12	0.52	1.10	5.9	3.22	1.68	18	4.02	603.78	596.22	594.86	0.02	67.88	13%	0.55	0.34	12.88	6.06
11		LINE 'A'		0.00	0.00	0.00	0.52	1.10	6.3	3.14	1.64	18	2.68	603.17	594.86	593.56	0.0201	64.77	13%	0.37	0.40	12.89	6.81
10	FI4	LINE 'A'	DA FI4	0.39	0.75	0.29	0.82	1.49	6.7	3.05	2.49	18	4.60	602.56	593.46	592.33	0.0249	45.33	17%	0.57	0.20	14.37	7.60
9		LINE 'A'		0.00	0.00	0.00	0.82	1.49	6.9	3.01	2.45	18	3.18	602.79	592.33	591.19	0.0249	45.78	17%	0.39	0.24	14.36	8.96
8	FI3	LINE 'A'	DA FI3	0.09	0.81	0.07	1.07	1.95	7.1	2.96	3.18	18	6.45	601.62	591.09	586.81	0.08	53.49	12%	0.44	0.22	25.74	9.03
7		LINE 'A'		0.00	0.00	0.00	1.07	1.95	7.3	2.92	3.14	18	6.59	599.00	586.81	579.31	0.08	93.79	12%	0.45	0.40	25.74	10.69
6	CO BOX3	LINE 'A'		0.00	0.00	0.00	1.07	1.95	7.7	2.85	3.06	18	7.00	591.50	579.21	576.05	0.20	15.80	8%	0.30	0.07	40.70	10.79
5	CO BOX2	LINE 'A'		0.00	0.00	0.00	1.07	1.95	7.8	2.84	3.05	18	8.56	590.00	575.95	562.46	0.2499	53.99	7%	0.33	0.22	45.49	12.55
4		LINE 'A'		0.00	0.00	0.00	1.07	1.95	8.0	2.80	3.01	18	8.57	587.00	562.46	547.28	0.2499	60.74	7%	0.33	0.31	45.50	23.04
3	CO BOX1	LINE 'A'		0.00	0.00	0.00	1.07	1.95	8.3	2.75	2.95	18	2.28	571.00	547.18	547.00	0.003	61.01	60%	0.81	0.45	4.94	22.32
2	EX. FI1	LINE 'A'		0.00	0.00	0.00	6.81	15.23	624.1	0.37	2.51	24	3.05	551.98	546.95	546.85	0.0096	10.39	13%	0.50	0.06	19.24	3.03
1	CB1	LINE 'A'	DA CB1	0.07	0.90	0.06	6.88	15.30	624.2	0.37	2.53	24	3.74	551.25	546.83	546.47	0.0101	35.56	13%	0.60	0.17	19.72	2.42

Notes: IDF File = CAMINO PABLO IDF 10 year.idf, Return Period = 10-yrs.

Project File: HYO-1360.sws

APPENDIX G
CONTRA COSTA COUNTY TABLE OF HEADLOSS FACTORS

CONTRA COSTA COUNTY
TABLE OF HEADLOSS FACTORS
THROUGH STRUCTURES

TYPE OF STRUCTURE	K
1. Straight run with change in pipe size	0.25
2. Straight run with same pipe size	0.17
3. 0° - 45° deflection with change in pipe size	0.50
4. 0° - 45° deflection with same pipe size	0.42
5. 45° - 90° deflection with change in pipe size	0.75
6. 45° - 90° deflection with same pipe size	0.75
7. Approaching 90° deflection	1.00
8. 90° deflection	1.25
9. Drop manhole	1.25
10. Short radius curves (50' and shorter)	0.35

Notes:

County freeboard requirement is 1.25' (15") to grate (not TOC).

CCC uses Manning's "n" values of 0.015 for RCP, and 0.024 for CMP.

Contributing Watershed (Square Miles)	Design Event
0 to 1	10-year
1 to 4	25-year
Greater than 4 square miles	100-year

APPENDIX H
10 - YEAR HYDRAULIC COMPUTATIONS

HGL Report

Stormwater Studio 2018 v 2.0.0.63

Project Name: Camino Pablo

12-21-2018

Line No.	To Line	Inlet ID	Flow Rate (cfs)	Line Size (in)	Vel Dn (ft/s)	Vel Up (ft/s)	Depth Dn (ft)	Depth Up (ft)	Vel Hd Dn (ft)	Vel Hd Up (ft)	Invert Dn (ft)	Invert Up (ft)	EGL Dn (ft)	HGL Dn (ft)	Line Length (ft)	Line Slope (ft/ft)	n-value Pipe	Sf Ave (ft/ft)	Energy Loss (ft)	EGL Up (ft)	HGL Up (ft)	HGL Junct (ft)	Grnd/Rim Elev Up (ft)	Free-board (ft)
1	Outfall	CB1	2.53	24	4.00	3.48	0.51	0.56**	0.25	0.19	546.47	546.83	547.22	546.98	35.56	0.0101	0.015	0.006	0.197	547.58	547.39	547.39	551.25	3.86
2	1	EX. FI1	2.51	24	2.67	3.44	0.68	0.57	0.11	0.18	546.85	546.95	547.64	547.53	10.39	0.0096	0.015	0.004	0.042	547.70	547.52	547.55	551.98	4.43
3	2	CO BOX1	2.95	18	2.16	2.40	1.09	0.99	0.07	0.09	547.00	547.18	548.16	548.09	61.01	0.003	0.015	0.002	0.097	548.26	548.17	548.18	571.00	22.82
4	3		3.01	18	13.14	4.00	0.28	0.66**	2.68	0.25	547.28	562.46	548.34	547.56	60.74	0.2499	0.015	0.004	0.266	563.37	563.12	563.12	587.00	23.88
5	4	CO BOX2	3.05	18	13.11	4.02	0.28	0.67**	2.67	0.25	562.46	575.95	563.38	562.74	53.99	0.2499	0.015	0.007	0.365	576.87	576.62	576.62	590.00	13.38
6	5	CO BOX3	3.06	18	9.97	4.02	0.34	0.67**	1.55	0.25	576.05	579.21	576.98	576.39	15.80	0.20	0.015	0.006	0.093	580.13	579.88	579.88	591.50	11.62
7	6		3.14	18	9.12	4.06	0.37	0.68**	1.29	0.26	579.31	586.81	580.25	579.68	93.79	0.08	0.015	0.006	0.569	587.74	587.49	587.49	599.00	11.51
8	7	FI3	3.18	18	8.82	4.08	0.39	0.68**	1.21	0.26	586.81	591.09	587.75	587.20	53.49	0.08	0.015	0.007	0.366	592.03	591.77	591.77	601.62	9.85
9	8		2.45	18	2.62	3.73	0.78	0.60**	0.11	0.22	591.19	592.33	592.08	591.98	45.78	0.0249	0.015	0.004	0.206	593.14	592.93	592.93	602.79	9.86
10	9	FI4	2.49	18	5.45	3.75	0.46	0.60**	0.46	0.22	592.33	593.46	593.15	592.79	45.33	0.0249	0.015	0.007	0.295	594.28	594.06	594.06	602.56	8.50
11	10		1.64	18	2.09	3.28	0.69	0.49**	0.07	0.17	593.56	594.86	594.31	594.25	64.77	0.0201	0.015	0.004	0.257	595.52	595.35	595.35	603.17	7.82
12	11	FI5	1.68	18	4.73	3.31	0.38	0.50**	0.35	0.17	594.86	596.22	595.53	595.24	67.88	0.02	0.015	0.006	0.419	596.89	596.72	596.72	603.78	7.06
13	12	FI6	1.36	18	2.50	3.10	0.52	0.44**	0.10	0.15	596.32	597.15	596.94	596.84	83.33	0.01	0.015	0.005	0.393	597.74	597.59	597.59	603.86	6.27
14	13	FI7	0.99	18	4.07	2.81	0.29	0.38**	0.26	0.12	597.25	598.57	597.78	597.54	65.86	0.02	0.015	0.004	0.292	599.07	598.95	598.95	608.96	10.01
15	2	FI 1	1.15	18	1.02	2.95	0.92	0.41**	0.02	0.13	547.20	549.00	548.13	548.12	14.70	0.1224	0.015	0.003	0.047	549.54	549.41	549.41	552.00	2.59
16	2	FI 2	0.28	18	0.37	1.97	0.67	0.20**	0.00	0.06	547.45	548.85	548.13	548.12	13.50	0.1037	0.015	0.003	0.043	549.11	549.05	549.05	551.85	2.80
17	8	FI8	0.65	18	0.64	2.49	0.84	0.31**	0.01	0.10	591.19	593.83	592.03	592.03	52.76	0.05	0.015	0.003	0.162	594.23	594.14	594.14	602.89	8.75
18	Outfall	CO BOX 4	1.32	12	1.68	1.73	1.00	0.94	0.04	0.05	558.80	558.89	559.84	559.80	18.27	0.0049	0.015	0.002	0.031	559.88	559.83	559.84	562.50	2.66
19	18	FI9	1.55	12	7.59	3.69	0.31	0.53**	0.90	0.21	558.89	581.00	559.94	559.20	358.63	0.0617	0.015	0.005	1.920	581.74	581.53	581.53	585.00	3.47
20	Outfall	CB2	4.10	18	2.32	2.35	1.50	1.45	0.08	0.09	552.40	552.50	553.98	553.90	26.59	0.0038	0.015	0.002	0.051	554.03	553.95	553.97	556.00	2.03
21	2	EX CB2	6.36	15	5.18	5.18	1.25	1.25	0.42	0.42	547.05	548.92	548.72	548.30	172.42	0.0108	0.015	0.013	2.224	550.94	550.52	550.61	552.50	1.89
22	21	FI10	4.00	15	3.26	3.26	1.25	1.25	0.16	0.16	549.00	549.50	551.14	550.98	13.72	0.0364	0.015	0.005	0.070	551.21	551.05	551.08	555.00	3.92
23	22	FI11	2.27	15	1.85	2.93	1.25	0.76	0.05	0.13	549.50	550.50	551.32	551.27	25.87	0.0387	0.015	0.003	0.067	551.39	551.26	551.28	558.00	6.72

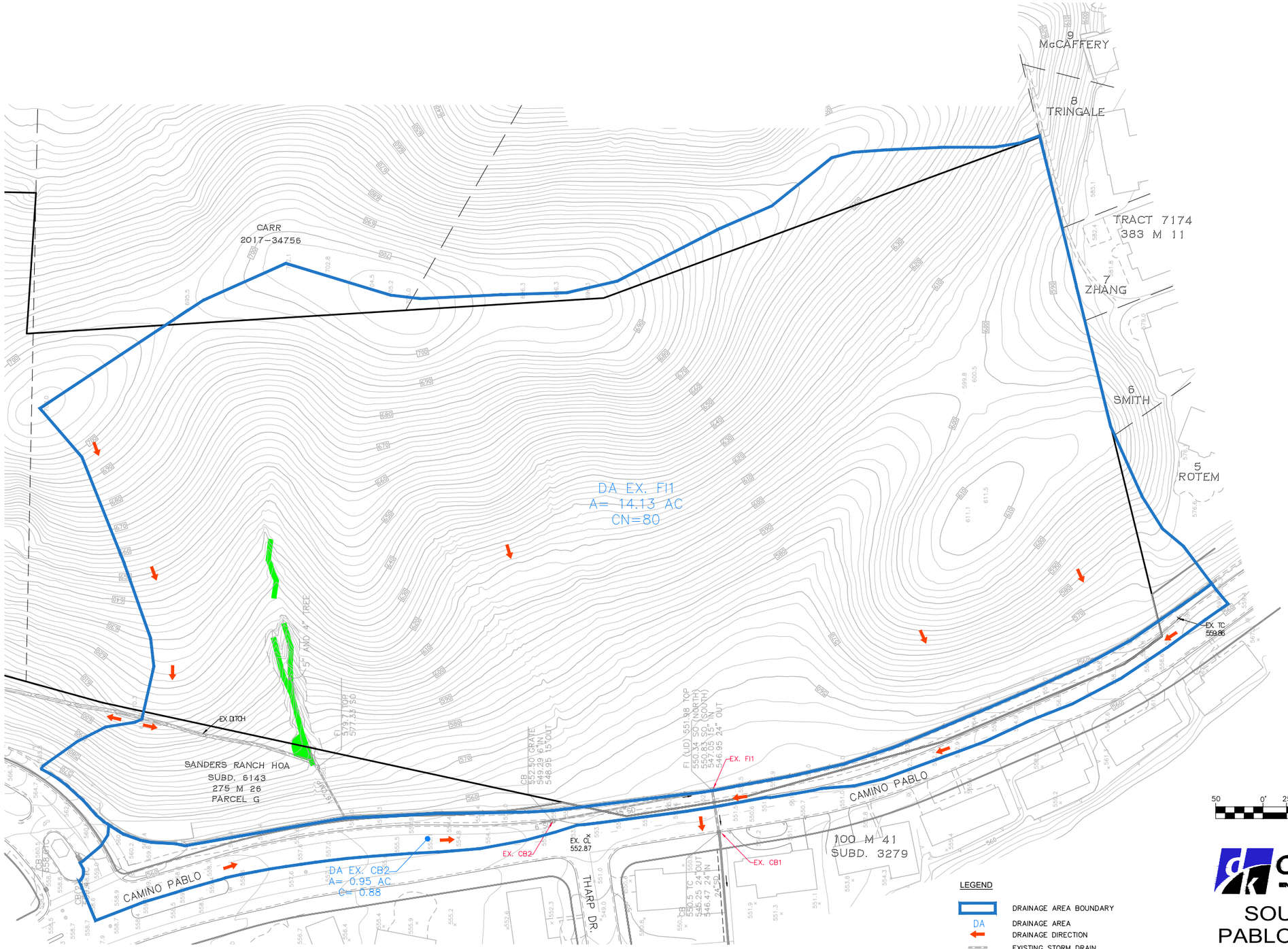
Notes: IDF File = CAMINO PABLO IDF 10 year.idf, Return Period = 10-yrs.

Project File: HYO-1360.sws

APPENDIX I

PRE - HYDROLOGY MAP FOR PONDPACK ANALYSIS

(1-11x17 map for quick reference and 1-full size map)



SEE OFF-SITE
STORM EXHIBIT

LEGEND

- DRAINAGE AREA BOUNDARY
- DA — DRAINAGE AREA
- DRAINAGE DIRECTION
- EXISTING STORM DRAIN
- EX. CB# — EXISTING CATCH BASIN #
- EXISTING FI# — EXISTING FIELD INLET #
- STORM DRAIN DIRECTION
- JURISDICTIONAL AREA

50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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SOUTH CAMINO PABLO ANNEXATION

PRE CONSTRUCTION
HYDROLOGY MAP FOR
PONDPACK ANALYSIS
TOWN OF MORAGA, CALIFORNIA
JANUARY, 2019

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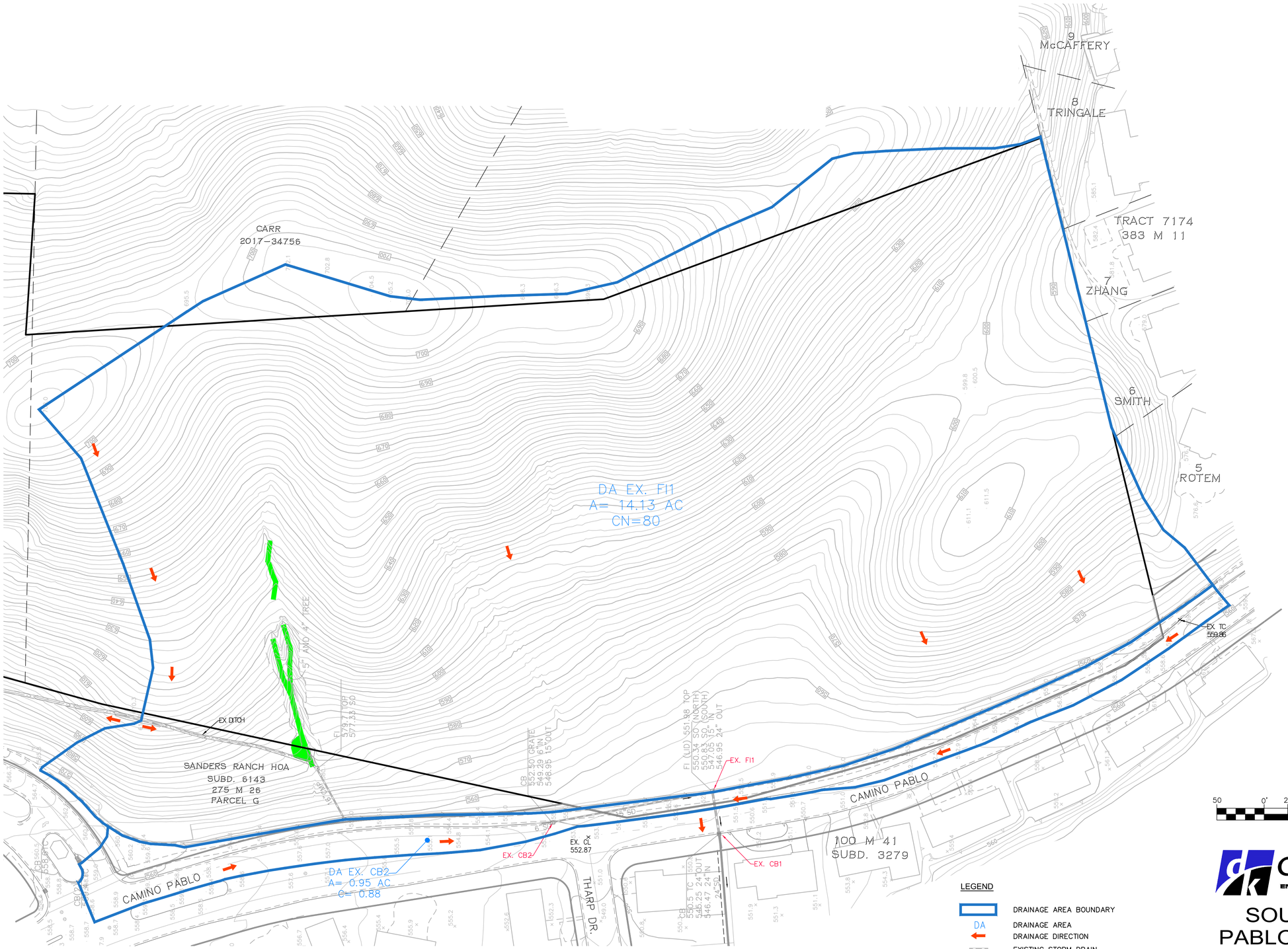
dk JOB# 13-1060-12

SHEET 1 OF 1



SEE OFF-SITE
STORM EXHIBIT

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SOUTH CAMINO PABLO ANNEXATION

PRE CONSTRUCTION
HYDROLOGY MAP FOR
PONDPACK ANALYSIS
TOWN OF MORAGA, CALIFORNIA
JANUARY, 2019

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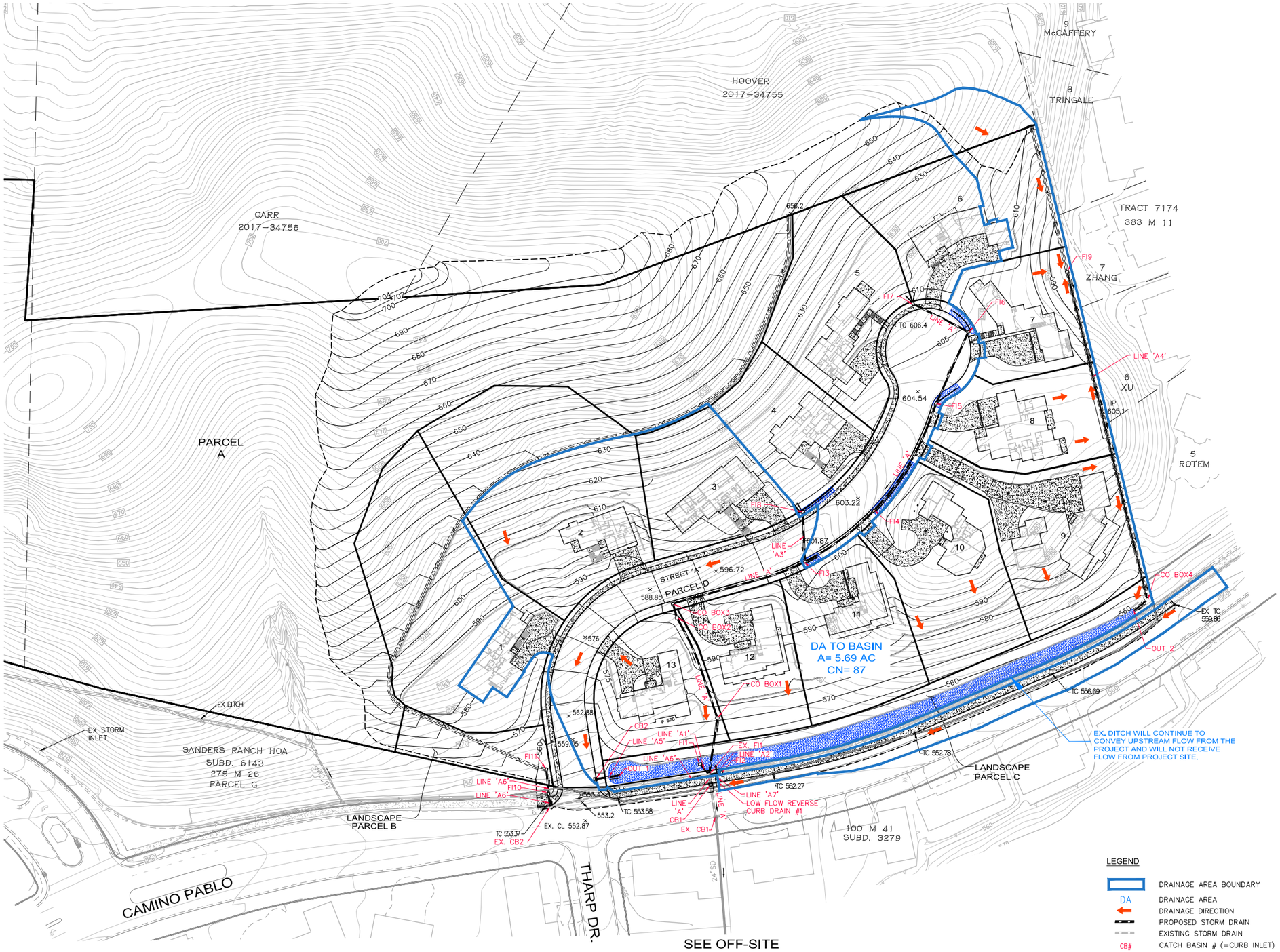
dk JOB# 13-1060-12

SHEET 1 OF 1

APPENDIX J

POST HYDROLOGY MAP FOR PONDPACK ANALYSIS

(1-11x17 map for quick reference and 1-full size map)



NOTE:
ALL BUILDINGS AND DRIVEWAYS AS A PART OF THIS PLAN ARE CONCEPTUAL.

LEGEND

	DRAINAGE AREA BOUNDARY
DA	DRAINAGE AREA
	DRAINAGE DIRECTION
	PROPOSED STORM DRAIN
	EXISTING STORM DRAIN
CB#	CATCH BASIN # (=CURB INLET)
CO BOX#	CLEANOUT BOX #
FI#	FIELD INLET #
LINE#	STORM DRAIN LINE #
OUT	OUTFALL AT BIORETENTION FILTER
	STORM DRAIN DIRECTION

50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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SOUTH CAMINO PABLO ANNEXATION

POST CONSTRUCTION HYDROLOGY MAP FOR PONDPACK ANALYSIS

TOWN OF MORAGA, CALIFORNIA
JANUARY, 2019

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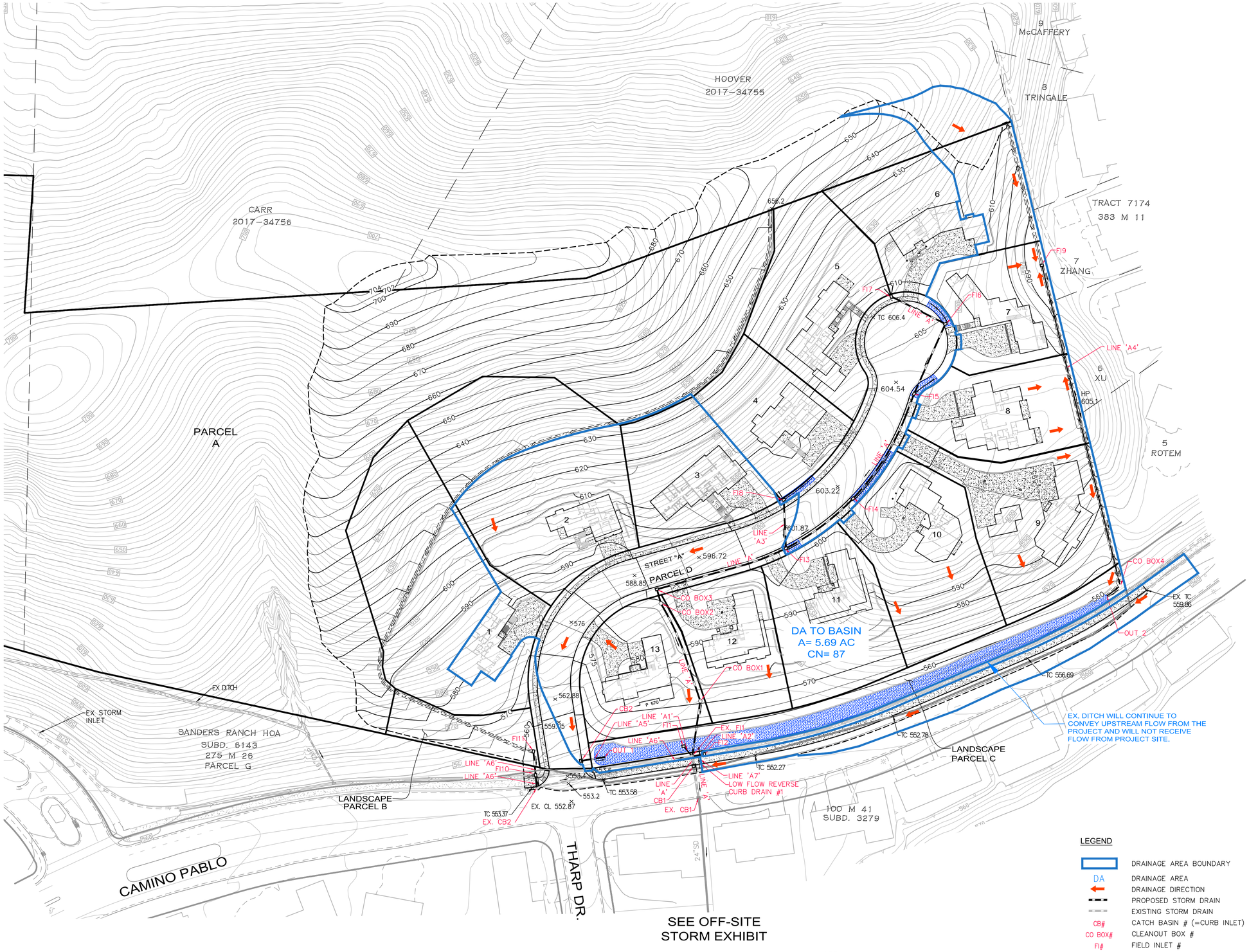
dk JOB# 13-1060-12



NOTE:
ALL BUILDINGS AND DRIVEWAYS AS A PART OF THIS PLAN ARE CONCEPTUAL.

LEGEND

	DRAINAGE AREA BOUNDARY
DA	DRAINAGE AREA
	DRAINAGE DIRECTION
	PROPOSED STORM DRAIN
	EXISTING STORM DRAIN
CB#	CATCH BASIN # (=CURB INLET)
CO BOX#	CLEANOUT BOX #
FI#	FIELD INLET #
LINE#	STORM DRAIN LINE #
OUT	OUTFALL AT BIORETENTION FILTER
	STORM DRAIN DIRECTION

50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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POST CONSTRUCTION HYDROLOGY MAP FOR PONDPACK ANALYSIS

TOWN OF MORAGA, CALIFORNIA
JANUARY, 2019

dk JOB# 13-1060-12

SHEET 1 OF 1

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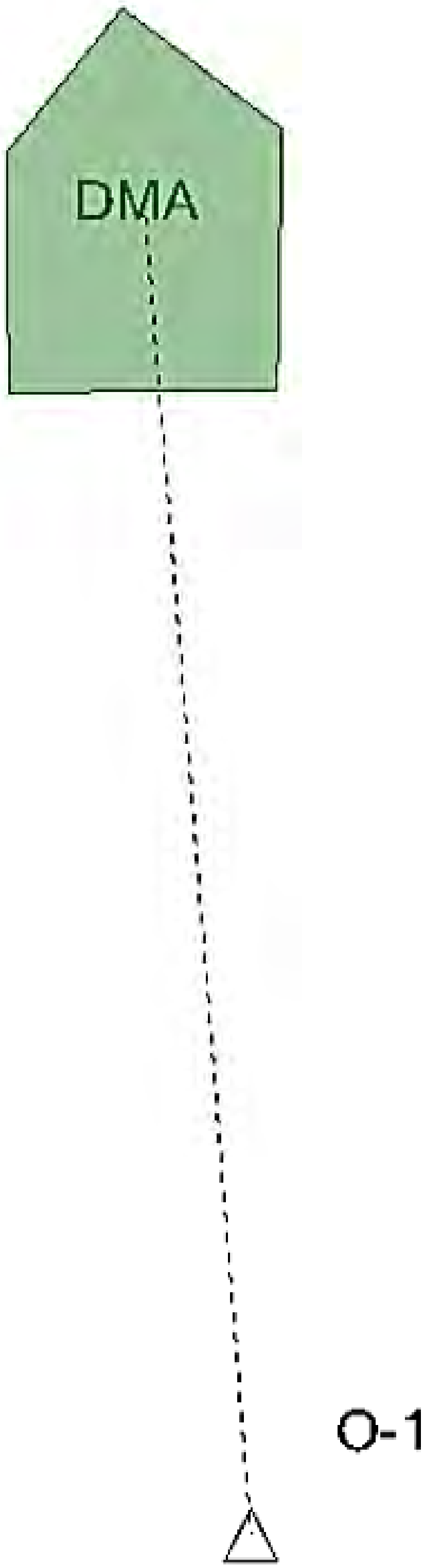
APPENDIX K
PONDPACK RESULTS: PRE - CONDITIONS


DMA
O-1

Scenario Calculation Summary

Scenario Summary	
ID	67
Label	Pre-Development Contra Costa County, 10 yrs
Notes	
Active Topology	Pre-Development Active Topology
Hydrology	Pre-Development Hydrology
Rainfall Runoff	Contra Costa County, 10 yrs
Physical	Pre-Development Physical
Initial Condition	Pre-Development Initial Condition
Boundary Condition	Pre-Development Boundary Condition
Infiltration and Inflow	Pre-Development Infiltration and Inflow
Output	Pre-Development Output
User Data Extensions	Pre-Development User Data Extensions
PondPack Engine Calculation Options	Base Calculation Options

Output Summary			
Output Increment	0.050 hours	Duration	24.000 hours

Rainfall Summary			
Return Event Tag	10	Rainfall Type	Time-Depth Curve
Total Depth	5.2201 in	Storm Event	Type I, 24hr (5.22 in)

Executive Summary (Nodes)

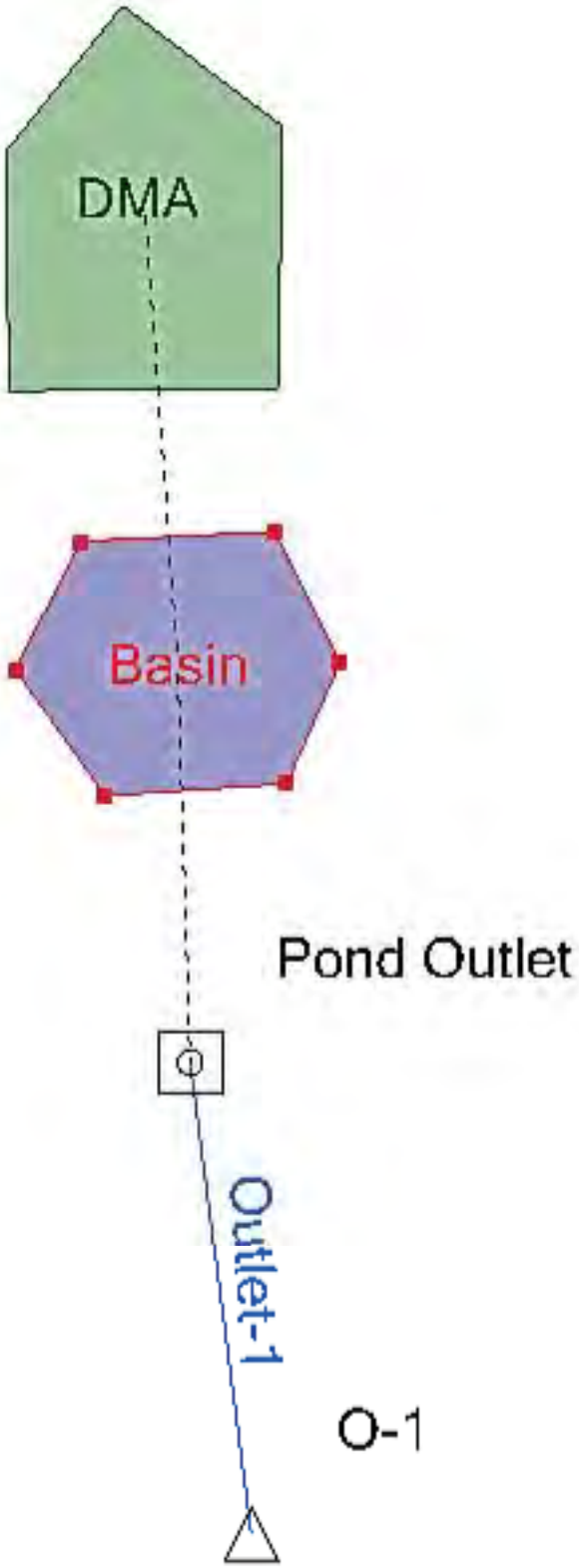
Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
DMA	Pre-Development Contra Costa County, 10 yrs	10	None	3.629	9.900	33.53	(N/A)	(N/A)
O-1	Pre-Development Contra Costa County, 10 yrs	10	None	3.629	9.900	33.53	(N/A)	(N/A)

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ac-ft)	Peak Time (hours)	Peak Flow (ft³/s)	End Point	Node Flow Direction

Messages

APPENDIX L
PONDPACK RESULTS: POST - CONDITIONS


DMA
Basin
Pond Outlet
Outlet-1
O-1

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
DMA	Post-Development Contra Costa County, 10 yrs	10	1.869	9.950	17.01
DMA	Pre-Development Contra Costa County, 10 yrs	10	3.629	9.900	33.53

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
O-1	Post-Development Contra Costa County, 10 yrs	10	0.321	10.400	2.31
O-1	Pre-Development Contra Costa County, 10 yrs	10	3.629	9.900	33.53

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Basin (IN)	Post-Development Contra Costa County, 10 yrs	10	1.869	9.950	17.01	(N/A)	(N/A)
Basin (OUT)	Post-Development Contra Costa County, 10 yrs	10	0.321	10.400	2.31	551.13	0.567

Storm Event	Type I, 24hr (5.22 in)
Return Event	10 years
Duration	24.000 hours
Depth	5.2201 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	14.130 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	9.922 hours
Flow (Peak, Computed)	34.66 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	9.900 hours
Flow (Peak Interpolated Output)	33.53 ft^3/s

Drainage Area	
SCS CN (Composite)	80.000
Area (User Defined)	14.130 acres
Maximum Retention (Pervious)	2.5000 in
Maximum Retention (Pervious, 20 percent)	0.5000 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	3.0857 in
Runoff Volume (Pervious)	3.633 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	3.629 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	192.12 ft^3/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.056 hours
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Summary for Hydrograph Addition at 'O-1'

Upstream Link	Upstream Node
Outlet-1	Basin

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	Outlet-1	0.321	10.400	2.31
Flow (In)	O-1	0.321	10.400	2.31

Summary for Hydrograph Addition at 'O-1'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	DMA

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	DMA	3.629	9.900	33.53
Flow (In)	O-1	3.629	9.900	33.53

Requested Pond Water Surface Elevations	
Minimum (Headwater)	548.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	551.75 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir - 1	Forward	RI#1 to EX. FI#1	550.75	551.75
Stand Pipe	Riser#1 (RI#1)	Forward	RI#1 to EX. FI#1	551.00	551.75
Orifice-Circular	Orifice - 1	Forward	RI#1 to EX. FI#1	550.50	551.75
Culvert-Circular	RI#1 to EX. FI#1	Forward	TW	547.16	551.75
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Riser#1 (RI#1) Structure Type: Stand Pipe	
Number of Openings	1
Elevation	551.00 ft
Diameter	36.0 in
Orifice Area	7.1 ft²
Orifice Coefficient	0.600
Weir Length	9.42 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: RI#1 to EX. FI#1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	10.0 in
Length	13.60 ft
Length (Computed Barrel)	13.60 ft
Slope (Computed)	0.010 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.040
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	0.000
T2 ratio (HW/D)	1.192
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	547.16 ft	T1 Flow	1.74 ft³/s
T2 Elevation	548.15 ft	T2 Flow	1.99 ft³/s

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	550.50 ft
Orifice Diameter	4.5 in
Orifice Coefficient	0.600

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	550.75 ft
Weir Length	2.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft^3/s
Flow Tolerance (Maximum)	10.000 ft^3/s

Subsection: Composite Rating Curve
Label: Outlet

Return Event: 10 years
Storm Event: Type I, 24hr (5.22 in)

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
548.00	0.00	(N/A)	0.00
548.50	0.00	(N/A)	0.00
549.00	0.00	(N/A)	0.00
549.50	0.00	(N/A)	0.00
550.00	0.00	(N/A)	0.00
550.50	0.00	(N/A)	0.00
550.75	0.11	(N/A)	0.00
551.00	1.05	(N/A)	0.00
551.50	5.95	(N/A)	0.00
551.75	6.14	(N/A)	0.00

Contributing Structures
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
(no Q: Weir - 1,Riser#1 (RI#1),Orifice - 1,RI#1 to EX. FI#1)
Orifice - 1,RI#1 to EX. FI#1 (no Q: Weir - 1,Riser#1 (RI#1))
Weir - 1,Orifice - 1,RI#1 to EX. FI#1 (no Q: Riser#1 (RI#1))
Riser#1 (RI#1),RI#1 to EX. FI#1 (no Q: Weir - 1,Orifice - 1)
Riser#1 (RI#1),RI#1 to EX. FI#1 (no Q: Weir - 1,Orifice - 1)

Subsection: Elevation-Volume-Flow Table (Pond)
Label: Basin

Return Event: 10 years
Storm Event: Type I, 24hr (5.22 in)

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	5.0000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	548.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (acres)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
548.00	0.00	0.000	0.179	0.00	0.00	0.00
548.50	0.00	0.089	0.179	0.90	0.90	44.22
549.00	0.00	0.179	0.179	0.90	0.90	87.54
549.50	0.00	0.268	0.179	0.90	0.90	130.86
550.00	0.00	0.358	0.179	0.90	0.90	174.17
550.50	0.00	0.447	0.179	0.90	0.90	217.49
550.75	0.11	0.493	0.188	0.95	1.06	239.86
551.00	1.05	0.542	0.198	1.00	2.04	264.17
551.50	5.95	0.643	0.204	1.03	6.98	318.20
551.75	6.14	0.694	0.204	1.03	7.17	343.08

PondMaker Worksheet Detailed Report: Worksheet (Basin)

Element Details

ID	92
Label	Worksheet (Basin)
Select Pond to Design	Basin
Flow Allowed Below Target	100.0
Flow Allowed Above Target	0.0
Flow Allowed Below Target	100.0
Flow Allowed Above Target	0.0
Volume Allowed Below Target	100.0
Volume Allowed Above Target	0.0
Tolerance Display	Display numerical values for tolerance fields

Notes

Volume

Pond Type	Elevation-Area	Use Void Space?	False

Elevation-Area

Pond Elevation (ft)	Pond Area (acres)
548.00	0.179
549.00	0.179
550.50	0.179
551.17	0.204
551.75	0.204

Infiltration

Infiltration Method	Average Infiltration Rate	Infiltration Rate (Average)	5.0000 in/h

Output

Detention Time	Compute All Methods

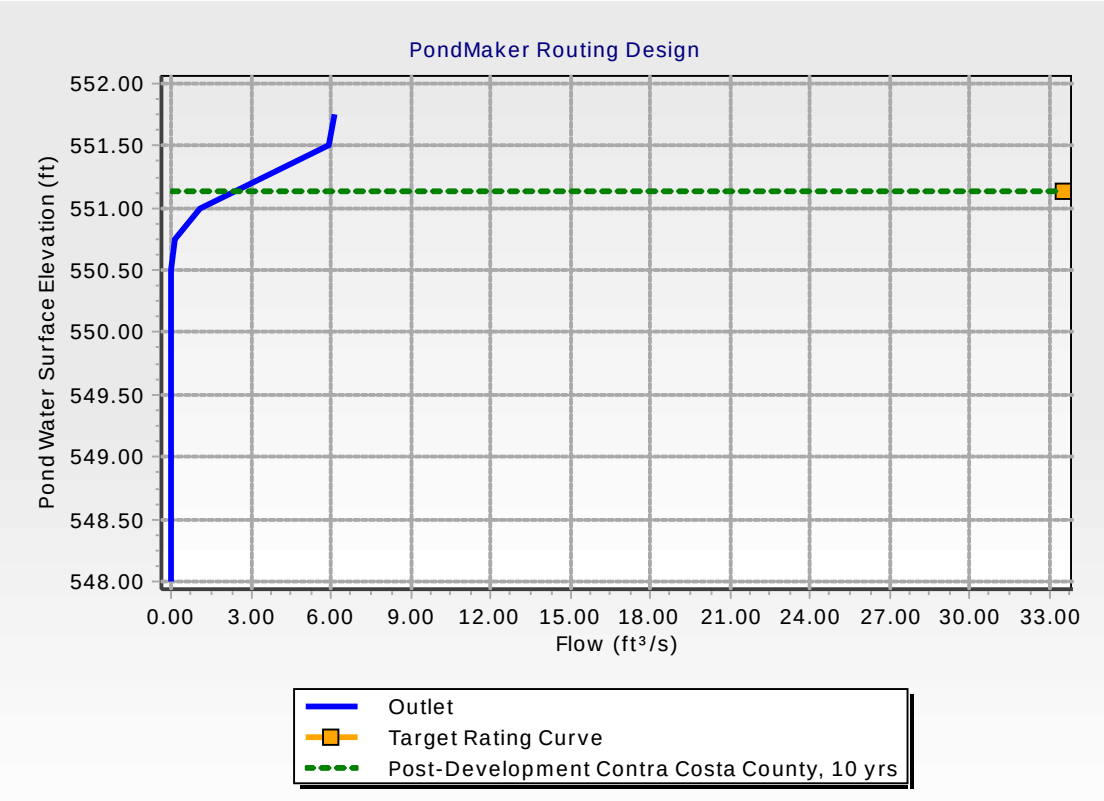
Initial Conditions

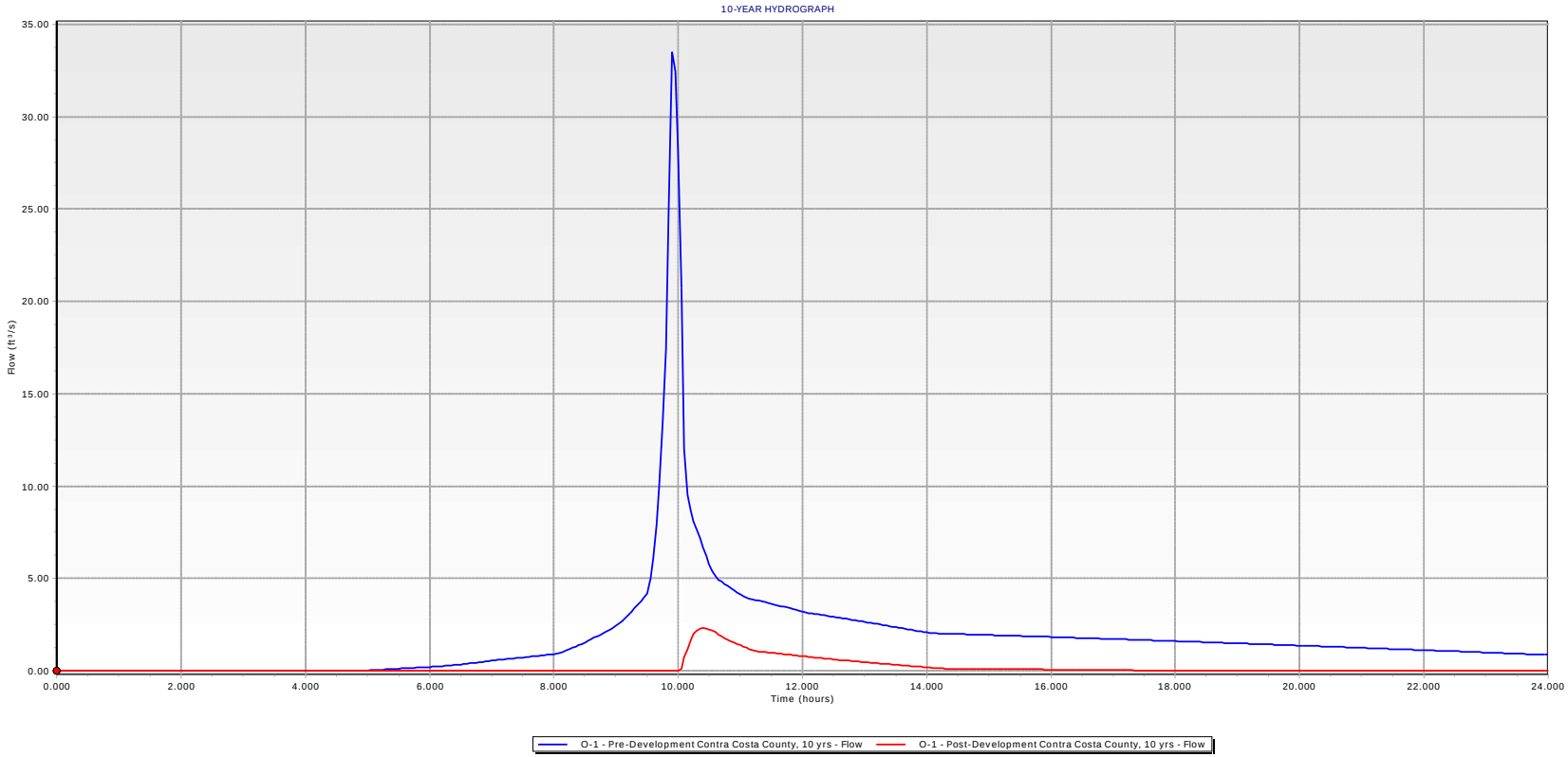
Is Outflow Averaging On?	False	Define Starting Water Surface Elevation	Pond Invert

PondMaker Worksheet (Routing Design)

Design Scenario	Design Return Event	Target Peak Outflow (ft³/s)	Computed Peak Outflow (ft³/s)	Computed Peak Outflow vs. Target (ft³/s)	Target Outflow Volume (ac-ft)
Post-Development Contra Costa County, 10 yrs	10	33.53	2.31	-31.22	3.629

Computed Volume Outflow (ac-ft)	Computed Outflow Volume vs. Target (ac-ft)	Routing Outlet Structure	Computed Max Water Elevation (ft)	Freeboard Depth (ft)	Maximum Storage (ac-ft)
0.321	-3.307	Outlet	551.13	0.62	0.567




10-YEAR HYDROGRAPH
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
Flow (ft^3/s)
0.000
2.000
4.000
6.000
8.000
10.000
12.000
14.000
16.000
18.000
20.000
22.000
24.000
Time (hours)
O-1 - Pre-Development Contra Costa County, 10 yrs - Flow
O-1 - Post-Development Contra Costa County, 10 yrs - Flow

PRELIMINARY STORMWATER CONTROL PLAN
for
SOUTH CAMINO PABLO ANNEXATION PROJECT
TOWN OF MORAGA, CALIFORNIA

January, 2019

APN: 725-829-001
Subdivision 9396

Prepared for:
Town of Moraga

Applicant/Developer:
Dobbins Properties, LLC
1520 W. Kettleman Lane, Suite 1-A
Lodi, CA 95242

CONSULTING
PLANNING · ENGINEERING · CONSTRUCTION

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Appendix C—Stormwater Control/C.3 Exhibit (one 11x17 map for quick reference and one full-sized map)

I. PROJECT DATA

Table 1. Project Data

Project Name/Number	South Camino Pablo Annexation Project
Application Submittal Date	January, 2019
Project Location	APN 725-829-001, 1211 Camino Pablo, Moraga, California
Name of Developer	Dobbins Properties, LLC
Project Phase No.	NA
Project Type and Description	Single Family Residential
Project Mean Annual Precipitation	29"
Total Project Site Area (acres)	23.90
Total Area of Land Disturbed (acres)	11.09
Total New Impervious Surface Area (sq. ft.)	109,612 sf
Total Replaced Impervious Surface Area	7,318 sf
Total Pre-Project Impervious Surface Area	7,819 sf
Total Post-Project Impervious Surface Area	116,930 sf
50% Rule	NA
Project Density	
Applicable Special Project Categories	3-DUA PD and Non-MOSO (single family residential)
Percent LID and non LID treatment	100% LID and 0% Non-LID
`HMP Compliance	Yes

II. PROJECT SETTING

II.A. PROJECT LOCATION AND DESCRIPTION

South Camino Pablo Annexation is a proposed single family residential project, Subdivision #9396, consisting of 13 lots. The following lots are between 15,000 and 20,000 square feet: 3, 4, 7, 8, 12 and 13. The remaining lots are over 20,000 square feet. Furthermore, the lots contain homes of approximately 3,000 square feet to 5,300 square feet, with an average size of about 4,000 square feet. The roughly 23.90-acre project is located at 1211 Camino Pablo, unincorporated Moraga, and will be annexed to the Town of Moraga. Approximately 0.24 acres of the project site will be dedicated to the Town of Moraga for widening Camino Pablo. The project site is bordered by Sanders Ranch Road to the north and west, Camino Pablo to the west, single family residential lots to the south, and agricultural land to the east. The existing site is comprised of agricultural land, wetlands, and brush. A vicinity map is included in Appendix A.

II.B. EXISTING SITE FEATURES AND CONDITIONS

This site consists of relatively steep hillside terrain and is open grassland. There are several jurisdictional areas located southwest and northeast of the site. A jurisdictional area of approximately 1,800 square feet is located southwest of the site and another jurisdictional area of roughly 850 square feet is northeast of the site. Both areas will not be affected by the proposed development. The majority of the site slopes westerly off the top of hills located along the eastern boundary of the site. The site has elevations ranging from 566 to 612 along the southern boundary. The west boundary falls from elevation 566 at the southwest corner to a low point of elevation 552 near Tharp Drive and rises again along Sanders Ranch Road to an elevation of 616 at the northernmost boundary. The east boundary rises from elevation 616 in the north to elevation 652 at about the midpoint of the east boundary. Then the east boundary turns west to an elevation of 694 and roughly follows the crest of the hill southerly to a maximum elevation of 705 before falling again to 612 at the southeast corner. The site drains largely from the higher east side to the low elevation side along Camino Pablo and Sanders Ranch Road.

The site is currently zoned A2 (General Agriculture) based on Contra Costa County designation. Based on Moraga's General Plan, the site is currently zoned OS (open space) and 1-DUA (1 dwelling unit per acre).

A preliminary geologic exploration of the site was performed by ENGEO, Inc. in a report dated January 21, 2014 (Project No. 10741.000.000). A second exploration to supplement the finding of ENGEO's preliminary exploration was recorded in a report dated October 26, 2015 (Project No. 10741.000.000). The site is located within the Coast Ranges, which are a series of ridges and valleys trending in a northwest – southeast direction.

The site is not located within a State of California Earthquake Fault Zone, and no known active faults cross the site. The nearest known active faults are the Hayward fault, which is approximately 4 miles southwest of the site, and the Calaveras fault, which is approximately 5 miles east of the site. Because of the presence of these nearby active faults, the region is considered seismically active. Locally the site contains an inactive thrust fault crossing the southwestern portion of the site and another inactive thrust fault coinciding with Camino Pablo.

Landslide areas exist in the southern portion of the site, which is the area proposed for development, and portions of these mapped landslides have been recently active. Based on ENGEO's findings, the landslides range from about 5 to 15 feet thick. As a result, landslide mitigation measures will need to be performed prior to proposed development. The native soils that were studied on site consist of clay, silt, claystone, siltstone, and sandstone.

From a geological and geotechnical standpoint, it was concluded by ENGEO, Inc. that the site is generally suitable for the proposed residential development.

The soils found at this site fall under NRCS Hydrologic Soil Group 'D', per the on-line "Web Soil Survey" hosted by the US Department of Agriculture's Natural Resources Conservation Service.

II.C. OPPORTUNITIES AND CONSTRAINTS FOR STORMWATER CONTROL

Constraints include relatively impermeable soils (hydrologic soil groups C and D) where deep infiltration is not possible. The limits of disturbance are within soil group D.

A portion of the site will no longer be pervious and about half of the street will drain to the bioretention filters adjacent to the street, while the remaining portion of the street will drain to a bioretention filter running along the Camino Pablo frontage.

III. LOW IMPACT DEVELOPMENT DESIGN STRATEGIES

III.A. Optimization of Site Layout

The nature of a single family residential project means that the houses are spread out throughout the project site and allows for more open space areas. The proposed street width is the minimum permitted. The natural drainage pattern will be maintained.

III.B. Dispersal of Runoff to Pervious Area

Some of the storm water runoff will be conveyed directly by sheet flow or via the storm drain system from the surrounding impervious areas to the bioretention filters. Because of the proposed site topography, some of the storm water runoff from impervious areas will first flow to adjacent vegetated areas which, in turn will drain to the bioretention filters.

III.C. Bioretention Areas

The bioretention filters have been designed and will be constructed according to the criteria included in Contra Costa Clean Water Program Stormwater C.3 Guidebook, Seventh Edition. The bioretention filters will have the following characteristics:

- Volume or depth of surface reservoir meets or exceeds minimum.
- 18" deep "loamy sand" soil mix with long-term percolation rate of 5"/hour.
- Area of soil mix meets or exceeds minimum.
- Perforated pipe (PVC SDR 35 or approved equivalent) underdrain bedded near the top of the "Class 2 perm" layer with holes facing downward. Connection and sufficient head to storm drain to approved discharge point.
- No filter fabric will be used.
- The bioretention filter underdrain will be fitted with clean-out ports consisting of a vertical, rigid, non-perforated PVC pipe, with a diameter matching that of the underdrain, and a watertight cap.
- Location and footprint of facility are shown on site plan, landscaping plan, and grading plan.
- The bioretention filters will be designed as a basin with level edges or as a series of adjacent basins or swales with different elevations to match the proposed topography, and the grading plan will be consistent with these elevations. If the facility is designed as a series of basins or swales, check dams will be set so the lip

of the weir of each dam will be at least as high as the toe of the next upstream dam to permit the necessary amount of surface water storage before spill-over.

- Curb openings to the bioretention filter will be 12" wide, will have 4"-6" reveal and an apron or other provision to prevent blockage when vegetation grows in, and energy dissipation as needed.

- The bioretention filter overflow will be connected to a downstream storm drain or approved discharge point.

- In the case of extreme storms which overwhelm the bioretention filter overflow structure, excess water will be safely conveyed overland to streets and eventually outfall to Camino Pablo and to the existing storm drain system.

- Bioretention filter planting will be selected by the landscape architect and will be suitable for the climate, exposure, soil, and occasional inundation characteristic of a bioretention filter.

- The irrigation system will be connected to the water supply, on a separate zone and with appropriate backflow prevention devices.

- Vaults, utility boxes, and light standards will be located outside the minimum soil mix surface area.

- When excavating the bioretention filters, avoid 'smearing' (smoothing and compacting) of the soils on the bottom and side slopes Minimize compaction of native soils and 'rip' soils if clayey and/or compacted. Protect the area from construction site runoff.

- The volume of surface and subsurface storage will meet or exceed the minimum required.

- The bioretention filter underdrain will be connected to the outlet storm drain via an appropriately sized orifice or other flow-limiting device.

IV. DOCUMENTATION OF DRAINAGE DESIGN

IV.A. Description of Each Drainage Management Area

IV.A.1. Table of Drainage Management Areas

Table 3

DMA Name	*Surface Type*	*Area (square feet)*
DMA1-A	*Concrete/Asphalt*	*5,190*
DMA1-B	*Concrete/Asphalt*	*432*
DMA1-C	*Landscape*	*336*
DMA3-A	*Concrete/Asphalt*	*6,941*
DMA3-B	*Concrete/Asphalt*	*477*
DMA3-C	*Landscape*	*274*
DMA3-D	*Concrete/Asphalt*	*1,138*
DMA3-E	*Landscape*	*3,889*
DMA3-F	*Roof Area*	*3,639*
DMA4-A	*Roof Area*	*3,427*
DMA4-B	*Concrete/Asphalt*	*1,953*
DMA4-C	*Landscape*	*753*
DMA5-A	*Roof Area*	*2,923*
DMA5-B	*Concrete/Asphalt*	*1,463*
DMA5-C	*Landscape*	*2,054*
DMA6-A	*Roof Area*	*3,614*
DMA6-B	*Concrete/Asphalt*	*1,756*
DMA6-C	*Roof Area*	*4,685*
DMA6-D	*Concrete/Asphalt*	*1,455*
DMA6-E	*Roof Area*	*4,601*
DMA6-F	*Concrete/Asphalt*	*5,018*
DMA6-G	*Roof Area*	*3,421*
DMA6-H	*Concrete/Asphalt*	*2,199*
DMA6-I	*Roof Area*	*3,238*
DMA6-J	*Concrete/Asphalt*	*1,480*
DMA6-K	*Roof Area*	*3,448*
DMA6-L	*Concrete/Asphalt*	*1,898*
DMA6-M	*Roof Area*	*3,102*
DMA6-N	*Concrete/Asphalt*	*1,580*
DMA6-O	*Concrete/Asphalt*	*15,996*
DMA6-P	*Roof Area*	*3,406*
DMA6-Q	*Concrete/Asphalt*	*1,905*
DMA6-R	*Roof Area*	*2,449*
DMA6-S	*Concrete/Asphalt*	*1,265*
DMA6-T	*Roof Area*	*3,541*
DMA6-U	*Concrete/Asphalt*	*1,541*

DMA6-V	*Landscape*	*35,889*
DMA6-W	*Landscape*	*112,272*
DMA6-X	*Concrete/Asphalt*	*8,347*
DMA6-Y	*Concrete/Asphalt*	*5,948*
DMA6-Z	*Concrete/Asphalt*	*246*
DMA7-A	*Concrete/Asphalt*	*3,049*
DMA7-B	*Concrete/Asphalt*	*246*
DMA7-C	*Landscape*	*510*

IV.A.2 Drainage Management Area Descriptions

DMA1-A, totaling 5,190 square feet, drains a portion of the street and sidewalk. DMA1-A drains to bioretention swale IMP-1.

DMA1-B, totaling 432 square feet, drains a portion the driveways at Lots 6 and 7. DMA1-B drains to bioretention swale IMP-1.

DMA1-C, totaling 336 square feet, drains a portion of street frontage landscaping at Lots 7 and 8. DMA1-C drains to bioretention swale IMP-1.

DMA3-A, totaling 6,941 square feet, drains a portion of the street and sidewalk. DMA3-A drains to bioretention swale IMP-3.

DMA3-B, totaling 477 square feet, drains a portion of the driveways at Lots 8 and 9. DMA3-B drains to bioretention swale IMP-3.

DMA3-C, totaling 274 square feet, drains a portion of the street frontage landscaping. DMA3-C drains to bioretention swale IMP-3.

DMA3-D, totaling 1,138 square feet, drains the driveway and walkways at Lot 5. DMA3-D drains to bioretention swale IMP-3.

DMA3-E, totaling 3,889 square feet, drains a portion of the street frontage landscaping and the landscaping at Lot 5. DMA3-E drains to bioretention swale IMP-3.

DMA3-F, totaling 3,639 square feet, drains the roof of the house at Lot 5. DMA3-F drains to bioretention swale IMP-3.

DMA4-A, totaling 3,427 square feet, drains the roof of the Lot 6 house. DMA4-A drains to bioretention swale IMP-4.

DMA4-B, totaling 1,953 square feet, drains a portion of the Lot 6 driveway. DMA4-B drains to bioretention swale IMP-4.

DMA4-C, totaling 753 square feet, drains a portion of the Lot 6 landscaping. DMA4-C drains to bioretention swale IMP-4.

DMA5-A, totaling 2,923 square feet, drains the roof of the Lot 4 house. DMA5-A drains to bioretention swale IMP-5.

DMA5-B, totaling 1,463 square feet, drains the driveway and front flatwork at Lot 4. DMA5-B drains to bioretention swale IMP-5.

DMA5-C, totaling 2,054 square feet, drains a portion of the Lot 4 landscaping and a portion of the street frontage landscaping. DMA5-C drains to bioretention swale IMP-5.

DMA6-A, totaling 3,614 square feet, drains the roof of the Lot 7 house. DMA6-A drains to bioretention basin IMP-6.

DMA6-B, totaling 1,756 square feet, drains a portion of the Lot 7 driveway and walkway. DMA6-B drains to bioretention basin IMP-6.

DMA6-C, totaling 4,685 square feet, drains the roof of the Lot 8 house. DMA6-C drains to bioretention basin IMP-6.

DMA6-D, totaling 1,455 square feet, drains a portion of the Lot 8 driveway. DMA6-D drains to bioretention basin IMP-6.

DMA6-E, totaling 4,601 square feet, drains the roof of the Lot 9 house and accessory building. DMA6-E drains to bioretention basin IMP-6.

DMA6-F, totaling 5,018 square feet, drains a portion of the Lot 9 driveway. DMA6-F drains to bioretention basin IMP-6.

DMA6-G, totaling 3,421 square feet, drains the roof of the Lot 10 house. DMA6-G drains to bioretention basin IMP-6.

DMA6-H, totaling 2,199 square feet, drains a portion of the Lot 10 driveway. DMA6-H drains to bioretention basin IMP-6.

DMA6-I, totaling 3,238 square feet, drains the Lot 11 house roof. DMA6-I drains to bioretention basin IMP-6.

DMA6-J, totaling 1,480 square feet, drains a portion of the Lot 11 driveway. DMA6-J drains to bioretention basin IMP-6.

DMA6-K, totaling 3,448 square feet, drains the Lot 12 house roof. DMA6-K drains to bioretention basin IMP-6.

DMA6-L, totaling 1,898 square feet, drains the Lot 12 driveway. DMA6-L drains to bioretention basin IMP-6.

DMA6-M, totaling 3,102 square feet, drains the Lot 13 house roof. DMA6-M drains to bioretention basin IMP-6.

DMA6-N, totaling 1,580 square feet, drains the Lot 13 driveway and walkway. DMA6-N drains to bioretention basin IMP-6.

DMA6-O, totaling 15,996 square feet, drains a portion of the street. DMA6-O drains to bioretention basin IMP-6.

DMA6-P, totaling 3,406 square feet, drains the Lot 1 house roof. DMA6-P drains to bioretention basin IMP-6.

DMA6-Q, totaling 1,905 square feet, drains the Lot 1 driveway and walkway. DMA6-Q drains to bioretention basin IMP-6.

DMA6-R, totaling 2,449 square feet, drains the Lot 2 house roof. DMA6-R drains to bioretention basin IMP-6.

DMA6-S, totaling 1,265 square feet, drains the Lot 2 driveway and walkways. DMA6-S drains to bioretention basin IMP-6.

DMA6-T, totaling 3,541 square feet, drains the Lot 3 house roof. DMA6-T drains to bioretention basin IMP-6.

DMA6-U, totaling 1,541 square feet, drains the Lot 3 driveway and walkway. DMA6-U drains to bioretention basin IMP-6.

DMA6-V, totaling 35,889 square feet, drains a portion of the hillside behind the houses at Lots 2 and 3, together with the lot landscaping and street frontage landscaping at these lots. DMA6-V drains to bioretention basin IMP-6.

DMA6-W, totaling 112,272 square feet, drains the lot landscaping at Lots 7 – 13, a portion of the lot landscaping at Lot 6, the street frontage landscaping at Lots 12 and 13, a portion of the street frontage landscaping at Lot 11, and a portion of the street frontage landscaping at Camino Pablo. DMA6-W drains to bioretention basin IMP-6.

DMA6-X, totaling 8,347 square feet, drains a portion of the sidewalk and street widening at Camino Pablo. DMA6-X drains to bioretention basin IMP-6.

DMA6-Y, totaling 5,948 square feet, drains a portion of the existing road surface of Camino Pablo, which is to remain undisturbed. DMA6-Y drains naturally towards bioretention filter IMP-6 and serves as "in-lieu" impervious surface to be treated as compensation for the 5,861 square feet of DMA NT-1 which cannot be treated due to elevation constraints.

DMA6-Z, totaling 246 square feet, drains a portion of the Lot 11 driveway. DMA6-Z drains to bioretention basin IMP-6.

DMA7-A, totaling 3,049 square feet, drains a portion of the street and sidewalk. DMA7-A drains to bioretention swale IMP-7.

DMA7-B, totaling 246 square feet, drains a portion of the Lot 10 driveway. DMA7-B drains to bioretention swale IMP-7.

DMA7-C, totaling 510 square feet, drains a portion of the street landscaping. DMA7-C drains to bioretention swale IMP-7.

IV.B. Tabulation and Sizing Calculations

IV.B.1. Information Summary for IMP Design

Table 4

Total Project Area (SQ. FT)	1,043,845
Mean Annual Precipitation	29 inches
IMPs Designed For:	Treatment and Flow Control

IV.B.2. Self-Retaining Areas

There are no self-retaining areas.

IV.B.3. Self-Treating Areas

Table 5

DMA Name	*Area (square feet)*
ST-1	707,394
ST-2	20,194 sf
ST-3	33,702 sf

IV.B.4. Areas Draining to Self-Retaining Areas

There are no areas draining to self-retaining areas.

IV.B.5. Areas Draining to IMPs

Note: The product of the IMP Sizing Factor and the Rainfall Adjustment Factor is less than the minimum value of 0.04 for all IMPs shown in the tables below. The value of 0.04 was used to adjust the areas instead.

Table 6

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type:	IMP Name			
					D	IMP-1			
DMA1-A	5,190	Street & Sidewalk	1.00	5,190					
DMA1-B	432	Driveway & Walkway	1.00	432					
DMA1-C	336	Landscape	0.70	235					
			Total	5,857	IMP Sizing Factor	Rain Adjust-ment Factor	Minimum Area or Volume	Proposed Area or Volume	
				Area	0.050	0.613	234	294	

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type: D	IMP Name IMP-3			
DMA3-A	6,941	Street & Sidewalk	1.00	6,941					
DMA3-B	477	Driveway	1.00	477					
DMA3-C	274	Landscape	0.70	192					
DMA3-D	1,138	Driveway & Walkways	1.00	1,138					
DMA3-E	3,889	Landscape	0.70	2,722					
DMA3-F	3,639	Roof	1.00	3,639					
			Total	15,109	IMP Sizing factor	Rain Adjust-ment Factor	Minimum Area or Volume	Proposed Area or Volume	
				Area	0.05	0.613	604	608	

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type: D	IMP Name IMP-4		
DMA4-A	3,427	Roof	1.00	3,427				
DMA4-B	1,953	Driveway	1.00	1,953				
DMA4-C	753	Landscape	0.70	527				
			Total	5,907	IMP Sizing factor	Rain Adjust-ment Factor	Minimum Area or Volume	
				Area	0.050	0.613	236	308

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type: D	IMP Name IMP-5		
DMA5-A	2,923	Roof	1.00	2,923				
DMA5-B	1,463	Driveway	1.00	1,463				
DMA5-C	2,054	Landscape	0.70	1,438				
			Total	5,824	IMP Sizing factor	Rain Adjust-ment Factor	Minimum Area or Volume	Proposed Area or Volume
				Area	0.050	0.613	233	278

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type: D	IMP Name IMP-6
DMA6-A	3,614	Roof	1.00	3,614		
DMA6-B	1,756	Driveway & Walkway	1.00	1,756		
DMA6-C	4,685	Roof	1.00	4,685		
DMA6-D	1,455	Driveway	1.00	1,455		
DMA6-E	4,601	Roof	1.00	4,601		
DMA6-F	5,018	Driveway	1.00	5,018		
DMA6-G	3,421	Roof	1.00	3,421		
DMA6-H	2,199	Driveway	1.00	2,199		
DMA6-I	3,238	Roof	1.00	3,238		
DMA6-J	1,480	Driveway	1.00	1,480		

	DMA Area (square	Post-project surface type	DMA Runoff factor	DMA Area × runoff	Soil Type:	IMP Name

DMA Name	feet)			factor	D	IMP-6		
DMA6-K	3,448	Roof	1.00	3,448				
DMA6-L	1,898	Driveway	1.00	1,898				
DMA6-M	3,102	Roof	1.00	3,102				
DMA6-N	1,580	Driveway	1.00	1,580				
DMA6-O	15,996	Street & Sidewalk	1.00	15,996				
DMA6-P	3,406	Roof	1.00	3,406				
DMA6-Q	1,905	Driveway & Walkway	1.00	1,905				
DMA6-R	2,449	Roof	1.00	2,449				
DMA6-S	1,265	Driveway & Walkway	1.00	1,265				
DMA6-T	3,541	Roof	1.00	3,541				
DMA6-U	1,541	Driveway & Walkway	1.00	1,541				
DMA6-V	35,889	Landscape	0.70	25,122				
DMA6-W	112,272	Landscape	0.70	78,590				
DMA6-X	8,347	Street & Sidewalk	1.00	8,347				
DMA6-Y	5,948	Street	1.00	5,948				
DMA6-Z	246	Driveway	1.00	246				
			Total	189,852	IMP Sizing factor	Rain Adjust -ment Factor	Minimum Area or Volume	Proposed Area or Volume
				Area	0.050	0.613	7,594	7,899

DMA Name	*DMA Area (square feet)*	*Post-project surface type*	*DMA Runoff factor*	*DMA Area × runoff factor*	*Soil Type:*	*IMP Name*		
					D	*IMP-7*		
DMA7-A	*3,049*	*Street & Sidewalk*	*1.00*	*3,049*				
DMA7-B	*246*	*Driveway*	*1.00*	*246*				
DMA7-C	*510*	*Landscape*	*0.70*	*357*	*IMP Sizing factor*	*Rain Adjust-ment Factor*	*Minimum Area or Volume*	
			Total	*3,652*				
				Area	*0.050*	*0.613*	*146*	*174*

IV.B.6. Areas Not Treated

Table 7

DMA Name	Area (square feet)
NT-1	5,861

NT-1, located at the entrance of the proposed street, will not be treated due to elevation and slope constraints. However, DMA6-Y, located near the frontage of the site along Camino Pablo, will be treated in lieu of NT-1. DMA6-Y, which consists of existing street pavement at Camino Pablo, has a larger area (5,948 square feet) than the untreated area of NT-1 (5,861 square feet).

V. SOURCE CONTROL MEASURES

V.A. Site Activities and Potential Sources of Pollutants

The single-family residential project will create some potential sources of stormwater pollutants. Sources to be controlled include:

- Potential dumping of wash-water or other liquids into storm drain inlets.
- Need for future indoor or structural pest control.
- Fertilizers and pesticides used in open space, garden, and yard maintenance.
- Vehicle washing.

V.B. Source Control Table

Table 8

Potential Source	**Permanent Controls (BMPs)**	**Operational Controls (BMPs)**
On-site dumping into storm drain inlets	All accessible on-site inlets will be marked with the words "No Dumping! Flows to Creek"	Markings will be periodically repainted or replaced. Provide stormwater pollution prevention information to new site owners, lessees, or operators. Inlets and pipes conveying stormwater to BMPs will be inspected and maintained as part of BMP Operation and Maintenance Plan. The following statement will be included in all lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
Need for future indoor & structural pest control	Note building design features that discourage entry of pests.	Integrated Pest Management (IPM) information will be provided to new homeowners, lessees, and operators.
Landscape/outdoor pesticide use	Final landscape plans will: Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. Be designed to minimize irrigation and runoff, to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.	Landscape will be maintained using minimum or no pesticides. IPM information will be provided to new homeowners.

	Specify plantings within bioretention areas and swales that are tolerant of the sandy loam soil and periodic inundation. Include pest-resistant plants, especially adjacent to hardscape. Include plantings appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	
Vehicle washing	Driveways and parking areas drain to bioretention area or swales.	Distribute stormwater pollution prevention information to new homeowners.
Fire Sprinkler test Water	Fire Sprinkler test valves will be equipped with a means to divert test water to the sanitary sewer.	
Miscellaneous Drain or Wash Water	Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. Rooftop equipment with potential to produce pollutants shall be roofed	

	and/or have secondary containment. Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff. Include controls for other sources as specified by local reviewer.	

V.C. SELECTION & PRELIMINARY DESIGN OF STORMWATER TREATMENT BMPS

Requirements to manage increases in runoff peak flow (hydrograph modification management) will apply on this site because the proposed project area is more than the one-acre impervious threshold. Therefore, the site is required to provide both flow control and treatment for stormwater runoff. As currently proposed, stormwater runoff will continue to flow from the east side of the property down the natural hillside and the proposed graded bank and will be intercepted by a concrete ditch on a drainage terrace behind or through Lots 1 – 6. This ditch will convey runoff from the self-treating hillside to the outfall storm drain at Camino Pablo, bypassing the bioretention filters. Below this bench and ditch the proposed graded bank will continue down to the rear yards of Lots 1 – 6. Where practicable without the need for cross-lot storm drain easements, a separate rear-yard storm drain system will capture the runoff from the hillside and rear yard pervious areas and convey it to the storm drain system, bypassing the bioretention filters. In other cases, runoff from the pervious and impervious areas will be commingled and conveyed to bioretention filters adjacent to the street. In the flatter (uphill) part of the street, runoff from the street itself and runoff from some of the lots on the east side of the street will be diverted to bioretention filters next to the west side of the street. Where the street is too steep to permit the construction of a viable bioretention filter, lot and hillside runoff will spill over into the street and will be captured by an inlet near the intersection of the street and Camino Pablo. It will then be conveyed to the large bioretention filter along Camino Pablo. Lots on the west side of the street will drain downhill to the Camino Pablo bioretention filter, while lots on the south side of the property will drain southerly to a concrete ditch and storm drain which will convey the

runoff to this bioretention filter. After treatment and storage, runoff from the bioretention filters will be discharge to an outfall storm drain and conveyed off-site.

Mean seasonal rainfall is interpolated to be approximately 29 inches per year based on Contra Costa County Public Works Department drawing B-166 "Mean Seasonal Isohyets Compiled from Precipitation Records 1879 – 1973". Since there are treatment and flow control BMPs proposed, treatment facilities are sized using a factor of 1.00 for impervious areas and 0.7 for landscaped areas, based on requirements from Contra Costa Clean Water Program Stormwater C.3 Guidebook, Seventh Edition.

The proposed improvements will help decrease peak flows 1) by delaying discharge by causing the runoff to filter through the bioretention filters for treatment, and 2) by temporary storage of runoff in the subsurface gravel layer and on the surface of the bioretention filter before being collected and discharged into the existing storm drain system. Through implementation of the proposed C.3 measures on this site, the peak runoff flow volume will be decreased from existing conditions. The Stormwater Control/ C.3 Exhibit shows the IMPs and the corresponding areas of the site that drain to the various bioretention filters. The sizes of the impervious and pervious areas; as well as the corresponding IMPs are shown in *Table 2*.

V.C.1. General Treatment BMP Characteristics

Runoff from roofs, driveways, walkways, non-self-retaining landscaped areas, and the street will be collected and conveyed to several treatment BMPs, the bioretention filters.
BMPs are located not just for use as treatment facilities, but are also incorporated into the landscaping. The BMPs are located in an open area, within the ROW, or a few feet past the ROW where access for maintenance purposes will be unhindered. The BMPs have adequate hydraulic head to allow drainage into, through, and away from the BMP without the need for pumps. The bioretention filters are located along the western boundary at the Camino Pablo frontage, and along the upper, flatter portion of the proposed street. Runoff from the site will flow towards the bioretention filters or will be captured and conveyed to the bioretention filters by the storm drain system. Because of the proposed topography of the site, all runoff from impervious areas will be treated before discharging into the storm drain system, except as noted below.

VI. BMP OPERATION AND MAINTENANCE

VI.A. Ownership and Responsibility for Maintenance in Perpetuity

The applicant agrees to operate and maintain the stormwater treatment facilities (bioretention filters) constructed in connection with the project until the legal incorporation of a private entity (HOA). The private entity would be responsible for maintenance, execute agreements that run with the land to provide and pay for maintenance of treatment facilities, and execution of a Stormwater Management Facilities Operation and Maintenance Agreement and Right of Entry in the form provided by the County.

The applicant will submit, with the application of building permits, a draft Stormwater Facilities Operation and Maintenance Plan including detailed maintenance requirements and a maintenance schedule.

VI.B. Summary of Maintenance Requirements

Bioretention facilities capture sheet flow from rooftops and paved areas. The runoff briefly floods the surface of the treatment area and then percolates through an active soil layer to drain rock below. Typical routine maintenance consists of the following:

- Examine curb openings. Remove any debris and repair any damaged curb.
- Inspect inlets for channels, exposure of soils, or other evidence of erosion. Clear any obstructions and remove any accumulation of sediment.
- Inspect outlets for erosion or plugging.
- Inspect side slopes for evidence of instability or erosion and correct as necessary.
- Observe soil at the surface of the bioretention filter for uniform percolation throughout. If portions of the bioretention filter do not drain within 48 hours after the end of a storm, the soil should be tilled and replanted. Remove any debris or accumulations of sediment.
- Confirm that check dams and flow spreaders are in place and level and that channelization within the swale or filter is effectively prevented.
- Examine the vegetation to ensure that it is healthy and dense enough to provide filtering and to protect soils from erosion. Replenish mulch as necessary, remove fallen leaves and debris, prune large shrubs or trees, and mow turf areas. When mowing, remove no more than 1/3 of the height of grasses. Confirm that irrigation is adequate and not excessive. Replace dead plants and remove noxious and invasive vegetation.
- Abate any potential vectors by filling holes in the ground in and around the swale and by insuring that there are no areas where water stands longer than 48 hours following a storm. If mosquito larvae are present and persistent, contact the Contra Costa Mosquito and Vector Control District for information and

advice. Mosquito larvicides should be applied only when absolutely necessary and then only by a licensed individual or contractor.

VII. CONSTRUCTION PLAN C.3 CHECKLIST

Table 8

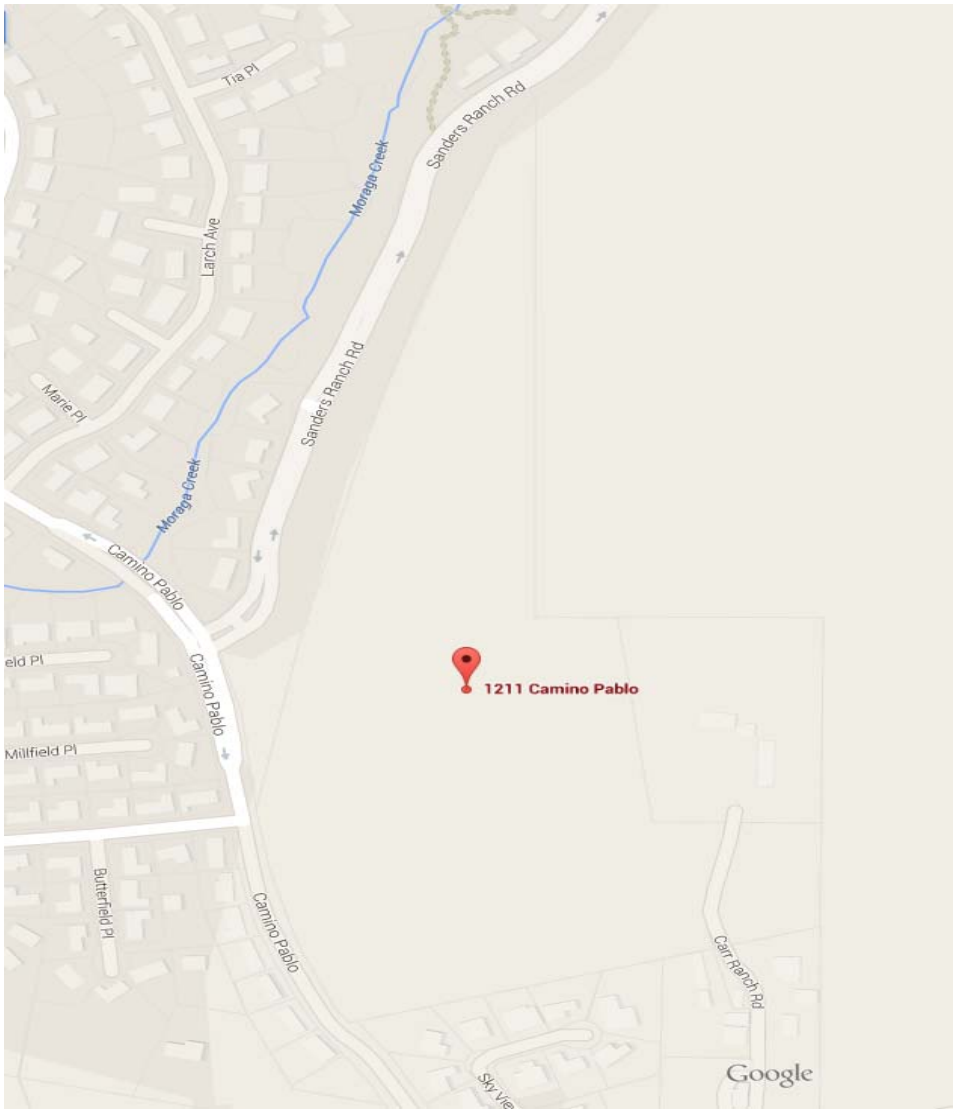
Stormwater Control Plan Page #	*BMP Description*	*See Plan Sheet #s*
7, 11	Runoff from DMA1-A is directed to IMP-1	2
7, 11	Runoff from DMA1-B is directed to IMP-1	2
7, 11	Runoff from DMA1-C is directed to IMP-1	2
7, 12	Runoff from DMA3-A is directed to IMP-3	2
7, 12	Runoff from DMA3-B is directed to IMP-3	2
7, 12	Runoff from DMA3-C is directed to IMP-3	2
7, 12	Runoff from DMA3-D is directed to IMP-3	2
7 12	Runoff from DMA3-E is directed to IMP-3	2
7, 12	Runoff from DMA3-F is directed to IMP-3	2
7, 12	Runoff from DMA4-A is directed to IMP-4	2
7, 12	Runoff from DMA4-B is directed to IMP-4	2
7, 12	Runoff from DMA4-C is directed to IMP-4	2
7, 13	Runoff from DMA5-A is directed to IMP-5	2
7, 13	Runoff from DMA5-B is directed to IMP-5	2
8, 13	Runoff from DMA5-C is directed to IMP-5	2
8, 13	Runoff from DMA6-A is directed to IMP-6	2
8, 13	Runoff from DMA6-B is directed to IMP-6	2
8, 13	Runoff from DMA6-C is directed to IMP-6	2
8, 13	Runoff from DMA6-D is directed to IMP-6	2
8, 13	Runoff from DMA6-E is directed to IMP-6	2
8, 13	Runoff from DMA6-F is directed to IMP-6	2
8, 13	Runoff from DMA6-G is directed to IMP-6	2
8, 13	Runoff from DMA6-H is directed to IMP-6	2
8, 13	Runoff from DMA6-I is directed to IMP-6	2
8, 13	Runoff from DMA6-J is directed to IMP-6	2
8, 14	Runoff from DMA6-K is directed to IMP-6	2
8, 14	Runoff from DMA6-L is directed to IMP-6	2
8, 14	Runoff from DMA6-M is directed to IMP-6	2
8, 14	Runoff from DMA6-N is directed to IMP-6	2
8, 14	Runoff from DMA6-O is directed to IMP-6	2
8, 14	Runoff from DMA6-P is directed to IMP-6	2
8, 14	Runoff from DMA6-Q is directed to IMP-6	2
9, 14	Runoff from DMA6-R is directed to IMP-6	2

9, 14	Runoff from DMA6-S is directed to IMP-6	2
9, 14	Runoff from DMA6-T is directed to IMP-6	2
9, 14	Runoff from DMA6-U is directed to IMP-6	2
9, 14	Runoff from DMA6-V is directed to IMP-6	2
9, 14	Runoff from DMA6-W is directed to IMP-6	2
9, 14	Runoff from DMA6-X is directed to IMP-6	2
9, 14	Runoff from DMA6-Y is directed to IMP-6	2
9, 14	Runoff from DMA6-Z is directed to IMP-6	2
9, 15	Runoff from DMA7-A is directed to IMP-7	2
9, 15	Runoff from DMA7-B is directed to IMP-7	2
9, 15	Runoff from DMA7-C is directed to IMP-7	2
10	ST-1 is self-treating	1, 2
10	ST-2 is self-treating	1, 2
10	ST-3 is self-treating	1, 2

VIII. CERTIFICATIONS

The selection, size, and preliminary design of treatment BMPs and other control measures in this plan meet the requirements of Regional Water Quality Control Board Order R2-2009-0074 and Order R2-2011-0083.

APPENDIX A


Tia Pl
Sanders Ranch Rd
Moraga Creek
Larch Ave
Marie Pl
Sanders Ranch Rd
Moraga Creek
Camino Pablo
Camino Pablo
1211 Camino Pablo
Millfield Pl
Butterfield Pl
Camino Pablo
Carr Ranch Rd
Google

APPENDIX B

Project Name: South Camino Pablo Annexation 1360
Project Type: Treatment and Flow Control
APN: 725-829-001
Drainage Area: 1,043,845
Mean Annual Precipitation: 29.0

Self-Treating DMAs

DMA Name	Area (sq ft)
ST-1	707,394.0
ST-2	20,194.0
ST-3	33,702.0

IV. Areas Draining to IMPs

IMP Name: IMP-1
IMP Type: Bioretention Facility
Soil Group: IMP-1

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 1-A	5,190	Concrete or Asphalt	1.00	5,190
DMA 1-B	432	Concrete or Asphalt	1.00	432
DMA 1-C	336	Landscape	0.70	235
			Total	5,857

	IMP Sizing			
	IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume
Area	0.050	0.613	234*	294
Surface Volume	0.042	0.613	151	160
Subsurface Volume	0.055	0.613	197	200
Maximum Underdrain Flow (cfs)				0.02
Orifice Diameter (in)				0.91

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

IMP Name: IMP-3
IMP Type: Bioretention Facility
Soil Group: IMP-3

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 3-A	6,941	Concrete or	1.00	6,941

IMP Sizing			
IMP Sizing	Rain	Minimum	Proposed

		Asphalt		
DMA 3-B	477	Concrete or Asphalt	1.00	477
DMA 3-C	274	Landscape	0.70	192
DMA 3-D	1,138	Concrete or Asphalt	1.00	1,138
DMA 3-E	3,889	Landscape	0.70	2,722
DMA 3-F	3,639	Conventional Roof	1.00	3,639
			Total	15,109

	Factor	Adjustment Factor	Area or Volume	Area or Volume
Area	0.050	0.613	604*	608
Surface Volume	0.042	0.613	389	400
Subsurface Volume	0.055	0.613	509	550
Maximum Underdrain Flow (cfs)				0.05
Orifice Diameter (in)				1.51

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

IMP Name: IMP-4
IMP Type: Bioretention Facility
Soil Group: IMP-4

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 4-A	3,427	Conventional Roof	1.00	3,427
DMA 4-B	1,953	Concrete or Asphalt	1.00	1,953
DMA 4-C	753	Landscape	0.70	527
			Total	5,907

IMP Sizing

	IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume
Area	0.050	0.613	236*	308
Surface Volume	0.042	0.613	152	165
Subsurface Volume	0.055	0.613	199	200
Maximum Underdrain Flow (cfs)				0.02
Orifice Diameter (in)				0.92

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

IMP Name: IMP-5

IMP Type: Bioretention Facility
Soil Group: IMP-5

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 5-A	2,923	Conventional Roof	1.00	2,923
DMA 5-B	1,463	Concrete or Asphalt	1.00	1,463
DMA 5-C	2,054	Landscape	0.70	1,438
			Total	5,824

IMP Sizing

	IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume
Area	0.050	0.613	233*	278
Surface Volume	0.042	0.613	150	160
Subsurface Volume	0.055	0.613	196	200
Maximum Underdrain Flow (cfs)				0.02
Orifice Diameter (in)				0.95

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

IMP Name: IMP-6
IMP Type: Bioretention Facility
Soil Group: IMP-6

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 6-A	3,614	Conventional Roof	1.00	3,614
DMA 6-B	1,756	Concrete or Asphalt	1.00	1,756
DMA 6-C	4,685	Conventional Roof	1.00	4,685
DMA 6-D	1,455	Concrete or Asphalt	1.00	1,455
DMA 6-E	4,601	Conventional Roof	1.00	4,601
DMA 6-F	5,018	Concrete or Asphalt	1.00	5,018
DMA 6-G	3,421	Conventional Roof	1.00	3,421
DMA 6-H	2,199	Concrete or Asphalt	1.00	2,199
DMA 6-I	3,238	Conventional Roof	1.00	3,238

IMP Sizing

IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume

DMA 6-J	1,480	Concrete or Asphalt	1.00	1,480				
DMA 6-K	3,448	Conventional Roof	1.00	3,448				
DMA 6-L	1,898	Concrete or Asphalt	1.00	1,898				
DMA 6-M	3,102	Conventional Roof	1.00	3,102				
DMA 6-N	1,580	Concrete or Asphalt	1.00	1,580				
DMA 6-O	15,996	Concrete or Asphalt	1.00	15,996				
DMA 6-P	3,406	Conventional Roof	1.00	3,406				
DMA 6-Q	1,905	Concrete or Asphalt	1.00	1,905				
DMA 6-R	2,449	Conventional Roof	1.00	2,449				
DMA 6-S	1,265	Concrete or Asphalt	1.00	1,265				
DMA 6-T	3,541	Conventional Roof	1.00	3,541				
DMA 6-U	1,541	Concrete or Asphalt	1.00	1,541				
DMA 6-V	35,889	Landscape	0.70	25,122				
DMA 6-W	112,272	Landscape	0.70	78,590				
DMA 6-X	8,347	Concrete or Asphalt	1.00	8,347				
DMA 6-Y	5,948	Concrete or Asphalt	1.00	5,948				
DMA 6-Z	246	Concrete or Asphalt	1.00	246				
			Total	189,852				
				Area	0.050	0.613	7,594*	7,899
				Surface Volume	0.042	0.613	4,886	5,000
				Subsurface Volume	0.055	0.613	6,399	6,600
							Maximum Underdrain Flow (cfs)	0.68
							Orifice Diameter (in)	5.70

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

IMP Name: IMP-7

IMP Type: Bioretention Facility
Soil Group: IMP-7

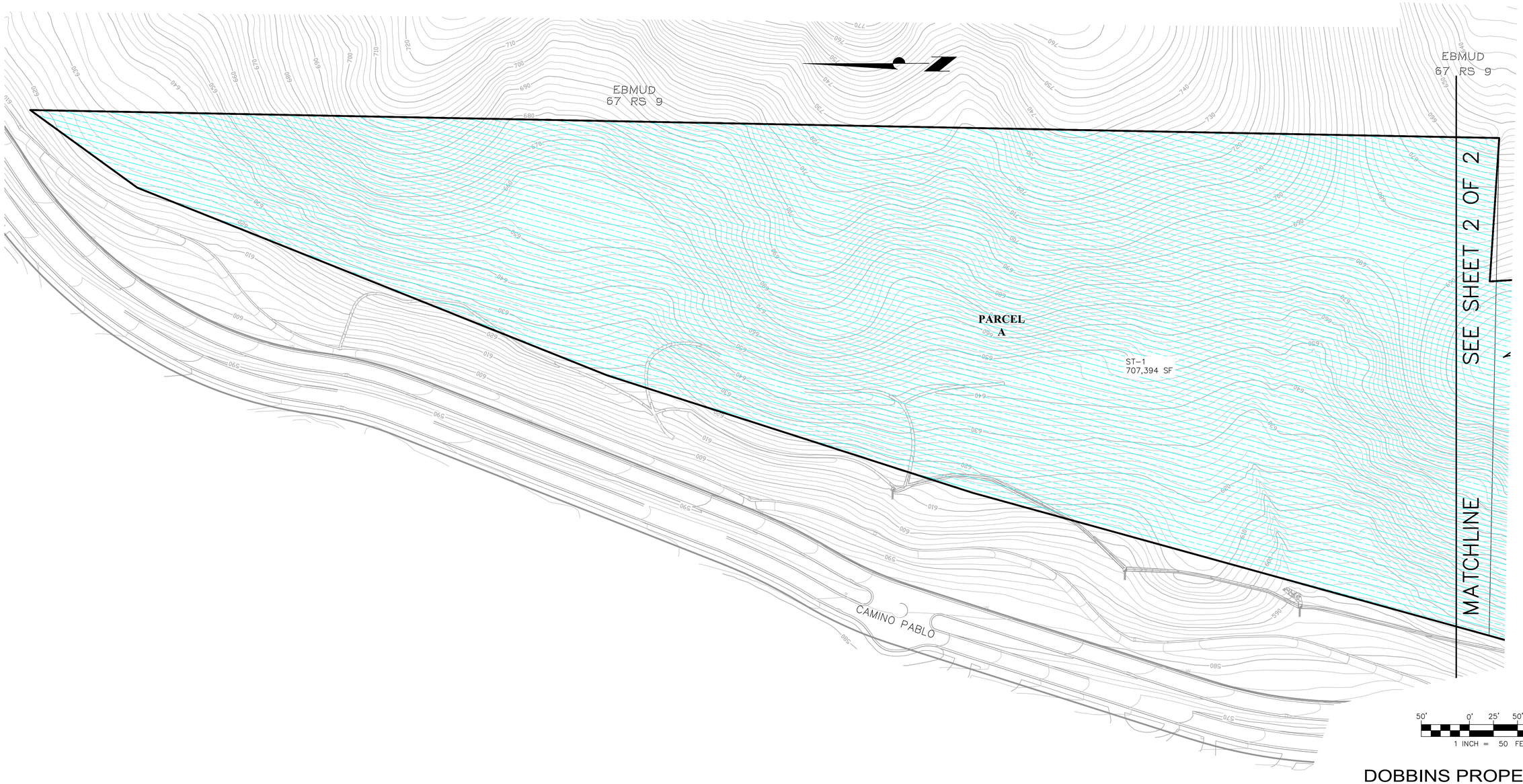
DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 7-A	3,049	Concrete or Asphalt	1.00	3,049
DMA 7-B	246	Concrete or Asphalt	1.00	246
DMA 7-C	510	Landscape	0.70	357
			Total	3,652

IMP Sizing

	IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume
Area	0.050	0.613	146*	174
Surface Volume	0.042	0.613	94	100
Subsurface Volume	0.055	0.613	123	150
Maximum Underdrain Flow (cfs)				0.01
Orifice Diameter (in)				0.73

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

APPENDIX C



LEGEND

- C.3 BIORETENTION BASIN
- AREAS DRAINING TO IMP-1
- AREAS DRAINING TO IMP-3
- AREAS DRAINING TO IMP-4
- AREAS DRAINING TO IMP-5
- AREAS DRAINING TO IMP-6
- AREAS DRAINING TO IMP-7
- IMP INTEGRATED MANAGEMENT PRACTICE
- DMA DRAINAGE MANAGEMENT AREA
- SELF-TREATING AREA (ST)
- AREA NOT TREATED (NT)
- STORM DRAIN – TREATED
- STORM DRAIN – UNTREATED

DOBBINS PROPERTIES, LLC

SOUTH CAMINO PABLO ANNEXATION SUBDIVISION 9396

TOWN OF MORAGA, CA

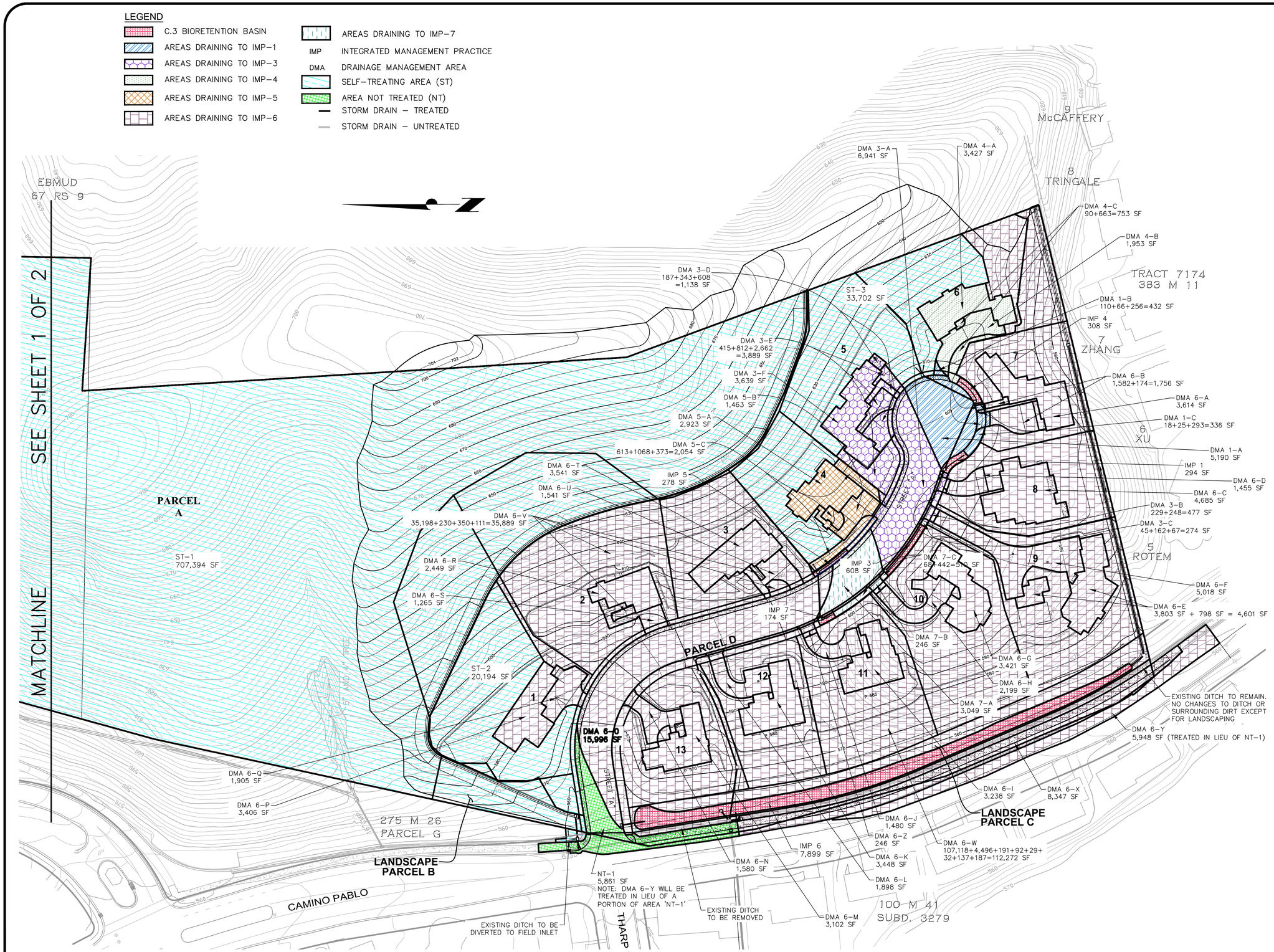
STORMWATER CONTROL PLAN

JANUARY, 2019

dk CONSULTING
ENGINEERING · PLANNING · SURVEYING
1931 SAN MIGUEL DRIVE, SUITE 100, WALNUT CREEK, CALIFORNIA 94596, (925) 932-6868

F:\PROJECTS\2013\13-1060-CAMINO PABLO\DWG\PLANNING\C.3\C-3-1060.DWG 12/19/2018

dk JOB# 13-1060-10



DOBBINS PROPERTIES, LLC
SOUTH CAMINO PABLO ANNEXATION SUBDIVISION 9396
TOWN OF MORAGA, CA
STORMWATER CONTROL PLAN
JANUARY, 2019

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dk JOB# 13-1060-10

ADDENDUM 1:
South Camino Pablo Annexation
Hydrologic & Hydraulic Analyses

Developer:
Dobbins Properties, LLC

Job# 13-1060-12
May 16, 2019

Prepared for:
Town of Moraga

ENGINEERING
SURVEYING • PLANNING

1931 San Miguel Drive, Suite 100, Walnut Creek, California 94596 / (925) 932-6868
www.dkEngin.com

Attachments

A Pre- and Post-Development Watershed Maps

B Contra Costa County Flood Control Isohyets

C Contra Costa County Precipitation Duration-Frequency-Depth Curves

D Pondpack Results: Pre-Development Conditions

E Pondpack Results: Post-Development Conditions

F 10-Year Runoff Hydrograph

This Addendum 1 is an addendum to the *Camino Pablo Annexation Hydrologic & Hydraulic Analyses,* prepared by dk Consulting, dated January 2019. This addendum was prepared to address questions raised by the Town of Moraga's CEQA consultant concerning the overall stormwater runoff flow rates from the entire area tributary to the existing 24" storm drain for the pre- and post-development conditions.

Discussion

Further analysis was required to accurately portray the effect of the proposed detention basin on the overall peak runoff from the site. Pondpack software was utilized to model the drainage areas and detention basin. Pondpack is a FEMA-approved software program for detention basin design and hydrology modeling. It was used for this analysis to design the basin size and outlet structure as well as calculate runoff flows for each of the watershed's drainage areas.

Several parameters were used to reflect the physical conditions that would prevail at the site. These parameters are listed below:

- Watershed delineations: Contributing drainage areas were delineated at points of concentration downstream from the watersheds for both the pre-and post-project site conditions. These delineations are displayed in Attachment A with their areas and other modeling parameters.
- Curve Numbers: A uniform Curve Number (CN) of 80 was assigned to the pre- condition watersheds based on USDA Natural Resources Conservation Service standard tables assuming pasture and grasslands in good condition on hydrologic group D soils. A uniform Curve Number (CN) of 85 was assigned to the post- condition watersheds based on these standard tables assuming residential districts of approximately 1/2 acre lots on hydrologic group D soils. A curve number of 98 was used for the portion of Camino Pablo which drains onto the site.
- SCS design storms: Contra Costa County isohyets (Attachment B) were used to determine a mean annual precipitation of 29 inches for the project site. The County's Precipitation Duration-Frequency-Depth Curves (Attachment C) indicate that the total anticipated 10-year, 24-hour rainfall event is on the order of 5.22 inches. This rainfall depth was modeled with a SCS Type 1 storm distribution.
- Basin volumes: Stage-storage relations for the detention basin were derived from grading information provided on the tentative map.
- Time of Concentration: The time of concentration for each subbasin was calculated using the TR-55 method. This combines sheet flow, shallow concentrated flow and open channel flow from the most hydraulically distant point of the watershed to the point of interest, which in this situation is the existing 24" storm drain. The time of concentration for each watershed is shown on the Hydrology Maps in Attachment A.

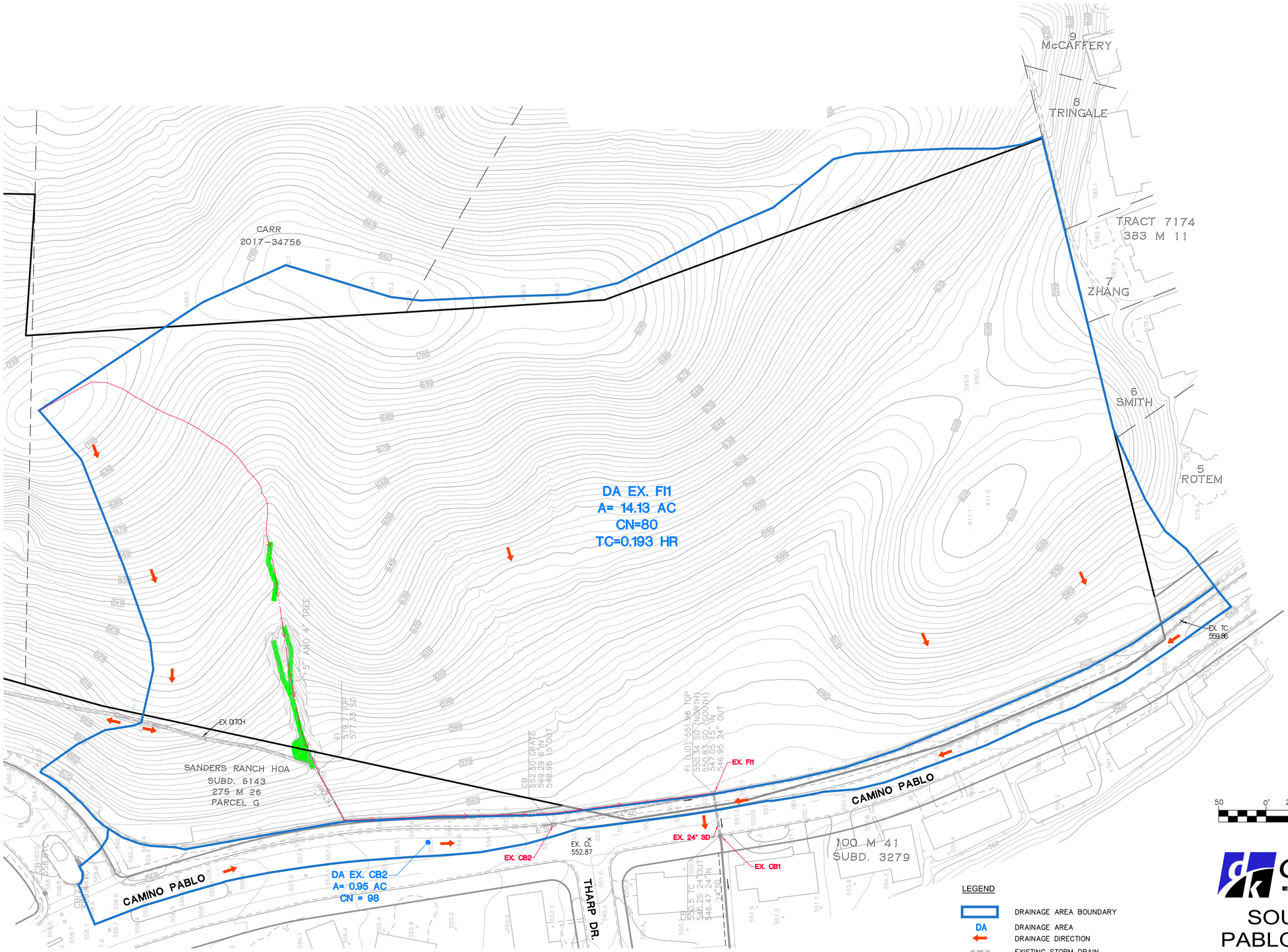
The Pondpack results for the pre-development condition are shown in Attachment D. The analysis shows a pre-development peak runoff flow rate of 31.97 cfs at the existing 24” storm drain. The results for the post-development condition are found in Attachment E. The analysis shows a post-development peak runoff flow rate of 22.50 cfs at the existing 24” storm drain.

There is a 29.6% reduction in the peak stormwater runoff flow as a result of the detention basin; therefore, the proposed development is significantly improving runoff conditions for this watershed. This is due to the capture of a considerable percentage of the project’s developed area by the detention basin, which receives the increased post-construction flow, stores it and releases it gradually over time. The outlet structure, described in Attachment E, is fitted with a flow-restricting orifice which controls the release of stormwater from the basin, effectively modifying the overall runoff hydrograph to have a reduced peak flow.

Attachment F shows the 10-year hydrographs for the pre- and post-development runoff flows over the course of the storm event. The hydrographs demonstrate the difference in runoff flows over the course of the storm event with the volume between the two graphs equaling the volume of water detained by the proposed basin.

ATTACHMENT A

HYDROLOGY MAPS



SEE OFF-SITE
STORM EXHIBIT

LEGEND

	DRAINAGE AREA BOUNDARY
DA	DRAINAGE AREA
	DRAINAGE DIRECTION
	EXISTING STORM DRAIN
EX. CB#	EXISTING CATCH BASIN #
EXISTING FI#	EXISTING FIELD INLET #
	STORM DRAIN DIRECTION
	JURISDICTIONAL AREA
	TIME OF CONCENTRATION FLOW PATH

50 0' 25 50 100 200

(IN FEET)
1 INCH = 50 ft.

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SOUTH CAMINO PABLO ANNEXATION

PRE CONSTRUCTION
HYDROLOGY MAP FOR
PONDPACK ANALYSIS
TOWN OF MORAGA, CALIFORNIA
MAY, 2019

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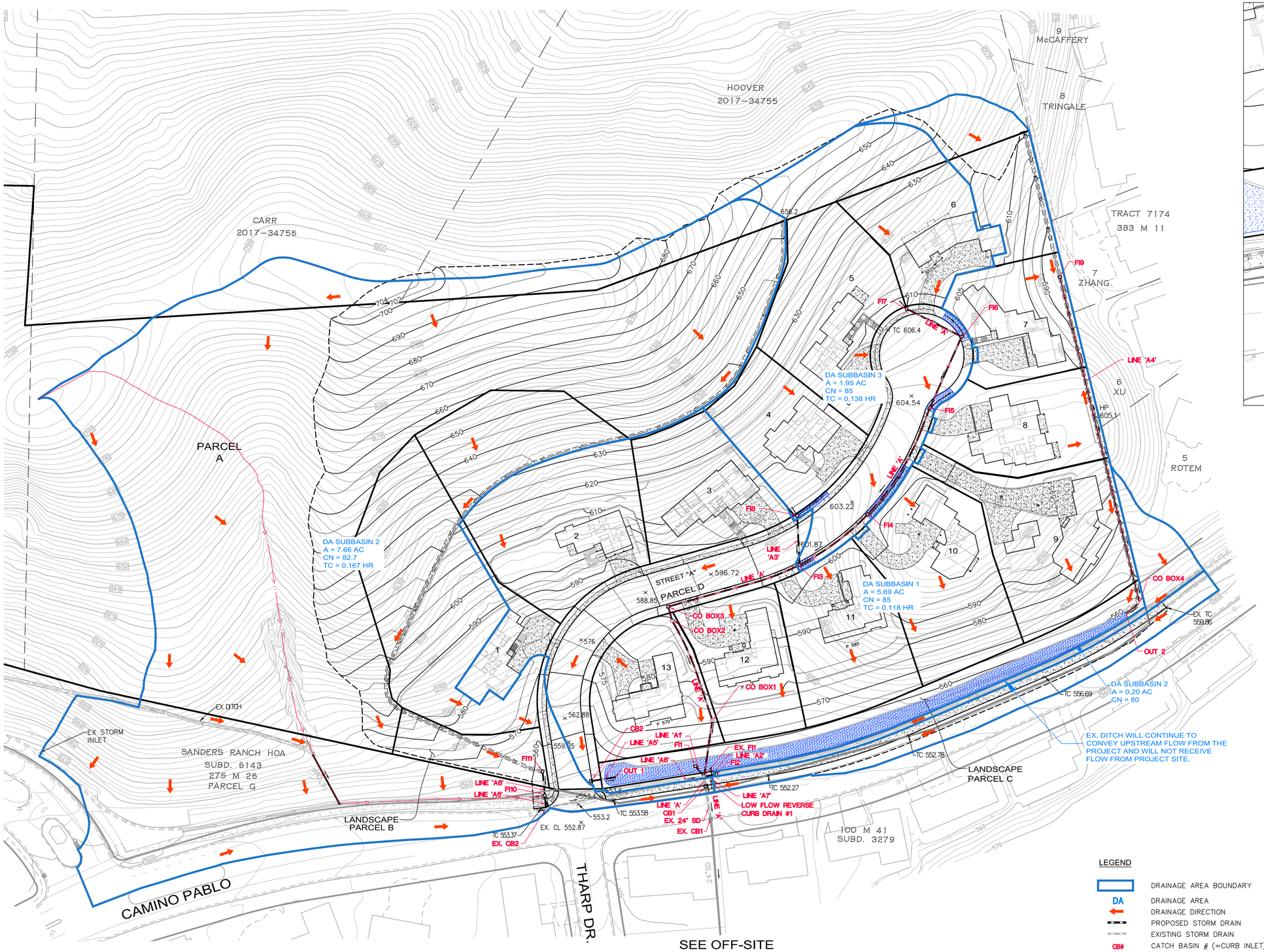
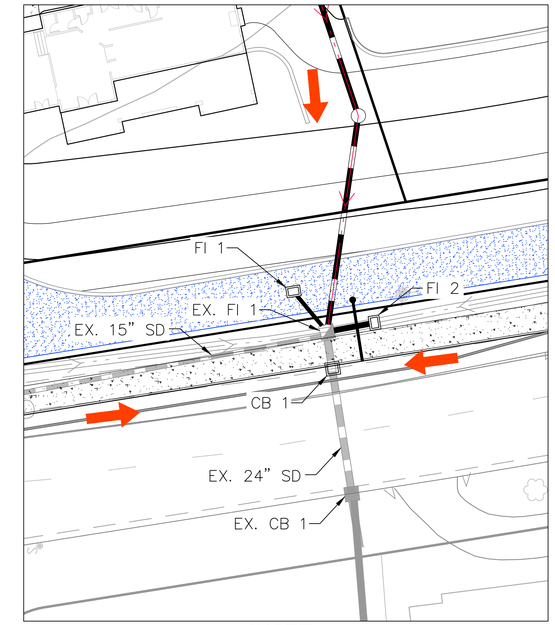
dk JOB# 13-1060-12





INSET
SCALE: 1"=20'

SEE OFF-SITE
STORM EXHIBIT

NOTE:
ALL BUILDINGS AND DRIVEWAYS AS A PART OF
THIS PLAN ARE CONCEPTUAL.

LEGEND

	DRAINAGE AREA BOUNDARY
DA	DRAINAGE AREA
	DRAINAGE DIRECTION
	PROPOSED STORM DRAIN
	EXISTING STORM DRAIN
CB#	CATCH BASIN # (=CURB INLET)
CO BOX#	CLEANOUT BOX #
FI#	FIELD INLET #
LINE#	STORM DRAIN LINE #
OUT	OUTFALL AT BIORETENTION FILTER
	STORM DRAIN DIRECTION

50 0' 25 50 100 200
(IN FEET)
1 INCH = 50 ft.

dk CONSULTING
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SOUTH CAMINO PABLO ANNEXATION

HYDROLOGY MAP

TOWN OF MORAGA, CALIFORNIA
MAY, 2019

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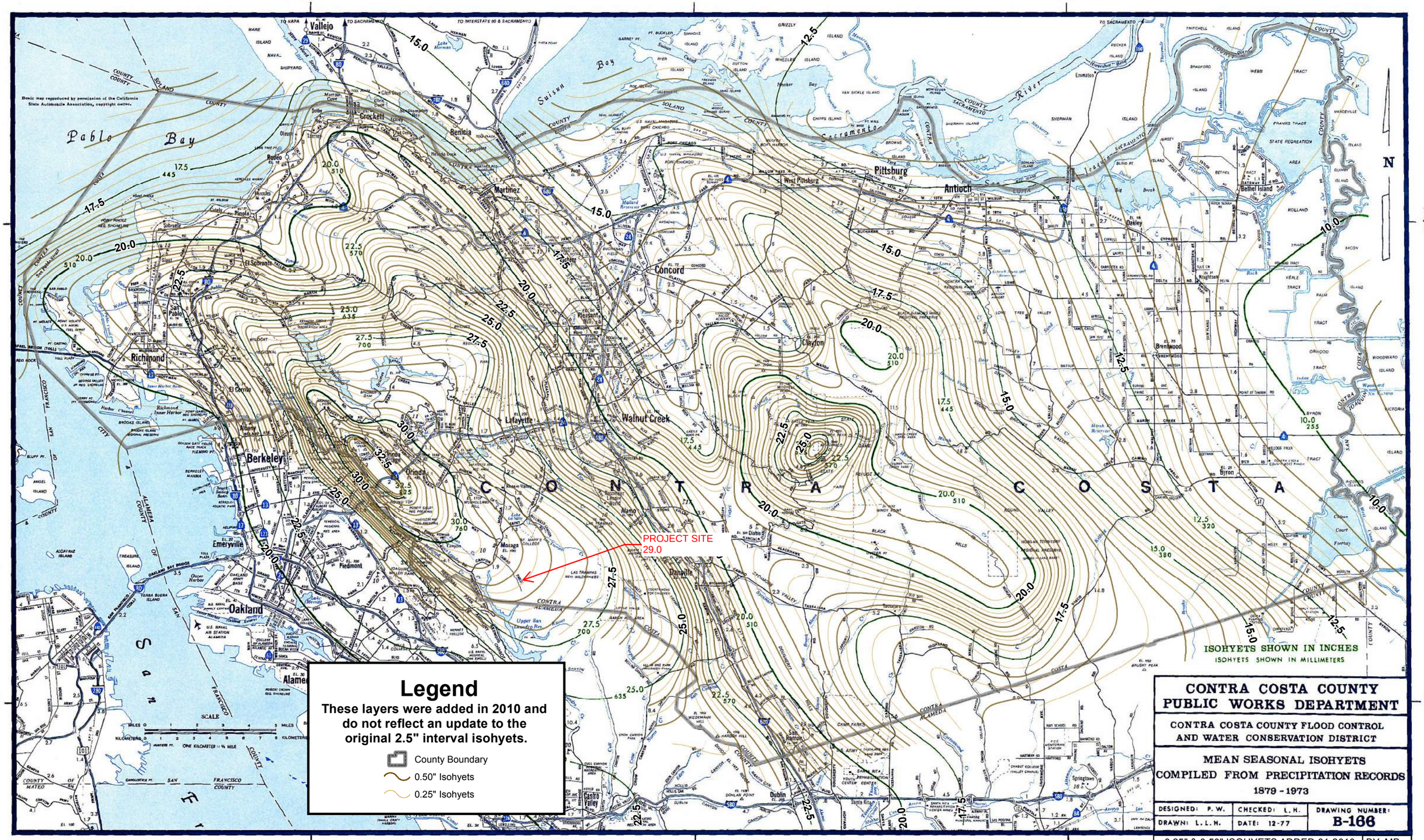
dk JOB# 13-1060-12

SHEET 1 OF 1

ATTACHMENT B

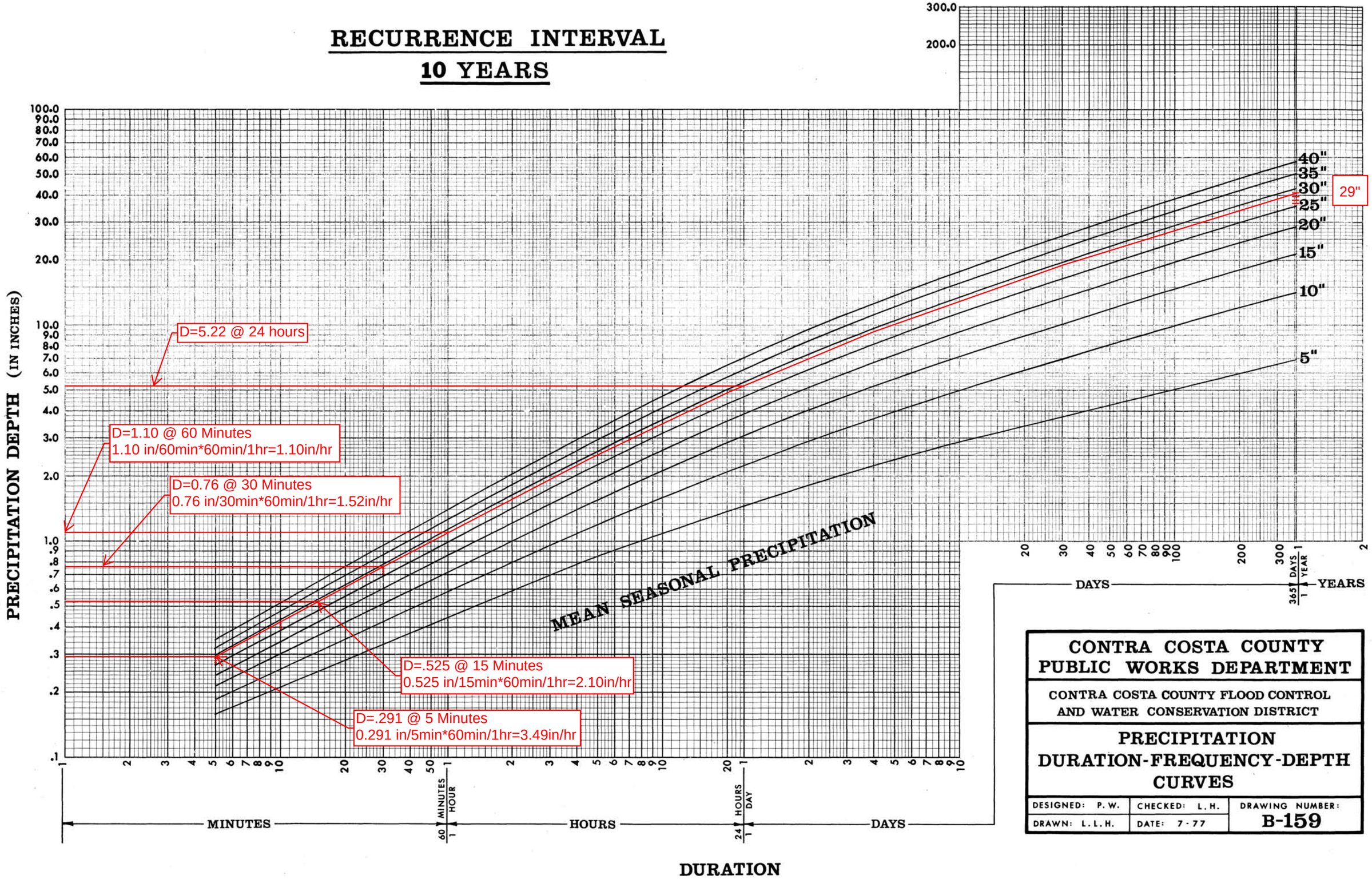
CONTRA COSTA COUNTY FLOOD CONTROL ISOHYETS


122°15′
122°00′
121°45′
38°00′
37°45′
Pablo Bay
Suisun Bay
Sacramento River
San Joaquin River
C O N T R A C O S T A
Vallejo
Crockett
Benicia
Martinez
Pittsburg
Antioch
West Pittsburg
Concord
Pleasant Hill
Walnut Creek
Lafayette
Orinda
Moraga
Danville
San Ramon
Dublin
Pleasanton
Livermore
Clayton
Brentwood
Oakley
Knightsen
Byron
Bethel Island
Rodeo
Hercules
Pinole
El Sobrante
San Pablo
Richmond
El Cerrito
Albany
Berkeley
Emeryville
Piedmont
Oakland
Alameda
Castro Valley
Alamo
Diablo
Springtown
PROJECT SITE
29.0
ISOHYETS SHOWN IN INCHES
ISOHYETS SHOWN IN MILLIMETERS
Legend
These layers were added in 2010 and do not reflect an update to the original 2.5" interval isohyets.
County Boundary
0.50" Isohyets
0.25" Isohyets
CONTRA COSTA COUNTY
PUBLIC WORKS DEPARTMENT
CONTRA COSTA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
MEAN SEASONAL ISOHYETS
COMPILED FROM PRECIPITATION RECORDS
1879 - 1973
DESIGNED: P. W.
CHECKED: L. H.
DRAWN: L. L. H.
DATE: 12-77
DRAWING NUMBER:
B-166
0.25" & 0.50" ISOHYETS ADDED 01-2010
BY: MB

ATTACHMENT C

CONTRA COSTA COUNTY PRECIPITATION DURATION-FREQUENCY-DEPTH CURVES

RECURRENCE INTERVAL
10 YEARS



CONTRA COSTA COUNTY
PUBLIC WORKS DEPARTMENT

CONTRA COSTA COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

PRECIPITATION
DURATION-FREQUENCY-DEPTH
CURVES

DESIGNED: P. W.	CHECKED: L. H.	DRAWING NUMBER:
DRAWN: L. L. H.	DATE: 7-77	B-159

ATTACHMENT D

PONDPACK RESULTS: PRE-DEVELOPMENT CONDITION

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
SUBBASIN 1	Pre-Development Contra Costa County, 10 yrs	10	3.985	10.000	31.97

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
EX-FI1	Pre-Development Contra Costa County, 10 yrs	10	3.985	10.000	31.97

Storm Event	Type I, 24hr (5.22 in)
Return Event	10 years
Duration	24.000 hours
Depth	5.2201 in
Time of Concentration (Composite)	0.193 hours
Area (User Defined)	15.080 acres

Computational Time Increment	0.026 hours
Time to Peak (Computed)	10.010 hours
Flow (Peak, Computed)	32.04 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	10.000 hours
Flow (Peak Interpolated Output)	31.97 ft^3/s

Drainage Area	
SCS CN (Composite)	81.000
Area (User Defined)	15.080 acres
Maximum Retention (Pervious)	2.3457 in
Maximum Retention (Pervious, 20 percent)	0.4691 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	3.1806 in
Runoff Volume (Pervious)	3.997 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	3.985 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.193 hours
Computational Time Increment	0.026 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	88.53 ft^3/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.129 hours
Unit receding limb, Tr	0.515 hours
Total unit time, Tb	0.643 hours

Storm Event	Type I, 24hr (5.22 in)
Return Event	10 years
Duration	24.000 hours
Depth	5.2201 in
Time of Concentration (Composite)	0.193 hours
Area (User Defined)	15.080 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
4.650	0.00	0.00	0.01	0.02	0.02
4.900	0.03	0.04	0.05	0.06	0.07
5.150	0.08	0.09	0.10	0.11	0.12
5.400	0.13	0.14	0.15	0.16	0.17
5.650	0.18	0.19	0.20	0.21	0.22
5.900	0.23	0.24	0.25	0.26	0.27
6.150	0.29	0.30	0.32	0.33	0.35
6.400	0.37	0.38	0.40	0.42	0.44
6.650	0.46	0.48	0.50	0.53	0.55
6.900	0.57	0.59	0.62	0.64	0.67
7.150	0.69	0.71	0.73	0.75	0.77
7.400	0.79	0.81	0.82	0.84	0.86
7.650	0.88	0.90	0.92	0.94	0.96
7.900	0.98	0.99	1.01	1.04	1.07
8.150	1.11	1.16	1.23	1.30	1.37
8.400	1.46	1.54	1.63	1.71	1.80
8.650	1.89	1.99	2.08	2.18	2.28
8.900	2.38	2.48	2.59	2.70	2.83
9.150	2.97	3.13	3.31	3.49	3.69
9.400	3.89	4.10	4.31	4.65	5.31
9.650	6.33	7.92	10.06	13.17	17.44
9.900	23.74	29.64	31.97	30.24	25.16
10.150	19.23	14.73	12.11	10.48	9.39
10.400	8.56	7.88	7.26	6.73	6.26
10.650	5.90	5.63	5.43	5.27	5.12
10.900	4.99	4.86	4.72	4.60	4.49
11.150	4.40	4.33	4.27	4.21	4.17
11.400	4.12	4.08	4.03	3.99	3.94
11.650	3.90	3.85	3.80	3.76	3.71
11.900	3.66	3.62	3.57	3.53	3.48
12.150	3.44	3.41	3.38	3.34	3.32
12.400	3.29	3.26	3.23	3.20	3.17
12.650	3.14	3.11	3.08	3.05	3.02
12.900	2.99	2.96	2.93	2.90	2.87

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
13.150	2.84	2.81	2.78	2.74	2.71
13.400	2.68	2.65	2.62	2.59	2.56
13.650	2.53	2.49	2.46	2.43	2.40
13.900	2.37	2.34	2.30	2.27	2.25
14.150	2.23	2.21	2.20	2.19	2.18
14.400	2.18	2.17	2.17	2.16	2.16
14.650	2.15	2.14	2.14	2.13	2.13
14.900	2.12	2.12	2.11	2.10	2.10
15.150	2.09	2.09	2.08	2.08	2.07
15.400	2.06	2.06	2.05	2.05	2.04
15.650	2.03	2.03	2.02	2.02	2.01
15.900	2.00	2.00	1.99	1.99	1.98
16.150	1.97	1.97	1.96	1.96	1.95
16.400	1.94	1.94	1.93	1.93	1.92
16.650	1.91	1.91	1.90	1.90	1.89
16.900	1.88	1.88	1.87	1.86	1.86
17.150	1.85	1.85	1.84	1.83	1.83
17.400	1.82	1.82	1.81	1.80	1.80
17.650	1.79	1.78	1.78	1.77	1.76
17.900	1.76	1.75	1.75	1.74	1.73
18.150	1.73	1.72	1.71	1.71	1.70
18.400	1.69	1.69	1.68	1.68	1.67
18.650	1.66	1.66	1.65	1.64	1.64
18.900	1.63	1.62	1.62	1.61	1.60
19.150	1.60	1.59	1.58	1.58	1.57
19.400	1.56	1.56	1.55	1.54	1.54
19.650	1.53	1.53	1.52	1.51	1.51
19.900	1.50	1.49	1.49	1.48	1.47
20.150	1.47	1.46	1.45	1.45	1.44
20.400	1.43	1.43	1.42	1.41	1.41
20.650	1.40	1.39	1.39	1.38	1.37
20.900	1.37	1.36	1.35	1.35	1.34
21.150	1.33	1.32	1.32	1.31	1.30
21.400	1.30	1.29	1.28	1.28	1.27
21.650	1.26	1.26	1.25	1.24	1.24
21.900	1.23	1.22	1.22	1.21	1.20
22.150	1.20	1.19	1.18	1.18	1.17
22.400	1.16	1.15	1.15	1.14	1.13
22.650	1.13	1.12	1.11	1.11	1.10
22.900	1.09	1.09	1.08	1.07	1.07
23.150	1.06	1.05	1.04	1.04	1.03
23.400	1.02	1.02	1.01	1.00	1.00
23.650	0.99	0.98	0.98	0.97	0.96
23.900	0.95	0.95	0.94	(N/A)	(N/A)

Summary for Hydrograph Addition at 'EX-FI1'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	SUBBASIN 1

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	SUBBASIN 1	3.984	10.000	31.97
Flow (In)	EX-FI1	3.984	10.000	31.97

ATTACHMENT E

PONDPACK RESULTS: POST-DEVELOPMENT CONDITION

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
SUBBASIN 1	Post-Development Contra Costa County, 10 yrs	10	1.691	9.950	15.25
SUBBASIN 2	Post-Development Contra Costa County, 10 yrs	10	2.130	10.000	17.68
SUBBASIN 3	Post-Development Contra Costa County, 10 yrs	10	0.579	9.950	5.07

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)
CB 1	Post-Development Contra Costa County, 10 yrs	10	2.919	10.000	22.50
EX-CB	Post-Development Contra Costa County, 10 yrs	10	3.003	9.900	25.55

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
DETENTION BASIN (IN)	Post-Development Contra Costa County, 10 yrs	10	1.691	9.950	15.25	(N/A)	(N/A)
DETENTION BASIN (OUT)	Post-Development Contra Costa County, 10 yrs	10	0.210	10.750	1.14	551.01	0.543

Storm Event	Type I, 24hr (5.22 in)
Return Event	10 years
Duration	24.000 hours
Depth	5.2201 in
Time of Concentration (Composite)	0.118 hours
Area (User Defined)	5.690 acres

Computational Time Increment	0.016 hours
Time to Peak (Computed)	9.937 hours
Flow (Peak, Computed)	15.35 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	9.950 hours
Flow (Peak Interpolated Output)	15.25 ft^3/s

Drainage Area	
SCS CN (Composite)	85.000
Area (User Defined)	5.690 acres
Maximum Retention (Pervious)	1.7647 in
Maximum Retention (Pervious, 20 percent)	0.3529 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	3.5720 in
Runoff Volume (Pervious)	1.694 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1.691 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.118 hours
Computational Time Increment	0.016 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	54.50 ft^3/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.079 hours
Unit receding limb, Tr	0.315 hours
Total unit time, Tb	0.394 hours

Storm Event	Type I, 24hr (5.22 in)
Return Event	10 years
Duration	24.000 hours
Depth	5.2201 in
Time of Concentration (Composite)	0.118 hours
Area (User Defined)	5.690 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
3.700	0.00	0.00	0.01	0.01	0.02
3.950	0.02	0.02	0.03	0.03	0.04
4.200	0.04	0.05	0.05	0.06	0.06
4.450	0.07	0.07	0.07	0.08	0.08
4.700	0.09	0.09	0.10	0.10	0.11
4.950	0.11	0.11	0.12	0.12	0.13
5.200	0.13	0.14	0.14	0.14	0.15
5.450	0.15	0.16	0.16	0.17	0.17
5.700	0.17	0.18	0.18	0.19	0.19
5.950	0.19	0.20	0.20	0.21	0.22
6.200	0.22	0.23	0.24	0.25	0.26
6.450	0.27	0.28	0.29	0.30	0.31
6.700	0.32	0.33	0.34	0.35	0.36
6.950	0.37	0.38	0.39	0.40	0.41
7.200	0.42	0.43	0.44	0.44	0.45
7.450	0.46	0.47	0.47	0.48	0.49
7.700	0.50	0.50	0.51	0.52	0.53
7.950	0.54	0.54	0.56	0.58	0.60
8.200	0.64	0.67	0.71	0.75	0.79
8.450	0.83	0.87	0.91	0.95	0.99
8.700	1.04	1.08	1.12	1.16	1.21
8.950	1.26	1.31	1.36	1.42	1.49
9.200	1.57	1.65	1.74	1.82	1.92
9.450	2.00	2.10	2.35	2.85	3.50
9.700	4.50	5.73	7.61	10.10	13.94
9.950	15.25	13.86	11.47	7.48	5.29
10.200	4.36	3.92	3.60	3.38	3.14
10.450	2.94	2.70	2.53	2.37	2.27
10.700	2.20	2.14	2.08	2.03	1.98
10.950	1.93	1.87	1.83	1.78	1.76
11.200	1.73	1.71	1.69	1.68	1.66
11.450	1.64	1.62	1.60	1.58	1.56
11.700	1.54	1.52	1.50	1.49	1.46
11.950	1.45	1.42	1.41	1.39	1.38

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
12.200	1.36	1.35	1.34	1.33	1.31
12.450	1.30	1.29	1.28	1.26	1.25
12.700	1.24	1.23	1.21	1.20	1.19
12.950	1.18	1.16	1.15	1.14	1.13
13.200	1.11	1.10	1.09	1.08	1.06
13.450	1.05	1.04	1.03	1.01	1.00
13.700	0.99	0.97	0.96	0.95	0.93
13.950	0.92	0.91	0.90	0.89	0.88
14.200	0.88	0.88	0.87	0.87	0.87
14.450	0.87	0.86	0.86	0.86	0.86
14.700	0.86	0.85	0.85	0.85	0.85
14.950	0.84	0.84	0.84	0.84	0.83
15.200	0.83	0.83	0.83	0.82	0.82
15.450	0.82	0.82	0.81	0.81	0.81
15.700	0.81	0.80	0.80	0.80	0.80
15.950	0.79	0.79	0.79	0.79	0.78
16.200	0.78	0.78	0.78	0.77	0.77
16.450	0.77	0.77	0.76	0.76	0.76
16.700	0.76	0.75	0.75	0.75	0.75
16.950	0.74	0.74	0.74	0.74	0.73
17.200	0.73	0.73	0.73	0.72	0.72
17.450	0.72	0.72	0.71	0.71	0.71
17.700	0.71	0.70	0.70	0.70	0.69
17.950	0.69	0.69	0.69	0.68	0.68
18.200	0.68	0.68	0.67	0.67	0.67
18.450	0.67	0.66	0.66	0.66	0.66
18.700	0.65	0.65	0.65	0.65	0.64
18.950	0.64	0.64	0.63	0.63	0.63
19.200	0.63	0.62	0.62	0.62	0.62
19.450	0.61	0.61	0.61	0.61	0.60
19.700	0.60	0.60	0.59	0.59	0.59
19.950	0.59	0.58	0.58	0.58	0.58
20.200	0.57	0.57	0.57	0.57	0.56
20.450	0.56	0.56	0.55	0.55	0.55
20.700	0.55	0.54	0.54	0.54	0.54
20.950	0.53	0.53	0.53	0.53	0.52
21.200	0.52	0.52	0.51	0.51	0.51
21.450	0.51	0.50	0.50	0.50	0.50
21.700	0.49	0.49	0.49	0.48	0.48
21.950	0.48	0.48	0.47	0.47	0.47
22.200	0.47	0.46	0.46	0.46	0.45
22.450	0.45	0.45	0.45	0.44	0.44
22.700	0.44	0.44	0.43	0.43	0.43
22.950	0.42	0.42	0.42	0.42	0.41

Subsection: Unit Hydrograph (Hydrograph Table) Return Event: 10 years
Label: SUBBASIN 1 Storm Event: Type I, 24hr (5.22 in)

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
23.200	0.41	0.41	0.41	0.40	0.40
23.450	0.40	0.39	0.39	0.39	0.39
23.700	0.38	0.38	0.38	0.38	0.37
23.950	0.37	0.37	(N/A)	(N/A)	(N/A)

Storm Event	Type I, 24hr (5.22 in)
Return Event	10 years
Duration	24.000 hours
Depth	5.2201 in
Time of Concentration (Composite)	0.167 hours
Area (User Defined)	7.660 acres

Computational Time Increment	0.022 hours
Time to Peak (Computed)	9.980 hours
Flow (Peak, Computed)	17.85 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	10.000 hours
Flow (Peak Interpolated Output)	17.68 ft^3/s

Drainage Area	
SCS CN (Composite)	82.700
Area (User Defined)	7.660 acres
Maximum Retention (Pervious)	2.0919 in
Maximum Retention (Pervious, 20 percent)	0.4184 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	3.3446 in
Runoff Volume (Pervious)	2.135 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	2.130 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.167 hours
Computational Time Increment	0.022 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	52.06 ft^3/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.111 hours
Unit receding limb, Tr	0.445 hours
Total unit time, Tb	0.556 hours

Storm Event	Type I, 24hr (5.22 in)
Return Event	10 years
Duration	24.000 hours
Depth	5.2201 in
Time of Concentration (Composite)	0.167 hours
Area (User Defined)	7.660 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
4.250	0.00	0.00	0.01	0.01	0.02
4.500	0.02	0.03	0.03	0.04	0.04
4.750	0.05	0.05	0.06	0.07	0.07
5.000	0.08	0.08	0.09	0.09	0.10
5.250	0.10	0.11	0.11	0.12	0.13
5.500	0.13	0.14	0.14	0.15	0.15
5.750	0.16	0.16	0.17	0.17	0.18
6.000	0.18	0.19	0.20	0.20	0.21
6.250	0.22	0.23	0.24	0.25	0.26
6.500	0.27	0.28	0.29	0.30	0.32
6.750	0.33	0.34	0.35	0.37	0.38
7.000	0.39	0.41	0.42	0.43	0.44
7.250	0.45	0.46	0.47	0.48	0.49
7.500	0.50	0.51	0.52	0.53	0.54
7.750	0.55	0.56	0.57	0.58	0.59
8.000	0.60	0.61	0.63	0.66	0.69
8.250	0.73	0.77	0.82	0.86	0.91
8.500	0.96	1.01	1.06	1.11	1.16
8.750	1.21	1.27	1.32	1.38	1.43
9.000	1.49	1.55	1.62	1.70	1.80
9.250	1.89	2.00	2.10	2.21	2.32
9.500	2.45	2.66	3.08	3.72	4.71
9.750	6.02	7.85	10.37	14.21	17.29
10.000	17.68	15.99	12.44	8.99	6.91
10.250	5.81	5.14	4.68	4.30	3.99
10.500	3.69	3.43	3.21	3.04	2.91
10.750	2.82	2.74	2.67	2.60	2.53
11.000	2.46	2.40	2.34	2.30	2.26
11.250	2.23	2.20	2.18	2.16	2.13
11.500	2.11	2.08	2.06	2.04	2.01
11.750	1.99	1.96	1.94	1.91	1.89
12.000	1.86	1.84	1.82	1.80	1.78
12.250	1.76	1.75	1.73	1.71	1.70
12.500	1.68	1.67	1.65	1.64	1.62

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
12.750	1.61	1.59	1.57	1.56	1.54
13.000	1.52	1.51	1.49	1.48	1.46
13.250	1.44	1.43	1.41	1.39	1.38
13.500	1.36	1.35	1.33	1.31	1.30
13.750	1.28	1.26	1.25	1.23	1.21
14.000	1.20	1.18	1.17	1.16	1.15
14.250	1.15	1.14	1.14	1.14	1.13
14.500	1.13	1.13	1.12	1.12	1.12
14.750	1.11	1.11	1.11	1.10	1.10
15.000	1.10	1.10	1.09	1.09	1.09
15.250	1.08	1.08	1.08	1.07	1.07
15.500	1.07	1.06	1.06	1.06	1.06
15.750	1.05	1.05	1.05	1.04	1.04
16.000	1.04	1.03	1.03	1.03	1.02
16.250	1.02	1.02	1.01	1.01	1.01
16.500	1.00	1.00	1.00	0.99	0.99
16.750	0.99	0.98	0.98	0.98	0.98
17.000	0.97	0.97	0.97	0.96	0.96
17.250	0.96	0.95	0.95	0.95	0.94
17.500	0.94	0.94	0.93	0.93	0.93
17.750	0.92	0.92	0.92	0.91	0.91
18.000	0.91	0.90	0.90	0.90	0.89
18.250	0.89	0.89	0.88	0.88	0.88
18.500	0.87	0.87	0.87	0.86	0.86
18.750	0.86	0.85	0.85	0.84	0.84
19.000	0.84	0.83	0.83	0.83	0.82
19.250	0.82	0.82	0.81	0.81	0.81
19.500	0.80	0.80	0.80	0.79	0.79
19.750	0.79	0.78	0.78	0.78	0.77
20.000	0.77	0.77	0.76	0.76	0.76
20.250	0.75	0.75	0.74	0.74	0.74
20.500	0.73	0.73	0.73	0.72	0.72
20.750	0.72	0.71	0.71	0.71	0.70
21.000	0.70	0.70	0.69	0.69	0.69
21.250	0.68	0.68	0.67	0.67	0.67
21.500	0.66	0.66	0.66	0.65	0.65
21.750	0.65	0.64	0.64	0.64	0.63
22.000	0.63	0.63	0.62	0.62	0.61
22.250	0.61	0.61	0.60	0.60	0.60
22.500	0.59	0.59	0.59	0.58	0.58
22.750	0.58	0.57	0.57	0.56	0.56
23.000	0.56	0.55	0.55	0.55	0.54
23.250	0.54	0.54	0.53	0.53	0.53
23.500	0.52	0.52	0.51	0.51	0.51

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
23.750	0.50	0.50	0.50	0.49	0.49
24.000	0.49	(N/A)	(N/A)	(N/A)	(N/A)

Storm Event	Type I, 24hr (5.22 in)
Return Event	10 years
Duration	24.000 hours
Depth	5.2201 in
Time of Concentration (Composite)	0.138 hours
Area (User Defined)	1.950 acres

Computational Time Increment	0.018 hours
Time to Peak (Computed)	9.958 hours
Flow (Peak, Computed)	5.09 ft^3/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	9.950 hours
Flow (Peak Interpolated Output)	5.07 ft^3/s

Drainage Area	
SCS CN (Composite)	85.000
Area (User Defined)	1.950 acres
Maximum Retention (Pervious)	1.7647 in
Maximum Retention (Pervious, 20 percent)	0.3529 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	3.5720 in
Runoff Volume (Pervious)	0.580 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.579 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.138 hours
Computational Time Increment	0.018 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	15.98 ft^3/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.092 hours
Unit receding limb, Tr	0.369 hours
Total unit time, Tb	0.461 hours

Storm Event	Type I, 24hr (5.22 in)
Return Event	10 years
Duration	24.000 hours
Depth	5.2201 in
Time of Concentration (Composite)	0.138 hours
Area (User Defined)	1.950 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
3.750	0.00	0.00	0.00	0.00	0.01
4.000	0.01	0.01	0.01	0.01	0.01
4.250	0.02	0.02	0.02	0.02	0.02
4.500	0.02	0.03	0.03	0.03	0.03
4.750	0.03	0.03	0.03	0.04	0.04
5.000	0.04	0.04	0.04	0.04	0.04
5.250	0.05	0.05	0.05	0.05	0.05
5.500	0.05	0.05	0.06	0.06	0.06
5.750	0.06	0.06	0.06	0.06	0.07
6.000	0.07	0.07	0.07	0.07	0.08
6.250	0.08	0.08	0.08	0.09	0.09
6.500	0.09	0.10	0.10	0.10	0.11
6.750	0.11	0.12	0.12	0.12	0.13
7.000	0.13	0.13	0.14	0.14	0.14
7.250	0.15	0.15	0.15	0.15	0.16
7.500	0.16	0.16	0.16	0.17	0.17
7.750	0.17	0.17	0.18	0.18	0.18
8.000	0.19	0.19	0.20	0.20	0.21
8.250	0.23	0.24	0.25	0.27	0.28
8.500	0.29	0.31	0.32	0.34	0.35
8.750	0.36	0.38	0.39	0.41	0.43
9.000	0.44	0.46	0.48	0.50	0.53
9.250	0.56	0.59	0.62	0.65	0.68
9.500	0.71	0.78	0.93	1.13	1.44
9.750	1.84	2.43	3.20	4.40	5.07
10.000	4.82	4.14	2.94	2.05	1.63
10.250	1.42	1.28	1.19	1.10	1.03
10.500	0.95	0.89	0.83	0.79	0.76
10.750	0.74	0.72	0.70	0.68	0.67
11.000	0.65	0.63	0.62	0.61	0.60
11.250	0.59	0.58	0.58	0.57	0.56
11.500	0.56	0.55	0.54	0.54	0.53
11.750	0.52	0.52	0.51	0.50	0.50
12.000	0.49	0.48	0.48	0.47	0.47

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
12.250	0.46	0.46	0.46	0.45	0.45
12.500	0.44	0.44	0.43	0.43	0.43
12.750	0.42	0.42	0.41	0.41	0.41
13.000	0.40	0.40	0.39	0.39	0.38
13.250	0.38	0.37	0.37	0.37	0.36
13.500	0.36	0.35	0.35	0.34	0.34
13.750	0.34	0.33	0.33	0.32	0.32
14.000	0.31	0.31	0.31	0.30	0.30
14.250	0.30	0.30	0.30	0.30	0.30
14.500	0.30	0.30	0.29	0.29	0.29
14.750	0.29	0.29	0.29	0.29	0.29
15.000	0.29	0.29	0.29	0.29	0.29
15.250	0.28	0.28	0.28	0.28	0.28
15.500	0.28	0.28	0.28	0.28	0.28
15.750	0.28	0.27	0.27	0.27	0.27
16.000	0.27	0.27	0.27	0.27	0.27
16.250	0.27	0.27	0.27	0.26	0.26
16.500	0.26	0.26	0.26	0.26	0.26
16.750	0.26	0.26	0.26	0.26	0.26
17.000	0.25	0.25	0.25	0.25	0.25
17.250	0.25	0.25	0.25	0.25	0.25
17.500	0.25	0.24	0.24	0.24	0.24
17.750	0.24	0.24	0.24	0.24	0.24
18.000	0.24	0.24	0.23	0.23	0.23
18.250	0.23	0.23	0.23	0.23	0.23
18.500	0.23	0.23	0.23	0.23	0.22
18.750	0.22	0.22	0.22	0.22	0.22
19.000	0.22	0.22	0.22	0.22	0.22
19.250	0.21	0.21	0.21	0.21	0.21
19.500	0.21	0.21	0.21	0.21	0.21
19.750	0.21	0.20	0.20	0.20	0.20
20.000	0.20	0.20	0.20	0.20	0.20
20.250	0.20	0.19	0.19	0.19	0.19
20.500	0.19	0.19	0.19	0.19	0.19
20.750	0.19	0.19	0.18	0.18	0.18
21.000	0.18	0.18	0.18	0.18	0.18
21.250	0.18	0.18	0.18	0.17	0.17
21.500	0.17	0.17	0.17	0.17	0.17
21.750	0.17	0.17	0.17	0.17	0.16
22.000	0.16	0.16	0.16	0.16	0.16
22.250	0.16	0.16	0.16	0.16	0.16
22.500	0.15	0.15	0.15	0.15	0.15
22.750	0.15	0.15	0.15	0.15	0.15
23.000	0.14	0.14	0.14	0.14	0.14

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
23.250	0.14	0.14	0.14	0.14	0.14
23.500	0.14	0.13	0.13	0.13	0.13
23.750	0.13	0.13	0.13	0.13	0.13
24.000	0.13	(N/A)	(N/A)	(N/A)	(N/A)

Summary for Hydrograph Addition at 'CB 1'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	SUBBASIN 3
Outlet-1	DETENTION BASIN
<Catchment to Outflow Node>	SUBBASIN 2

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	SUBBASIN 3	0.579	9.950	5.07
Flow (From)	Outlet-1	0.210	10.750	1.14
Flow (From)	SUBBASIN 2	2.130	10.000	17.68
Flow (In)	CB 1	2.919	10.000	22.50

Summary for Hydrograph Addition at 'EX-CB'

Upstream Link	Upstream Node
EX-24" PIPE	CB 1

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	EX-24" PIPE	3.003	9.900	25.55
Flow (In)	EX-CB	3.003	9.900	25.55

Requested Pond Water Surface Elevations	
Minimum (Headwater)	548.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	551.75 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	Weir - 1	Forward	RI#1 to EX. FI#1	550.75	551.75
Stand Pipe	Riser#1 (RI#1)	Forward	RI#1 to EX. FI#1	551.00	551.75
Orifice-Circular	Orifice - 1	Forward	RI#1 to EX. FI#1	550.50	551.75
Culvert-Circular	RI#1 to EX. FI#1	Forward	TW	547.16	551.75
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Riser#1 (RI#1) Structure Type: Stand Pipe	
Number of Openings	1
Elevation	551.00 ft
Diameter	36.0 in
Orifice Area	7.1 ft²
Orifice Coefficient	0.600
Weir Length	9.42 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: RI#1 to EX. FI#1 Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	10.0 in
Length	13.60 ft
Length (Computed Barrel)	13.60 ft
Slope (Computed)	0.010 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.200
Kb	0.040
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0045
M	2.0000
C	0.0317
Y	0.6900
T1 ratio (HW/D)	1.091
T2 ratio (HW/D)	1.192
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	548.07 ft	T1 Flow	1.74 ft³/s
T2 Elevation	548.15 ft	T2 Flow	1.99 ft³/s

Structure ID: Orifice - 1 Structure Type: Orifice-Circular	
Number of Openings	1
Elevation	550.50 ft
Orifice Diameter	4.5 in
Orifice Coefficient	0.600

Structure ID: Weir - 1 Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	550.75 ft
Weir Length	2.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft^3/s
Flow Tolerance (Maximum)	10.000 ft^3/s

Subsection: Detention Time
Label: DETENTION BASIN (IN)

Return Event: 10 years
Storm Event: Type I, 24hr (5.22 in)

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	5.0000 in/h

Approximate Detention Times	
Time to Peak (Outflow + Infiltration, Peak to Peak Detention Time)	10.750 hours
Time to Peak (Inflow, Peak to Peak Detention Time)	9.950 hours
Detention Time (Peak to Peak)	0.800 hours
Time to Centroid (Outflow)	15.237 hours
Time to Centroid (Inflow)	12.812 hours
Detention Time (Centroid to Centroid)	2.426 hours
Weighted Average Plug Time	3.763 hours
Maximum Plug Volume Plug Time	2.166 hours
Maximum Inflow Plug Volume	0.060 ac-ft
Time (Maximum Plug Volume, Start)	9.900 hours
Time (Maximum Plug Volume, End)	9.950 hours

Infiltration	
Infiltration Method (Computed)	Average Infiltration Rate
Infiltration Rate (Average)	5.0000 in/h

Initial Conditions	
Elevation (Water Surface, Initial)	548.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	15.25 ft³/s	Time to Peak (Flow, In)	9.950 hours
Infiltration (Peak)	1.00 ft³/s	Time to Peak (Infiltration)	10.750 hours
Flow (Peak Outlet)	1.14 ft³/s	Time to Peak (Flow, Outlet)	10.750 hours

Elevation (Water Surface, Peak)	551.01 ft
Volume (Peak)	0.543 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.691 ac-ft
Volume (Total Infiltration)	1.234 ac-ft
Volume (Total Outlet Outflow)	0.210 ac-ft
Volume (Retained)	0.247 ac-ft
Volume (Unrouted)	0.000 ac-ft
Error (Mass Balance)	0.0 %

Summary for Hydrograph Addition at 'DETENTION BASIN'

Upstream Link	Upstream Node
<Catchment to Outflow Node>	SUBBASIN 1

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	SUBBASIN 1	1.691	9.950	15.25
Flow (In)	DETENTION BASIN	1.691	9.950	15.25

PondMaker Worksheet Detailed Report: Worksheet (Basin)

Element Details

ID	92
Label	Worksheet (Basin)
Select Pond to Design	DETENTION BASIN
Flow Allowed Below Target	100.0
Flow Allowed Above Target	0.0
Flow Allowed Below Target	100.0
Flow Allowed Above Target	0.0
Volume Allowed Below Target	100.0
Volume Allowed Above Target	0.0
Tolerance Display	Display numerical values for tolerance fields

Notes

Volume

Pond Type	Elevation-Area	Use Void Space?	False

Elevation-Area

Pond Elevation (ft)	Pond Area (acres)
548.00	0.179
549.00	0.179
550.50	0.179
551.17	0.204
551.75	0.204

Infiltration

Infiltration Method	Average Infiltration Rate	Infiltration Rate (Average)	5.0000 in/h

Output

Detention Time	Compute All Methods

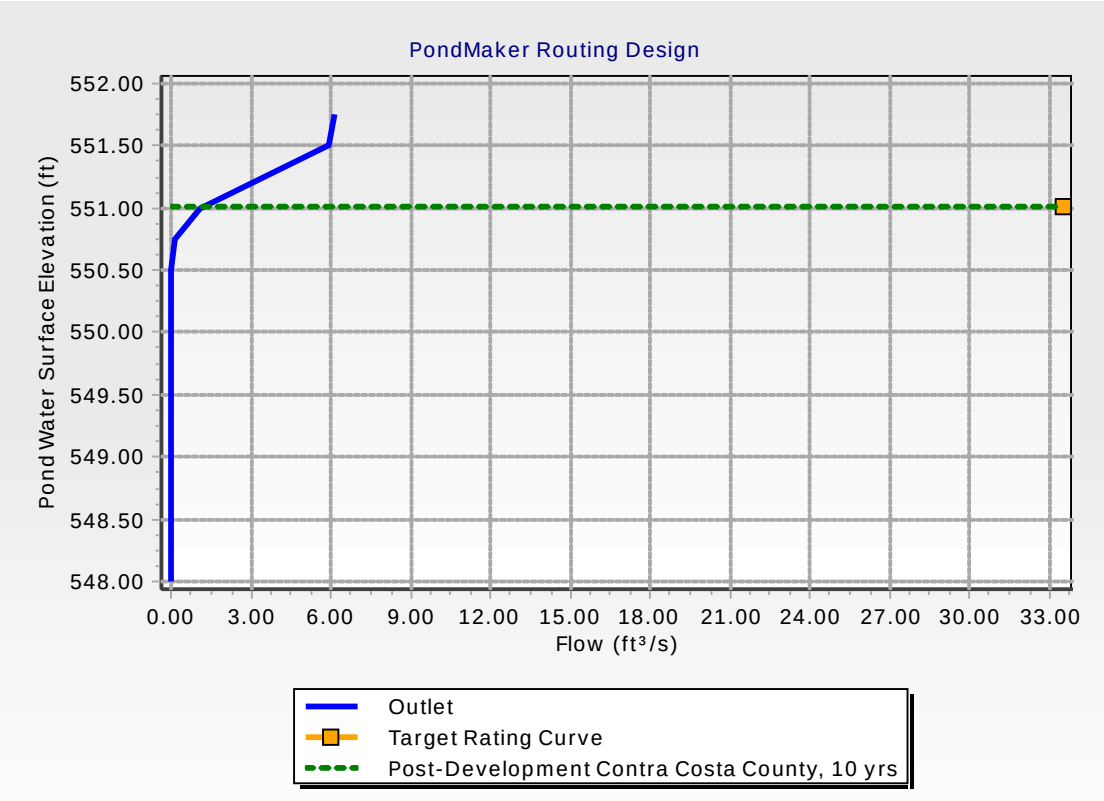
Initial Conditions

Is Outflow Averaging On?	False	Define Starting Water Surface Elevation	Pond Invert

PondMaker Worksheet (Routing Design)

Design Scenario	Design Return Event	Target Peak Outflow (ft³/s)	Computed Peak Outflow (ft³/s)	Computed Peak Outflow vs. Target (ft³/s)	Target Outflow Volume (ac-ft)
Post-Development Contra Costa County, 10 yrs	10	33.53	1.14	-32.38	3.629

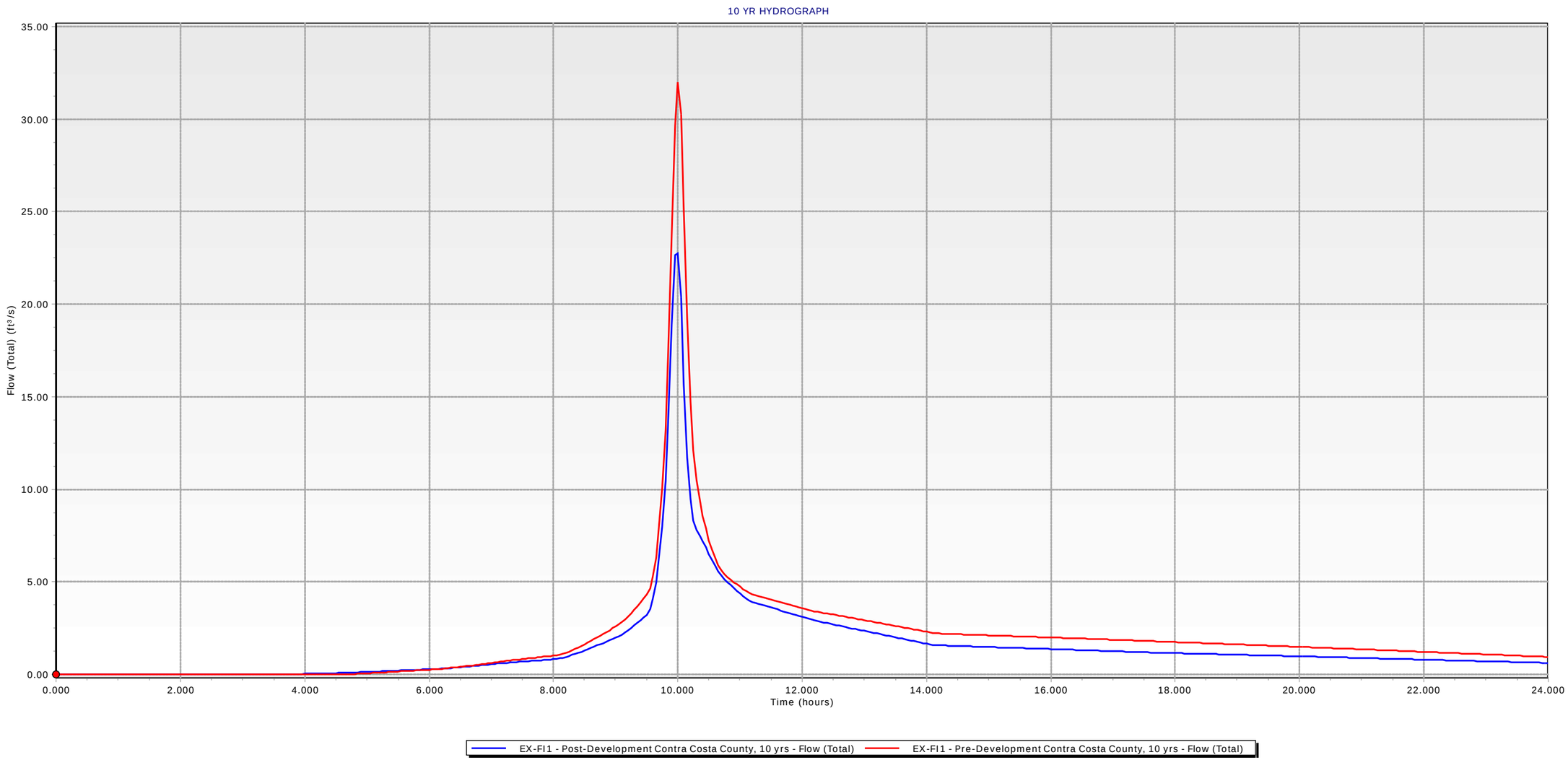
Computed Volume Outflow (ac-ft)	Computed Outflow Volume vs. Target (ac-ft)	Routing Outlet Structure	Computed Max Water Elevation (ft)	Freeboard Depth (ft)	Maximum Storage (ac-ft)
0.210	-3.418	Outlet	551.01	0.74	0.543



ATTACHMENT F

10-YEAR RUNOFF HYDROGRAPH

CAMINO PABLO PRE- VS. POST-DEVELOPMENT RUNOFF



PRELIMINARY STORMWATER CONTROL PLAN
for
SOUTH CAMINO PABLO ANNEXATION PROJECT
TOWN OF MORAGA, CALIFORNIA

January, 2019

APN: 725-829-001
Subdivision 9396

Prepared for:
Town of Moraga

Applicant/Developer:
Dobbins Properties, LLC
1520 W. Kettleman Lane, Suite 1-A
Lodi, CA 95242

CONSULTING
PLANNING · ENGINEERING · CONSTRUCTION

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Appendix C—Stormwater Control/C.3 Exhibit (one 11x17 map for quick reference and one full-sized map)

I. PROJECT DATA

Table 1. Project Data

Project Name/Number	South Camino Pablo Annexation Project
Application Submittal Date	January, 2019
Project Location	APN 725-829-001, 1211 Camino Pablo, Moraga, California
Name of Developer	Dobbins Properties, LLC
Project Phase No.	NA
Project Type and Description	Single Family Residential
Project Mean Annual Precipitation	29"
Total Project Site Area (acres)	23.90
Total Area of Land Disturbed (acres)	11.09
Total New Impervious Surface Area (sq. ft.)	109,612 sf
Total Replaced Impervious Surface Area	7,318 sf
Total Pre-Project Impervious Surface Area	7,819 sf
Total Post-Project Impervious Surface Area	116,930 sf
50% Rule	NA
Project Density	
Applicable Special Project Categories	3-DUA PD and Non-MOSO (single family residential)
Percent LID and non LID treatment	100% LID and 0% Non-LID
`HMP Compliance	Yes

II. PROJECT SETTING

II.A. PROJECT LOCATION AND DESCRIPTION

South Camino Pablo Annexation is a proposed single family residential project, Subdivision #9396, consisting of 13 lots. The following lots are between 15,000 and 20,000 square feet: 3, 4, 7, 8, 12 and 13. The remaining lots are over 20,000 square feet. Furthermore, the lots contain homes of approximately 3,000 square feet to 5,300 square feet, with an average size of about 4,000 square feet. The roughly 23.90-acre project is located at 1211 Camino Pablo, unincorporated Moraga, and will be annexed to the Town of Moraga. Approximately 0.24 acres of the project site will be dedicated to the Town of Moraga for widening Camino Pablo. The project site is bordered by Sanders Ranch Road to the north and west, Camino Pablo to the west, single family residential lots to the south, and agricultural land to the east. The existing site is comprised of agricultural land, wetlands, and brush. A vicinity map is included in Appendix A.

II.B. EXISTING SITE FEATURES AND CONDITIONS

This site consists of relatively steep hillside terrain and is open grassland. There are several jurisdictional areas located southwest and northeast of the site. A jurisdictional area of approximately 1,800 square feet is located southwest of the site and another jurisdictional area of roughly 850 square feet is northeast of the site. Both areas will not be affected by the proposed development. The majority of the site slopes westerly off the top of hills located along the eastern boundary of the site. The site has elevations ranging from 566 to 612 along the southern boundary. The west boundary falls from elevation 566 at the southwest corner to a low point of elevation 552 near Tharp Drive and rises again along Sanders Ranch Road to an elevation of 616 at the northernmost boundary. The east boundary rises from elevation 616 in the north to elevation 652 at about the midpoint of the east boundary. Then the east boundary turns west to an elevation of 694 and roughly follows the crest of the hill southerly to a maximum elevation of 705 before falling again to 612 at the southeast corner. The site drains largely from the higher east side to the low elevation side along Camino Pablo and Sanders Ranch Road.

The site is currently zoned A2 (General Agriculture) based on Contra Costa County designation. Based on Moraga's General Plan, the site is currently zoned OS (open space) and 1-DUA (1 dwelling unit per acre).

A preliminary geologic exploration of the site was performed by ENGEO, Inc. in a report dated January 21, 2014 (Project No. 10741.000.000). A second exploration to supplement the finding of ENGEO's preliminary exploration was recorded in a report dated October 26, 2015 (Project No. 10741.000.000). The site is located within the Coast Ranges, which are a series of ridges and valleys trending in a northwest – southeast direction.

The site is not located within a State of California Earthquake Fault Zone, and no known active faults cross the site. The nearest known active faults are the Hayward fault, which is approximately 4 miles southwest of the site, and the Calaveras fault, which is approximately 5 miles east of the site. Because of the presence of these nearby active faults, the region is considered seismically active. Locally the site contains an inactive thrust fault crossing the southwestern portion of the site and another inactive thrust fault coinciding with Camino Pablo.

Landslide areas exist in the southern portion of the site, which is the area proposed for development, and portions of these mapped landslides have been recently active. Based on ENGEO's findings, the landslides range from about 5 to 15 feet thick. As a result, landslide mitigation measures will need to be performed prior to proposed development. The native soils that were studied on site consist of clay, silt, claystone, siltstone, and sandstone.

From a geological and geotechnical standpoint, it was concluded by ENGEO, Inc. that the site is generally suitable for the proposed residential development.

The soils found at this site fall under NRCS Hydrologic Soil Group 'D', per the on-line "Web Soil Survey" hosted by the US Department of Agriculture's Natural Resources Conservation Service.

II.C. OPPORTUNITIES AND CONSTRAINTS FOR STORMWATER CONTROL

Constraints include relatively impermeable soils (hydrologic soil groups C and D) where deep infiltration is not possible. The limits of disturbance are within soil group D.

A portion of the site will no longer be pervious and about half of the street will drain to the bioretention filters adjacent to the street, while the remaining portion of the street will drain to a bioretention filter running along the Camino Pablo frontage.

III. LOW IMPACT DEVELOPMENT DESIGN STRATEGIES

III.A. Optimization of Site Layout

The nature of a single family residential project means that the houses are spread out throughout the project site and allows for more open space areas. The proposed street width is the minimum permitted. The natural drainage pattern will be maintained.

III.B. Dispersal of Runoff to Pervious Area

Some of the storm water runoff will be conveyed directly by sheet flow or via the storm drain system from the surrounding impervious areas to the bioretention filters. Because of the proposed site topography, some of the storm water runoff from impervious areas will first flow to adjacent vegetated areas which, in turn will drain to the bioretention filters.

III.C. Bioretention Areas

The bioretention filters have been designed and will be constructed according to the criteria included in Contra Costa Clean Water Program Stormwater C.3 Guidebook, Seventh Edition. The bioretention filters will have the following characteristics:

- Volume or depth of surface reservoir meets or exceeds minimum.
- 18" deep "loamy sand" soil mix with long-term percolation rate of 5"/hour.
- Area of soil mix meets or exceeds minimum.
- Perforated pipe (PVC SDR 35 or approved equivalent) underdrain bedded near the top of the "Class 2 perm" layer with holes facing downward. Connection and sufficient head to storm drain to approved discharge point.
- No filter fabric will be used.
- The bioretention filter underdrain will be fitted with clean-out ports consisting of a vertical, rigid, non-perforated PVC pipe, with a diameter matching that of the underdrain, and a watertight cap.
- Location and footprint of facility are shown on site plan, landscaping plan, and grading plan.
- The bioretention filters will be designed as a basin with level edges or as a series of adjacent basins or swales with different elevations to match the proposed topography, and the grading plan will be consistent with these elevations. If the facility is designed as a series of basins or swales, check dams will be set so the lip

of the weir of each dam will be at least as high as the toe of the next upstream dam to permit the necessary amount of surface water storage before spill-over.

- Curb openings to the bioretention filter will be 12" wide, will have 4"-6" reveal and an apron or other provision to prevent blockage when vegetation grows in, and energy dissipation as needed.

- The bioretention filter overflow will be connected to a downstream storm drain or approved discharge point.

- In the case of extreme storms which overwhelm the bioretention filter overflow structure, excess water will be safely conveyed overland to streets and eventually outfall to Camino Pablo and to the existing storm drain system.

- Bioretention filter planting will be selected by the landscape architect and will be suitable for the climate, exposure, soil, and occasional inundation characteristic of a bioretention filter.

- The irrigation system will be connected to the water supply, on a separate zone and with appropriate backflow prevention devices.

- Vaults, utility boxes, and light standards will be located outside the minimum soil mix surface area.

- When excavating the bioretention filters, avoid 'smearing' (smoothing and compacting) of the soils on the bottom and side slopes Minimize compaction of native soils and 'rip' soils if clayey and/or compacted. Protect the area from construction site runoff.

- The volume of surface and subsurface storage will meet or exceed the minimum required.

- The bioretention filter underdrain will be connected to the outlet storm drain via an appropriately sized orifice or other flow-limiting device.

IV. DOCUMENTATION OF DRAINAGE DESIGN

IV.A. Description of Each Drainage Management Area

IV.A.1. Table of Drainage Management Areas

Table 3

DMA Name	*Surface Type*	*Area (square feet)*
DMA1-A	*Concrete/Asphalt*	*5,190*
DMA1-B	*Concrete/Asphalt*	*432*
DMA1-C	*Landscape*	*336*
DMA3-A	*Concrete/Asphalt*	*6,941*
DMA3-B	*Concrete/Asphalt*	*477*
DMA3-C	*Landscape*	*274*
DMA3-D	*Concrete/Asphalt*	*1,138*
DMA3-E	*Landscape*	*3,889*
DMA3-F	*Roof Area*	*3,639*
DMA4-A	*Roof Area*	*3,427*
DMA4-B	*Concrete/Asphalt*	*1,953*
DMA4-C	*Landscape*	*753*
DMA5-A	*Roof Area*	*2,923*
DMA5-B	*Concrete/Asphalt*	*1,463*
DMA5-C	*Landscape*	*2,054*
DMA6-A	*Roof Area*	*3,614*
DMA6-B	*Concrete/Asphalt*	*1,756*
DMA6-C	*Roof Area*	*4,685*
DMA6-D	*Concrete/Asphalt*	*1,455*
DMA6-E	*Roof Area*	*4,601*
DMA6-F	*Concrete/Asphalt*	*5,018*
DMA6-G	*Roof Area*	*3,421*
DMA6-H	*Concrete/Asphalt*	*2,199*
DMA6-I	*Roof Area*	*3,238*
DMA6-J	*Concrete/Asphalt*	*1,480*
DMA6-K	*Roof Area*	*3,448*
DMA6-L	*Concrete/Asphalt*	*1,898*
DMA6-M	*Roof Area*	*3,102*
DMA6-N	*Concrete/Asphalt*	*1,580*
DMA6-O	*Concrete/Asphalt*	*15,996*
DMA6-P	*Roof Area*	*3,406*
DMA6-Q	*Concrete/Asphalt*	*1,905*
DMA6-R	*Roof Area*	*2,449*
DMA6-S	*Concrete/Asphalt*	*1,265*
DMA6-T	*Roof Area*	*3,541*
DMA6-U	*Concrete/Asphalt*	*1,541*

DMA6-V	*Landscape*	*35,889*
DMA6-W	*Landscape*	*112,272*
DMA6-X	*Concrete/Asphalt*	*8,347*
DMA6-Y	*Concrete/Asphalt*	*5,948*
DMA6-Z	*Concrete/Asphalt*	*246*
DMA7-A	*Concrete/Asphalt*	*3,049*
DMA7-B	*Concrete/Asphalt*	*246*
DMA7-C	*Landscape*	*510*

IV.A.2 Drainage Management Area Descriptions

DMA1-A, totaling 5,190 square feet, drains a portion of the street and sidewalk. DMA1-A drains to bioretention swale IMP-1.

DMA1-B, totaling 432 square feet, drains a portion the driveways at Lots 6 and 7. DMA1-B drains to bioretention swale IMP-1.

DMA1-C, totaling 336 square feet, drains a portion of street frontage landscaping at Lots 7 and 8. DMA1-C drains to bioretention swale IMP-1.

DMA3-A, totaling 6,941 square feet, drains a portion of the street and sidewalk. DMA3-A drains to bioretention swale IMP-3.

DMA3-B, totaling 477 square feet, drains a portion of the driveways at Lots 8 and 9. DMA3-B drains to bioretention swale IMP-3.

DMA3-C, totaling 274 square feet, drains a portion of the street frontage landscaping. DMA3-C drains to bioretention swale IMP-3.

DMA3-D, totaling 1,138 square feet, drains the driveway and walkways at Lot 5. DMA3-D drains to bioretention swale IMP-3.

DMA3-E, totaling 3,889 square feet, drains a portion of the street frontage landscaping and the landscaping at Lot 5. DMA3-E drains to bioretention swale IMP-3.

DMA3-F, totaling 3,639 square feet, drains the roof of the house at Lot 5. DMA3-F drains to bioretention swale IMP-3.

DMA4-A, totaling 3,427 square feet, drains the roof of the Lot 6 house. DMA4-A drains to bioretention swale IMP-4.

DMA4-B, totaling 1,953 square feet, drains a portion of the Lot 6 driveway. DMA4-B drains to bioretention swale IMP-4.

DMA4-C, totaling 753 square feet, drains a portion of the Lot 6 landscaping. DMA4-C drains to bioretention swale IMP-4.

DMA5-A, totaling 2,923 square feet, drains the roof of the Lot 4 house. DMA5-A drains to bioretention swale IMP-5.

DMA5-B, totaling 1,463 square feet, drains the driveway and front flatwork at Lot 4. DMA5-B drains to bioretention swale IMP-5.

DMA5-C, totaling 2,054 square feet, drains a portion of the Lot 4 landscaping and a portion of the street frontage landscaping. DMA5-C drains to bioretention swale IMP-5.

DMA6-A, totaling 3,614 square feet, drains the roof of the Lot 7 house. DMA6-A drains to bioretention basin IMP-6.

DMA6-B, totaling 1,756 square feet, drains a portion of the Lot 7 driveway and walkway. DMA6-B drains to bioretention basin IMP-6.

DMA6-C, totaling 4,685 square feet, drains the roof of the Lot 8 house. DMA6-C drains to bioretention basin IMP-6.

DMA6-D, totaling 1,455 square feet, drains a portion of the Lot 8 driveway. DMA6-D drains to bioretention basin IMP-6.

DMA6-E, totaling 4,601 square feet, drains the roof of the Lot 9 house and accessory building. DMA6-E drains to bioretention basin IMP-6.

DMA6-F, totaling 5,018 square feet, drains a portion of the Lot 9 driveway. DMA6-F drains to bioretention basin IMP-6.

DMA6-G, totaling 3,421 square feet, drains the roof of the Lot 10 house. DMA6-G drains to bioretention basin IMP-6.

DMA6-H, totaling 2,199 square feet, drains a portion of the Lot 10 driveway. DMA6-H drains to bioretention basin IMP-6.

DMA6-I, totaling 3,238 square feet, drains the Lot 11 house roof. DMA6-I drains to bioretention basin IMP-6.

DMA6-J, totaling 1,480 square feet, drains a portion of the Lot 11 driveway. DMA6-J drains to bioretention basin IMP-6.

DMA6-K, totaling 3,448 square feet, drains the Lot 12 house roof. DMA6-K drains to bioretention basin IMP-6.

DMA6-L, totaling 1,898 square feet, drains the Lot 12 driveway. DMA6-L drains to bioretention basin IMP-6.

DMA6-M, totaling 3,102 square feet, drains the Lot 13 house roof. DMA6-M drains to bioretention basin IMP-6.

DMA6-N, totaling 1,580 square feet, drains the Lot 13 driveway and walkway. DMA6-N drains to bioretention basin IMP-6.

DMA6-O, totaling 15,996 square feet, drains a portion of the street. DMA6-O drains to bioretention basin IMP-6.

DMA6-P, totaling 3,406 square feet, drains the Lot 1 house roof. DMA6-P drains to bioretention basin IMP-6.

DMA6-Q, totaling 1,905 square feet, drains the Lot 1 driveway and walkway. DMA6-Q drains to bioretention basin IMP-6.

DMA6-R, totaling 2,449 square feet, drains the Lot 2 house roof. DMA6-R drains to bioretention basin IMP-6.

DMA6-S, totaling 1,265 square feet, drains the Lot 2 driveway and walkways. DMA6-S drains to bioretention basin IMP-6.

DMA6-T, totaling 3,541 square feet, drains the Lot 3 house roof. DMA6-T drains to bioretention basin IMP-6.

DMA6-U, totaling 1,541 square feet, drains the Lot 3 driveway and walkway. DMA6-U drains to bioretention basin IMP-6.

DMA6-V, totaling 35,889 square feet, drains a portion of the hillside behind the houses at Lots 2 and 3, together with the lot landscaping and street frontage landscaping at these lots. DMA6-V drains to bioretention basin IMP-6.

DMA6-W, totaling 112,272 square feet, drains the lot landscaping at Lots 7 – 13, a portion of the lot landscaping at Lot 6, the street frontage landscaping at Lots 12 and 13, a portion of the street frontage landscaping at Lot 11, and a portion of the street frontage landscaping at Camino Pablo. DMA6-W drains to bioretention basin IMP-6.

DMA6-X, totaling 8,347 square feet, drains a portion of the sidewalk and street widening at Camino Pablo. DMA6-X drains to bioretention basin IMP-6.

DMA6-Y, totaling 5,948 square feet, drains a portion of the existing road surface of Camino Pablo, which is to remain undisturbed. DMA6-Y drains naturally towards bioretention filter IMP-6 and serves as "in-lieu" impervious surface to be treated as compensation for the 5,861 square feet of DMA NT-1 which cannot be treated due to elevation constraints.

DMA6-Z, totaling 246 square feet, drains a portion of the Lot 11 driveway. DMA6-Z drains to bioretention basin IMP-6.

DMA7-A, totaling 3,049 square feet, drains a portion of the street and sidewalk. DMA7-A drains to bioretention swale IMP-7.

DMA7-B, totaling 246 square feet, drains a portion of the Lot 10 driveway. DMA7-B drains to bioretention swale IMP-7.

DMA7-C, totaling 510 square feet, drains a portion of the street landscaping. DMA7-C drains to bioretention swale IMP-7.

IV.B. Tabulation and Sizing Calculations

IV.B.1. Information Summary for IMP Design

Table 4

Total Project Area (SQ. FT)	1,043,845
Mean Annual Precipitation	29 inches
IMPs Designed For:	Treatment and Flow Control

IV.B.2. Self-Retaining Areas

There are no self-retaining areas.

IV.B.3. Self-Treating Areas

Table 5

DMA Name	*Area (square feet)*
ST-1	707,394
ST-2	20,194 sf
ST-3	33,702 sf

IV.B.4. Areas Draining to Self-Retaining Areas

There are no areas draining to self-retaining areas.

IV.B.5. Areas Draining to IMPs

Note: The product of the IMP Sizing Factor and the Rainfall Adjustment Factor is less than the minimum value of 0.04 for all IMPs shown in the tables below. The value of 0.04 was used to adjust the areas instead.

Table 6

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type:	IMP Name			
					D	IMP-1			
DMA1-A	5,190	Street & Sidewalk	1.00	5,190					
DMA1-B	432	Driveway & Walkway	1.00	432					
DMA1-C	336	Landscape	0.70	235					
			Total	5,857	IMP Sizing Factor	Rain Adjust-ment Factor	Minimum Area or Volume	Proposed Area or Volume	
				Area	0.050	0.613	234	294	

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type: D	IMP Name IMP-3			
DMA3-A	6,941	Street & Sidewalk	1.00	6,941					
DMA3-B	477	Driveway	1.00	477					
DMA3-C	274	Landscape	0.70	192					
DMA3-D	1,138	Driveway & Walkways	1.00	1,138					
DMA3-E	3,889	Landscape	0.70	2,722					
DMA3-F	3,639	Roof	1.00	3,639					
			Total	15,109	IMP Sizing factor	Rain Adjust-ment Factor	Minimum Area or Volume	Proposed Area or Volume	
				Area	0.05	0.613	604	608	

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type: D	IMP Name IMP-4		
DMA4-A	3,427	Roof	1.00	3,427				
DMA4-B	1,953	Driveway	1.00	1,953				
DMA4-C	753	Landscape	0.70	527				
			Total	5,907	IMP Sizing factor	Rain Adjust-ment Factor	Minimum Area or Volume	
				Area	0.050	0.613	236	308

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type: D	IMP Name IMP-5		
DMA5-A	2,923	Roof	1.00	2,923				
DMA5-B	1,463	Driveway	1.00	1,463				
DMA5-C	2,054	Landscape	0.70	1,438				
			Total	5,824	IMP Sizing factor	Rain Adjust-ment Factor	Minimum Area or Volume	Proposed Area or Volume
				Area	0.050	0.613	233	278

DMA Name	DMA Area (square feet)	Post-project surface type	DMA Runoff factor	DMA Area × runoff factor	Soil Type: D	IMP Name IMP-6
DMA6-A	3,614	Roof	1.00	3,614		
DMA6-B	1,756	Driveway & Walkway	1.00	1,756		
DMA6-C	4,685	Roof	1.00	4,685		
DMA6-D	1,455	Driveway	1.00	1,455		
DMA6-E	4,601	Roof	1.00	4,601		
DMA6-F	5,018	Driveway	1.00	5,018		
DMA6-G	3,421	Roof	1.00	3,421		
DMA6-H	2,199	Driveway	1.00	2,199		
DMA6-I	3,238	Roof	1.00	3,238		
DMA6-J	1,480	Driveway	1.00	1,480		

	DMA Area (square	Post-project surface type	DMA Runoff factor	DMA Area × runoff	Soil Type:	IMP Name

DMA Name	feet)			factor	D	IMP-6		
DMA6-K	3,448	Roof	1.00	3,448				
DMA6-L	1,898	Driveway	1.00	1,898				
DMA6-M	3,102	Roof	1.00	3,102				
DMA6-N	1,580	Driveway	1.00	1,580				
DMA6-O	15,996	Street & Sidewalk	1.00	15,996				
DMA6-P	3,406	Roof	1.00	3,406				
DMA6-Q	1,905	Driveway & Walkway	1.00	1,905				
DMA6-R	2,449	Roof	1.00	2,449				
DMA6-S	1,265	Driveway & Walkway	1.00	1,265				
DMA6-T	3,541	Roof	1.00	3,541				
DMA6-U	1,541	Driveway & Walkway	1.00	1,541				
DMA6-V	35,889	Landscape	0.70	25,122				
DMA6-W	112,272	Landscape	0.70	78,590				
DMA6-X	8,347	Street & Sidewalk	1.00	8,347				
DMA6-Y	5,948	Street	1.00	5,948				
DMA6-Z	246	Driveway	1.00	246				
			Total	189,852	IMP Sizing factor	Rain Adjust -ment Factor	Minimum Area or Volume	Proposed Area or Volume
				Area	0.050	0.613	7,594	7,899

DMA Name	*DMA Area (square feet)*	*Post-project surface type*	*DMA Runoff factor*	*DMA Area × runoff factor*	*Soil Type:*	*IMP Name*		
					D	*IMP-7*		
DMA7-A	*3,049*	*Street & Sidewalk*	*1.00*	*3,049*				
DMA7-B	*246*	*Driveway*	*1.00*	*246*				
DMA7-C	*510*	*Landscape*	*0.70*	*357*	*IMP Sizing factor*	*Rain Adjust-ment Factor*	*Minimum Area or Volume*	
			Total	*3,652*				
				Area	*0.050*	*0.613*	*146*	*174*

IV.B.6. Areas Not Treated

Table 7

DMA Name	Area (square feet)
NT-1	5,861

NT-1, located at the entrance of the proposed street, will not be treated due to elevation and slope constraints. However, DMA6-Y, located near the frontage of the site along Camino Pablo, will be treated in lieu of NT-1. DMA6-Y, which consists of existing street pavement at Camino Pablo, has a larger area (5,948 square feet) than the untreated area of NT-1 (5,861 square feet).

V. SOURCE CONTROL MEASURES

V.A. Site Activities and Potential Sources of Pollutants

The single-family residential project will create some potential sources of stormwater pollutants. Sources to be controlled include:

- Potential dumping of wash-water or other liquids into storm drain inlets.
- Need for future indoor or structural pest control.
- Fertilizers and pesticides used in open space, garden, and yard maintenance.
- Vehicle washing.

V.B. Source Control Table

Table 8

Potential Source	**Permanent Controls (BMPs)**	**Operational Controls (BMPs)**
On-site dumping into storm drain inlets	All accessible on-site inlets will be marked with the words "No Dumping! Flows to Creek"	Markings will be periodically repainted or replaced. Provide stormwater pollution prevention information to new site owners, lessees, or operators. Inlets and pipes conveying stormwater to BMPs will be inspected and maintained as part of BMP Operation and Maintenance Plan. The following statement will be included in all lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."
Need for future indoor & structural pest control	Note building design features that discourage entry of pests.	Integrated Pest Management (IPM) information will be provided to new homeowners, lessees, and operators.
Landscape/outdoor pesticide use	Final landscape plans will: Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. Be designed to minimize irrigation and runoff, to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.	Landscape will be maintained using minimum or no pesticides. IPM information will be provided to new homeowners.

	Specify plantings within bioretention areas and swales that are tolerant of the sandy loam soil and periodic inundation. Include pest-resistant plants, especially adjacent to hardscape. Include plantings appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	
Vehicle washing	Driveways and parking areas drain to bioretention area or swales.	Distribute stormwater pollution prevention information to new homeowners.
Fire Sprinkler test Water	Fire Sprinkler test valves will be equipped with a means to divert test water to the sanitary sewer.	
Miscellaneous Drain or Wash Water	Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system. Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system. Rooftop equipment with potential to produce pollutants shall be roofed	

	and/or have secondary containment. Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water. Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff. Include controls for other sources as specified by local reviewer.	

V.C. SELECTION & PRELIMINARY DESIGN OF STORMWATER TREATMENT BMPS

Requirements to manage increases in runoff peak flow (hydrograph modification management) will apply on this site because the proposed project area is more than the one-acre impervious threshold. Therefore, the site is required to provide both flow control and treatment for stormwater runoff. As currently proposed, stormwater runoff will continue to flow from the east side of the property down the natural hillside and the proposed graded bank and will be intercepted by a concrete ditch on a drainage terrace behind or through Lots 1 – 6. This ditch will convey runoff from the self-treating hillside to the outfall storm drain at Camino Pablo, bypassing the bioretention filters. Below this bench and ditch the proposed graded bank will continue down to the rear yards of Lots 1 – 6. Where practicable without the need for cross-lot storm drain easements, a separate rear-yard storm drain system will capture the runoff from the hillside and rear yard pervious areas and convey it to the storm drain system, bypassing the bioretention filters. In other cases, runoff from the pervious and impervious areas will be commingled and conveyed to bioretention filters adjacent to the street. In the flatter (uphill) part of the street, runoff from the street itself and runoff from some of the lots on the east side of the street will be diverted to bioretention filters next to the west side of the street. Where the street is too steep to permit the construction of a viable bioretention filter, lot and hillside runoff will spill over into the street and will be captured by an inlet near the intersection of the street and Camino Pablo. It will then be conveyed to the large bioretention filter along Camino Pablo. Lots on the west side of the street will drain downhill to the Camino Pablo bioretention filter, while lots on the south side of the property will drain southerly to a concrete ditch and storm drain which will convey the

runoff to this bioretention filter. After treatment and storage, runoff from the bioretention filters will be discharge to an outfall storm drain and conveyed off-site.

Mean seasonal rainfall is interpolated to be approximately 29 inches per year based on Contra Costa County Public Works Department drawing B-166 "Mean Seasonal Isohyets Compiled from Precipitation Records 1879 – 1973". Since there are treatment and flow control BMPs proposed, treatment facilities are sized using a factor of 1.00 for impervious areas and 0.7 for landscaped areas, based on requirements from Contra Costa Clean Water Program Stormwater C.3 Guidebook, Seventh Edition.

The proposed improvements will help decrease peak flows 1) by delaying discharge by causing the runoff to filter through the bioretention filters for treatment, and 2) by temporary storage of runoff in the subsurface gravel layer and on the surface of the bioretention filter before being collected and discharged into the existing storm drain system. Through implementation of the proposed C.3 measures on this site, the peak runoff flow volume will be decreased from existing conditions. The Stormwater Control/ C.3 Exhibit shows the IMPs and the corresponding areas of the site that drain to the various bioretention filters. The sizes of the impervious and pervious areas; as well as the corresponding IMPs are shown in *Table 2*.

V.C.1. General Treatment BMP Characteristics

Runoff from roofs, driveways, walkways, non-self-retaining landscaped areas, and the street will be collected and conveyed to several treatment BMPs, the bioretention filters.
BMPs are located not just for use as treatment facilities, but are also incorporated into the landscaping. The BMPs are located in an open area, within the ROW, or a few feet past the ROW where access for maintenance purposes will be unhindered. The BMPs have adequate hydraulic head to allow drainage into, through, and away from the BMP without the need for pumps. The bioretention filters are located along the western boundary at the Camino Pablo frontage, and along the upper, flatter portion of the proposed street. Runoff from the site will flow towards the bioretention filters or will be captured and conveyed to the bioretention filters by the storm drain system. Because of the proposed topography of the site, all runoff from impervious areas will be treated before discharging into the storm drain system, except as noted below.

VI. BMP OPERATION AND MAINTENANCE

VI.A. Ownership and Responsibility for Maintenance in Perpetuity

The applicant agrees to operate and maintain the stormwater treatment facilities (bioretention filters) constructed in connection with the project until the legal incorporation of a private entity (HOA). The private entity would be responsible for maintenance, execute agreements that run with the land to provide and pay for maintenance of treatment facilities, and execution of a Stormwater Management Facilities Operation and Maintenance Agreement and Right of Entry in the form provided by the County.

The applicant will submit, with the application of building permits, a draft Stormwater Facilities Operation and Maintenance Plan including detailed maintenance requirements and a maintenance schedule.

VI.B. Summary of Maintenance Requirements

Bioretention facilities capture sheet flow from rooftops and paved areas. The runoff briefly floods the surface of the treatment area and then percolates through an active soil layer to drain rock below. Typical routine maintenance consists of the following:

- Examine curb openings. Remove any debris and repair any damaged curb.
- Inspect inlets for channels, exposure of soils, or other evidence of erosion. Clear any obstructions and remove any accumulation of sediment.
- Inspect outlets for erosion or plugging.
- Inspect side slopes for evidence of instability or erosion and correct as necessary.
- Observe soil at the surface of the bioretention filter for uniform percolation throughout. If portions of the bioretention filter do not drain within 48 hours after the end of a storm, the soil should be tilled and replanted. Remove any debris or accumulations of sediment.
- Confirm that check dams and flow spreaders are in place and level and that channelization within the swale or filter is effectively prevented.
- Examine the vegetation to ensure that it is healthy and dense enough to provide filtering and to protect soils from erosion. Replenish mulch as necessary, remove fallen leaves and debris, prune large shrubs or trees, and mow turf areas. When mowing, remove no more than 1/3 of the height of grasses. Confirm that irrigation is adequate and not excessive. Replace dead plants and remove noxious and invasive vegetation.
- Abate any potential vectors by filling holes in the ground in and around the swale and by insuring that there are no areas where water stands longer than 48 hours following a storm. If mosquito larvae are present and persistent, contact the Contra Costa Mosquito and Vector Control District for information and

advice. Mosquito larvicides should be applied only when absolutely necessary and then only by a licensed individual or contractor.

VII. CONSTRUCTION PLAN C.3 CHECKLIST

Table 8

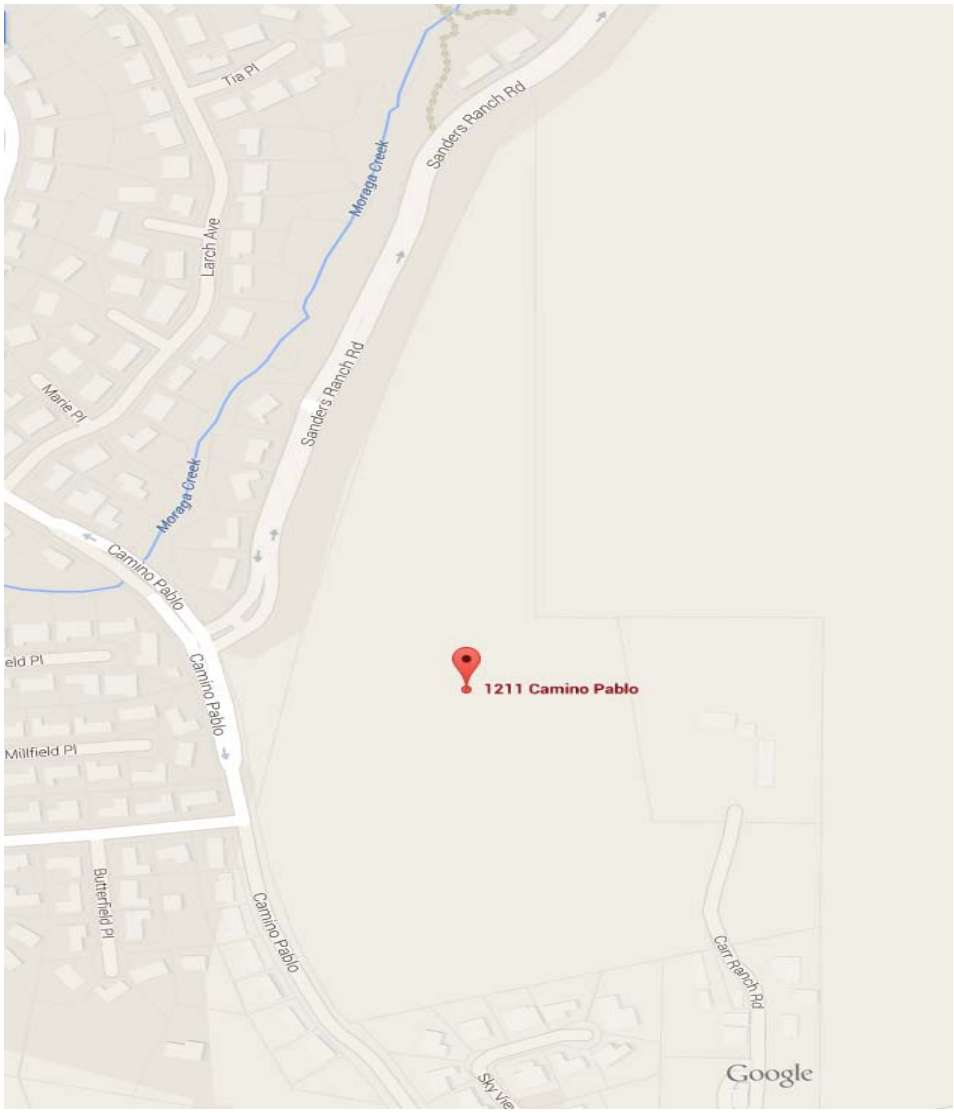
Stormwater Control Plan Page #	*BMP Description*	*See Plan Sheet #s*
7, 11	Runoff from DMA1-A is directed to IMP-1	2
7, 11	Runoff from DMA1-B is directed to IMP-1	2
7, 11	Runoff from DMA1-C is directed to IMP-1	2
7, 12	Runoff from DMA3-A is directed to IMP-3	2
7, 12	Runoff from DMA3-B is directed to IMP-3	2
7, 12	Runoff from DMA3-C is directed to IMP-3	2
7, 12	Runoff from DMA3-D is directed to IMP-3	2
7 12	Runoff from DMA3-E is directed to IMP-3	2
7, 12	Runoff from DMA3-F is directed to IMP-3	2
7, 12	Runoff from DMA4-A is directed to IMP-4	2
7, 12	Runoff from DMA4-B is directed to IMP-4	2
7, 12	Runoff from DMA4-C is directed to IMP-4	2
7, 13	Runoff from DMA5-A is directed to IMP-5	2
7, 13	Runoff from DMA5-B is directed to IMP-5	2
8, 13	Runoff from DMA5-C is directed to IMP-5	2
8, 13	Runoff from DMA6-A is directed to IMP-6	2
8, 13	Runoff from DMA6-B is directed to IMP-6	2
8, 13	Runoff from DMA6-C is directed to IMP-6	2
8, 13	Runoff from DMA6-D is directed to IMP-6	2
8, 13	Runoff from DMA6-E is directed to IMP-6	2
8, 13	Runoff from DMA6-F is directed to IMP-6	2
8, 13	Runoff from DMA6-G is directed to IMP-6	2
8, 13	Runoff from DMA6-H is directed to IMP-6	2
8, 13	Runoff from DMA6-I is directed to IMP-6	2
8, 13	Runoff from DMA6-J is directed to IMP-6	2
8, 14	Runoff from DMA6-K is directed to IMP-6	2
8, 14	Runoff from DMA6-L is directed to IMP-6	2
8, 14	Runoff from DMA6-M is directed to IMP-6	2
8, 14	Runoff from DMA6-N is directed to IMP-6	2
8, 14	Runoff from DMA6-O is directed to IMP-6	2
8, 14	Runoff from DMA6-P is directed to IMP-6	2
8, 14	Runoff from DMA6-Q is directed to IMP-6	2
9, 14	Runoff from DMA6-R is directed to IMP-6	2

9, 14	Runoff from DMA6-S is directed to IMP-6	2
9, 14	Runoff from DMA6-T is directed to IMP-6	2
9, 14	Runoff from DMA6-U is directed to IMP-6	2
9, 14	Runoff from DMA6-V is directed to IMP-6	2
9, 14	Runoff from DMA6-W is directed to IMP-6	2
9, 14	Runoff from DMA6-X is directed to IMP-6	2
9, 14	Runoff from DMA6-Y is directed to IMP-6	2
9, 14	Runoff from DMA6-Z is directed to IMP-6	2
9, 15	Runoff from DMA7-A is directed to IMP-7	2
9, 15	Runoff from DMA7-B is directed to IMP-7	2
9, 15	Runoff from DMA7-C is directed to IMP-7	2
10	ST-1 is self-treating	1, 2
10	ST-2 is self-treating	1, 2
10	ST-3 is self-treating	1, 2

VIII. CERTIFICATIONS

The selection, size, and preliminary design of treatment BMPs and other control measures in this plan meet the requirements of Regional Water Quality Control Board Order R2-2009-0074 and Order R2-2011-0083.

APPENDIX A


Tia Pl
Sanders Ranch Rd
Moraga Creek
Larch Ave
Marie Pl
Sanders Ranch Rd
Moraga Creek
Camino Pablo
Camino Pablo
1211 Camino Pablo
Millfield Pl
Butterfield Pl
Camino Pablo
Carr Ranch Rd
Google

APPENDIX B

Project Name: South Camino Pablo Annexation 1360
Project Type: Treatment and Flow Control
APN: 725-829-001
Drainage Area: 1,043,845
Mean Annual Precipitation: 29.0

Self-Treating DMAs

DMA Name	Area (sq ft)
ST-1	707,394.0
ST-2	20,194.0
ST-3	33,702.0

IV. Areas Draining to IMPs

IMP Name: IMP-1
IMP Type: Bioretention Facility
Soil Group: IMP-1

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 1-A	5,190	Concrete or Asphalt	1.00	5,190
DMA 1-B	432	Concrete or Asphalt	1.00	432
DMA 1-C	336	Landscape	0.70	235
			Total	5,857

	IMP Sizing			
	IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume
Area	0.050	0.613	234*	294
Surface Volume	0.042	0.613	151	160
Subsurface Volume	0.055	0.613	197	200
Maximum Underdrain Flow (cfs)				0.02
Orifice Diameter (in)				0.91

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

IMP Name: IMP-3
IMP Type: Bioretention Facility
Soil Group: IMP-3

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 3-A	6,941	Concrete or	1.00	6,941

IMP Sizing			
IMP Sizing	Rain	Minimum	Proposed

		Asphalt		
DMA 3-B	477	Concrete or Asphalt	1.00	477
DMA 3-C	274	Landscape	0.70	192
DMA 3-D	1,138	Concrete or Asphalt	1.00	1,138
DMA 3-E	3,889	Landscape	0.70	2,722
DMA 3-F	3,639	Conventional Roof	1.00	3,639
			Total	15,109

	Factor	Adjustment Factor	Area or Volume	Area or Volume
Area	0.050	0.613	604*	608
Surface Volume	0.042	0.613	389	400
Subsurface Volume	0.055	0.613	509	550
Maximum Underdrain Flow (cfs)				0.05
Orifice Diameter (in)				1.51

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

IMP Name: IMP-4
IMP Type: Bioretention Facility
Soil Group: IMP-4

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 4-A	3,427	Conventional Roof	1.00	3,427
DMA 4-B	1,953	Concrete or Asphalt	1.00	1,953
DMA 4-C	753	Landscape	0.70	527
			Total	5,907

IMP Sizing

	IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume
Area	0.050	0.613	236*	308
Surface Volume	0.042	0.613	152	165
Subsurface Volume	0.055	0.613	199	200
Maximum Underdrain Flow (cfs)				0.02
Orifice Diameter (in)				0.92

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

IMP Name: IMP-5

IMP Type: Bioretention Facility
Soil Group: IMP-5

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 5-A	2,923	Conventional Roof	1.00	2,923
DMA 5-B	1,463	Concrete or Asphalt	1.00	1,463
DMA 5-C	2,054	Landscape	0.70	1,438
			Total	5,824

IMP Sizing

	IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume
Area	0.050	0.613	233*	278
Surface Volume	0.042	0.613	150	160
Subsurface Volume	0.055	0.613	196	200
Maximum Underdrain Flow (cfs)				0.02
Orifice Diameter (in)				0.95

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

IMP Name: IMP-6
IMP Type: Bioretention Facility
Soil Group: IMP-6

DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 6-A	3,614	Conventional Roof	1.00	3,614
DMA 6-B	1,756	Concrete or Asphalt	1.00	1,756
DMA 6-C	4,685	Conventional Roof	1.00	4,685
DMA 6-D	1,455	Concrete or Asphalt	1.00	1,455
DMA 6-E	4,601	Conventional Roof	1.00	4,601
DMA 6-F	5,018	Concrete or Asphalt	1.00	5,018
DMA 6-G	3,421	Conventional Roof	1.00	3,421
DMA 6-H	2,199	Concrete or Asphalt	1.00	2,199
DMA 6-I	3,238	Conventional Roof	1.00	3,238

IMP Sizing

IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume

DMA 6-J	1,480	Concrete or Asphalt	1.00	1,480				
DMA 6-K	3,448	Conventional Roof	1.00	3,448				
DMA 6-L	1,898	Concrete or Asphalt	1.00	1,898				
DMA 6-M	3,102	Conventional Roof	1.00	3,102				
DMA 6-N	1,580	Concrete or Asphalt	1.00	1,580				
DMA 6-O	15,996	Concrete or Asphalt	1.00	15,996				
DMA 6-P	3,406	Conventional Roof	1.00	3,406				
DMA 6-Q	1,905	Concrete or Asphalt	1.00	1,905				
DMA 6-R	2,449	Conventional Roof	1.00	2,449				
DMA 6-S	1,265	Concrete or Asphalt	1.00	1,265				
DMA 6-T	3,541	Conventional Roof	1.00	3,541				
DMA 6-U	1,541	Concrete or Asphalt	1.00	1,541				
DMA 6-V	35,889	Landscape	0.70	25,122				
DMA 6-W	112,272	Landscape	0.70	78,590				
DMA 6-X	8,347	Concrete or Asphalt	1.00	8,347				
DMA 6-Y	5,948	Concrete or Asphalt	1.00	5,948				
DMA 6-Z	246	Concrete or Asphalt	1.00	246				
			Total	189,852				
				Area	0.050	0.613	7,594*	7,899
				Surface Volume	0.042	0.613	4,886	5,000
				Subsurface Volume	0.055	0.613	6,399	6,600
							Maximum Underdrain Flow (cfs)	0.68
							Orifice Diameter (in)	5.70

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

IMP Name: IMP-7

IMP Type: Bioretention Facility
Soil Group: IMP-7

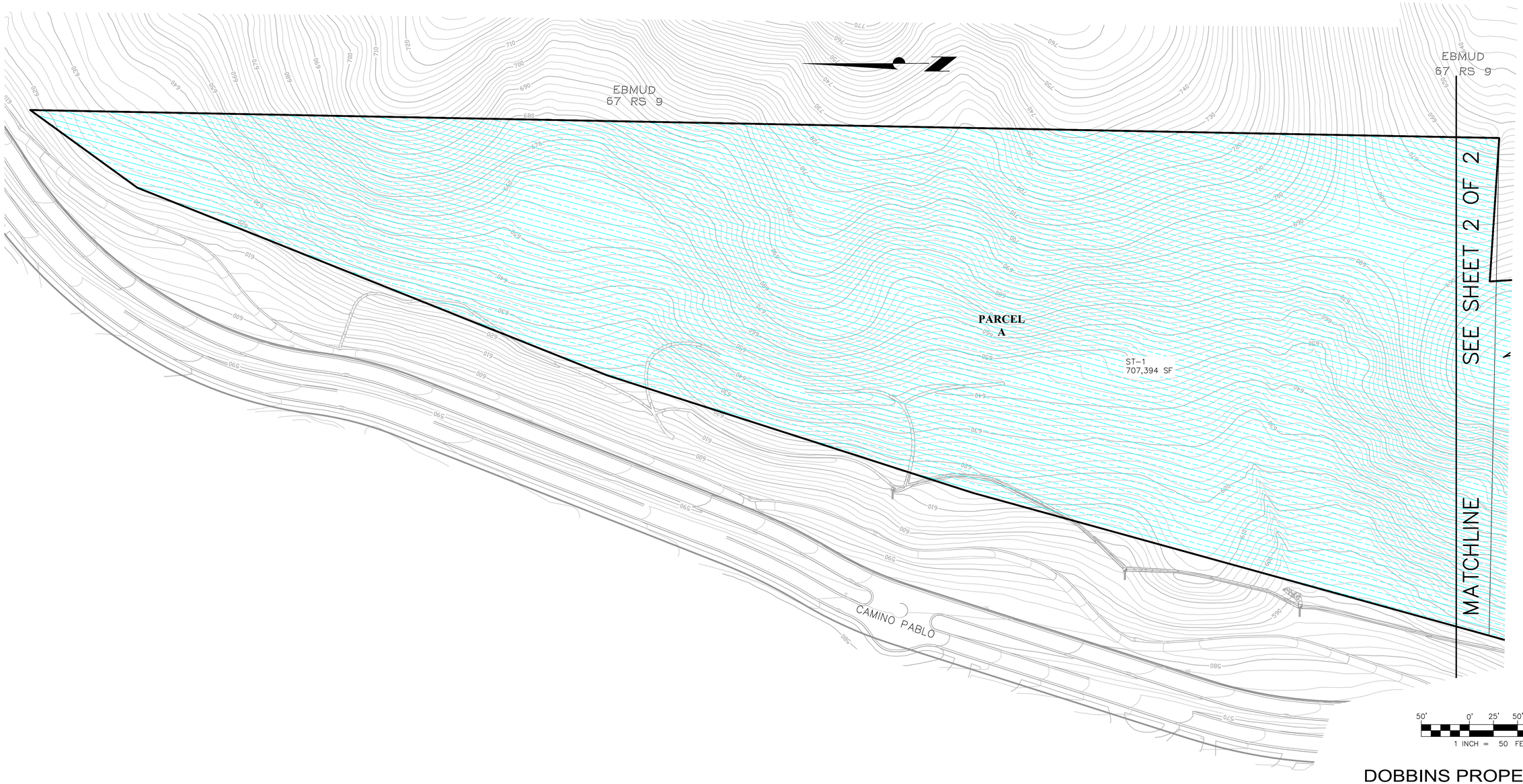
DMA Name	Area (sq ft)	Post Project Surface Type	DMA Runoff Factor	DMA Area x Runoff Factor
DMA 7-A	3,049	Concrete or Asphalt	1.00	3,049
DMA 7-B	246	Concrete or Asphalt	1.00	246
DMA 7-C	510	Landscape	0.70	357
			Total	3,652

IMP Sizing

	IMP Sizing Factor	Rain Adjustment Factor	Minimum Area or Volume	Proposed Area or Volume
Area	0.050	0.613	146*	174
Surface Volume	0.042	0.613	94	100
Subsurface Volume	0.055	0.613	123	150
Maximum Underdrain Flow (cfs)				0.01
Orifice Diameter (in)				0.73

* The product of the IMP Sizing Factor and the Rainfall Adjument Factor was less than the minimum value of 0.04. The value of 0.04 was used to adjust the area instead.

APPENDIX C



LEGEND

- C.3 BIORETENTION BASIN
- AREAS DRAINING TO IMP-1
- AREAS DRAINING TO IMP-3
- AREAS DRAINING TO IMP-4
- AREAS DRAINING TO IMP-5
- AREAS DRAINING TO IMP-6
- AREAS DRAINING TO IMP-7
- IMP INTEGRATED MANAGEMENT PRACTICE
- DMA DRAINAGE MANAGEMENT AREA
- SELF-TREATING AREA (ST)
- AREA NOT TREATED (NT)
- STORM DRAIN – TREATED
- STORM DRAIN – UNTREATED

DOBBINS PROPERTIES, LLC

SOUTH CAMINO PABLO ANNEXATION SUBDIVISION 9396

TOWN OF MORAGA, CA

STORMWATER CONTROL PLAN

JANUARY, 2019

dk CONSULTING
ENGINEERING · PLANNING · SURVEYING
1931 SAN MIGUEL DRIVE, SUITE 100, WALNUT CREEK, CALIFORNIA 94596, (925) 932-6868

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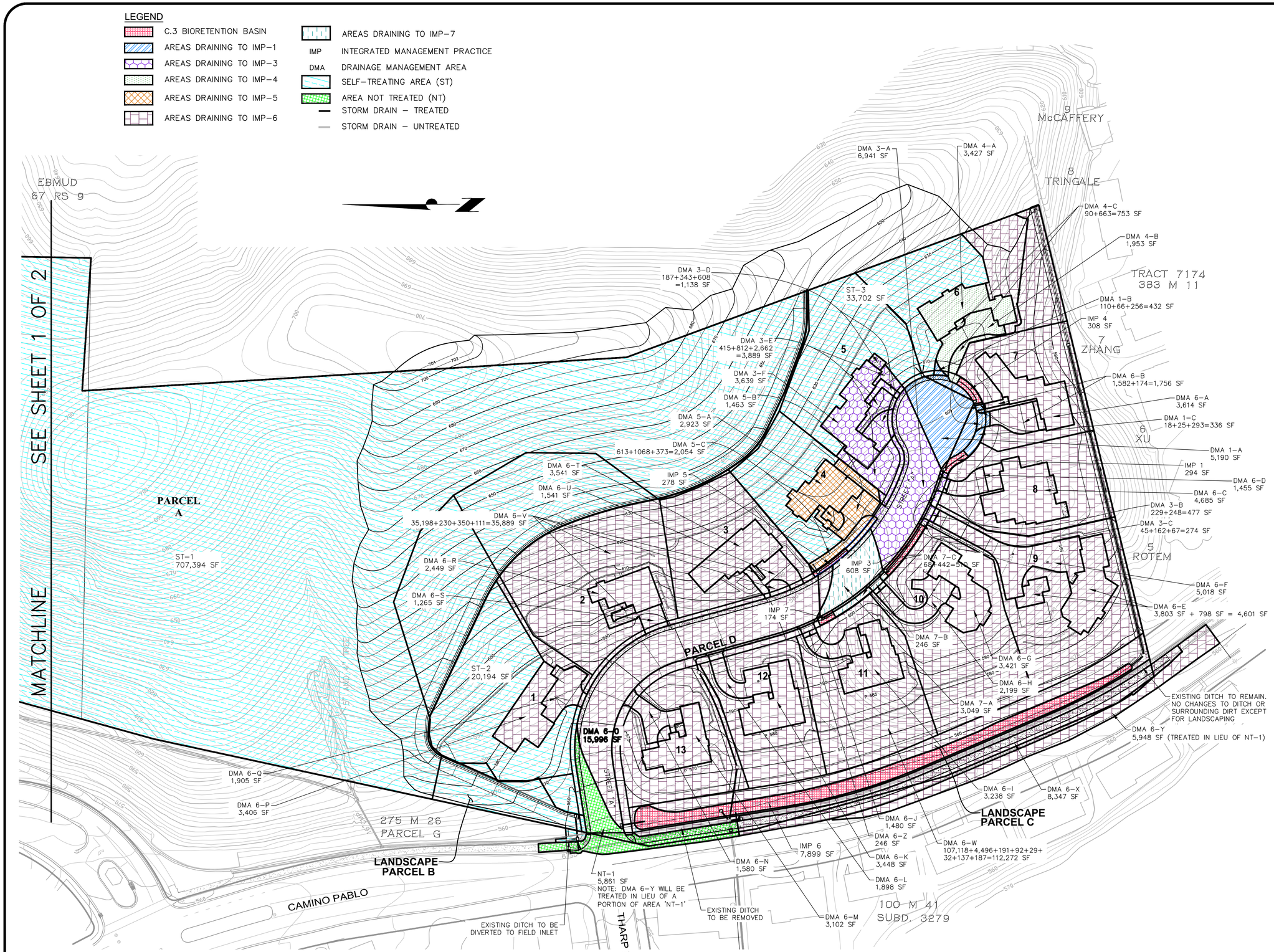

DOBBINS PROPERTIES, LLC
SOUTH CAMINO PABLO ANNEXATION SUBDIVISION 9396
TOWN OF MORAGA, CA
STORMWATER CONTROL PLAN
JANUARY, 2019

dk CONSULTING
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dk JOB# 13-1060-10

South Camino Pablo Annexation
Hydrologic & Hydraulic Analyses

Developer:
Dobbins Properties, LLC

Job# 13-1060-12
February 10, 2020

Prepared for:
Town of Moraga

ENGINEERING
SURVEYING · PLANNING
Designing forward.

1931 San Miguel Drive, Suite 100, Walnut Creek, California 94596 / (925) 932-6868
www.dkconsultinginc.com

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1.0 INTRODUCTION

1.1 General

This report, dated February 10, 2020, is to supersede the previous report titled "South Camino Pablo Annexation Hydrologic & Hydraulic Analyses" dated January 2019 as well as the Addendum 1 dated May 16, 2019. All the existing and proposed storm drain pipes collecting drainage from the site at 1211 Camino Pablo have been analyzed herein.

This report has been prepared in accordance with the standard methods approved by Contra Costa County and the Town of Moraga (Town) for distribution to the Town and the applicant. The purpose of this report is to present hydrologic and hydraulic calculations, provide analyses of the existing and proposed storm drain system, and demonstrate that the future developed conditions comply with the requirements of the Town and Contra Costa County.

1.2 Project Description

South Camino Pablo Annexation is a 23.90-acre site owned by Dobbins Properties. The project site is located on the southeast corner of the intersection of Camino Pablo and Sanders Ranch Road in the Town of Moraga. The project site consists of one parcel, which is currently agricultural land. The property is bordered to the north by Sanders Ranch Road, to the west by Camino Pablo and Sanders Ranch Road, to the south by single family residential lots, and agricultural land abuts the property to the east. The southwest portion of the site, approximately 7.69 acres, will be developed as single-family hillside homes and associated residential infrastructure. Approximately 0.57 acres will consist of landscape parcels, and 0.24 acres will be dedicated to the Town of Moraga. The remaining property, approximately 15.40 acres, will remain for agricultural uses.

The project proposes connecting to an existing storm drain system which currently collects the runoff from the undeveloped site. This storm drain system flows through the adjacent Subdivision 3279 and outfalls into Moraga Creek. This report and calculations have been compiled to demonstrate the adequacy of the downstream system for both the pre- and post-development conditions.

2.0 PROJECT SETTING

2.1 Land Use and Topography

The project site is located at 1211 Camino Pablo, Moraga, California (see Vicinity Map in Appendix A). The existing site is currently undeveloped and is in an area of relatively steep hillside terrain. The site is open grassland and brush that is currently used for grazing. Existing onsite improvements appear to be limited to perimeter fencing, concrete v-ditches and field inlets.

2.2 Runoff Description

The pre-development site is mostly pervious. The proposed development, 8.5 acres of the total 23.90-acre site, will consist of 13 single family hillside homes, landscape buffers, and street improvements. The storm water runoff from the site will be treated by bioretention basins and discharge into the proposed storm drain system onsite before exiting into the existing storm drain system that releases into the Moraga Creek. The remaining portion of the site will remain as undeveloped and will continue to discharge into an existing v-ditch, located adjacent to Camino Pablo, and finally into the existing storm drain system.

Pre-development and post-development hydrology maps are included in Appendix B.1 and B.2.

2.3 Supporting Information

In order to complete analysis of the downstream storm drain system, several resources listed below were utilized.

Topographic surveys were completed by dk Engineering in 2014 for the project site and adjacent frontage. The program Autodesk Infraworks was then utilized to supplement the offsite topography within the adjacent Subdivision 3279. Drainage areas for the offsite inlets were drawn according to these GIS contours.

Information regarding the existing downstream storm drain infrastructure within the public right-of-way was obtained by field investigations completed by dk Engineering on January 2020. Note that where access is restricted on private property and field survey information could not be obtained, the information provided by Mark Summers at the Town of Moraga was utilized. The map provided by the Town is shown in Appendix C.

3.0 HYDROLOGIC AND HYDRAULIC ANALYSES

The following sections discuss the analyses for the hydrology and hydraulics in depth. The analyses have been prepared to demonstrate compliance with Contra Costa County's criteria for storm drain systems. See Hydrology Map (Appendix B) for watersheds and locations of storm drain systems.

3.1 Hydrologic Analysis

According to Contra Costa County Flood Control District, the design storm is based on the watershed area. If the watershed area is less than 1 square mile (640 acres), then storm design for a 10-year rainfall event is required. Based on the drainage area of this project, the rational method was used to calculate the 10-year storm event quantities. The rational method uses the formula:

$$Q = CiA$$

where:
- Q = Discharge (cfs)
- C = Runoff Coefficient
- I = Rainfall Intensity (in/hr)
- A = Drainage Area (acres)

The runoff coefficients for this project were developed using the County's designated runoff coefficients (see Appendix D). A mean annual precipitation depth of 29" was derived from the County's Isohyetal Mean Annual Precipitation (see Appendix E). A Precipitation Duration-Frequency-Depth Curve (see Appendix F) was developed for the 10-year storm event by interpolating between the 25" and 30" mean seasonal precipitation curves and reading the rainfall depth for the given time of concentration. Rainfall intensity values were then calculated using these depths and times of concentration. The program used for hydrology calculations, Stormwater Studio, creates its own Intensity-Duration-Frequency curve based on this data. This curve is shown in Appendix G.

For this analysis, a conservative time of concentration of five minutes was applied to all structures with exception to FI10, which is an upstream structure collecting a large undeveloped hillside drainage area. The time of concentration for this structure was calculated using the TR-55 method, accounting for sheet flow, shallow concentrated flow and channel flow. The calculation for time of concentration is shown in Appendix H.

With the initial time of concentration having been determined, the flows to the upstream structure were then calculated using the rational method. The flows into the downstream structures on that same line were calculated using a time of concentration developed based on the travel time of the flows within the pipe plus the initial time of concentration. This method was repeated yielding a total flow at the downstream end of the system. See Appendix I for 10-year hydrology calculations.

Storm drain structures and the bioretention basins have been designed to convey the 10-year storm. Residential lots will drain into private yard drains, which will be directed into the proposed storm drain system or into the streets via sheet flow and/or through curb drains. The runoff from the lots will be treated via bioretention basins and ultimately drain to the primary storm system.

3.2 Hydraulic Analysis

The hydraulic analysis of the storm drain system utilizes stormwater studio and the generally accepted backwater methodology – where:

$$Z_1 + Y_1 + \frac{V_1^2}{2g} = Z_2 + Y_2 + \frac{V_2^2}{2g} + HL$$

Z = Invert Elevation (feet)
Y = HGL minus the invert elevation (feet)
V = Velocity (feet per second)
HL = Head Loss (feet)

Friction losses are computed by the following equation:

$$HL = \frac{(hf_1 + hf_2)}{2}$$

hf_1 = Head friction at the downstream end
hf_2 = Head friction at the upstream end

Head friction is computed by:

$$Hf = (Qn/ K_m AR^{0.667})^2 \text{ x Line Length}$$

K_m = 1.486
n = Manning's n
A = Cross sectional area of flow (ft^2)
R = Hydraulic Radius

The starting hydraulic grade line (HGL) was taken as the pipe soffit at the outfall into Moraga Creek, located within Subdivision 3279 Lot 19. The program begins at the most downstream line for the starting HGL, which in this case, is calculated to be 533.53. An upstream HGL is assumed for a given line and is checked against the energy equation. If the equation does not balance, another HGL is assumed until the assumed HGL equals the computed HGL. The downstream or starting HGL for the next upstream line is based on the HGL plus any junction

loss. The junction losses are computed using the methodology and loss coefficients recommended by Urban Drainage Design Manual, HEC-22. A manning's n-value of 0.014 was used for all pipes within the system. Hydraulic computations are shown in Appendix J.

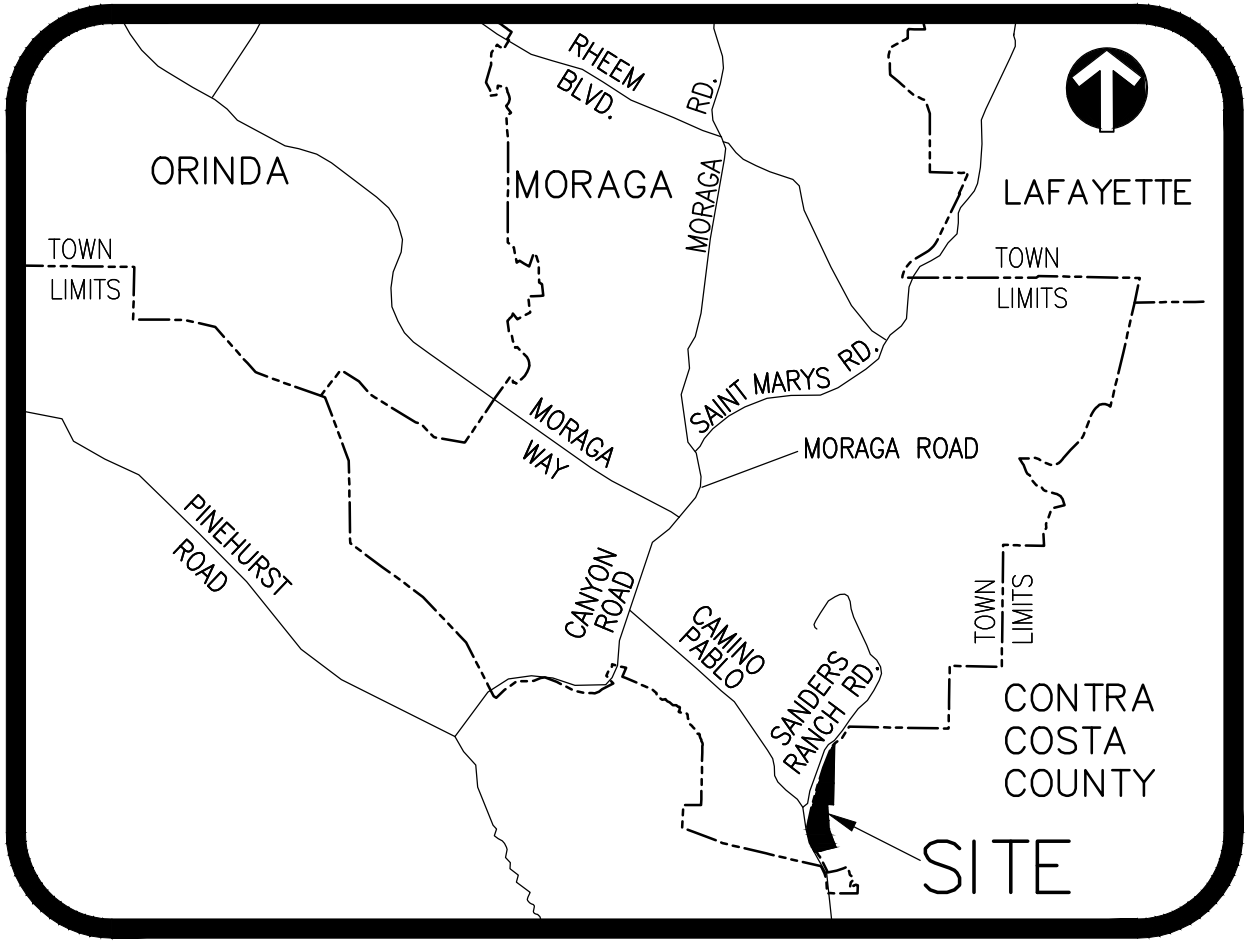
All existing downstream pipes have adequate capacity for the site's developed condition except for the existing 15″ pipe located along the project's frontage within Camino Pablo. Two existing 36″ pipes (labeled 3 & 4 in the analysis) are flowing slightly under pressure but within the County's acceptable standards. The existing 15″ pipe along Camino Pablo (connecting EX. CB7 and EX. FI1) as shown in Appendix B is proposed to be upsized to an 18″ pipe. The existing 36″ pipes have well above the county's minimum freeboard requirement. Throughout the system, minimum County standards of 1.25 feet for hydraulic freeboard have been observed at all structures.

4.0 DISCUSSION AND CONCLUSIONS

Based upon our analysis, we conclude that the offsite storm drain system can meet the requirements of Contra Costa County and the Town of Moraga. The analyses performed in this report demonstrates that the existing downstream system is adequate to receive runoff from the development of this project. All proposed pipes have adequate capacity for a 10-year storm. All existing and proposed structures meet the County's minimum freeboard requirement of 1.25 feet. No onsite detention is needed or required for the project.

If the outlets of the system were clogged or overwhelmed and flows escaped through the top of the system, the designed overland release route is through the project site's proposed road and/or downstream to Camino Pablo.

APPENDIX A
VICINITY MAP



VICINITY MAP

NOT TO SCALE

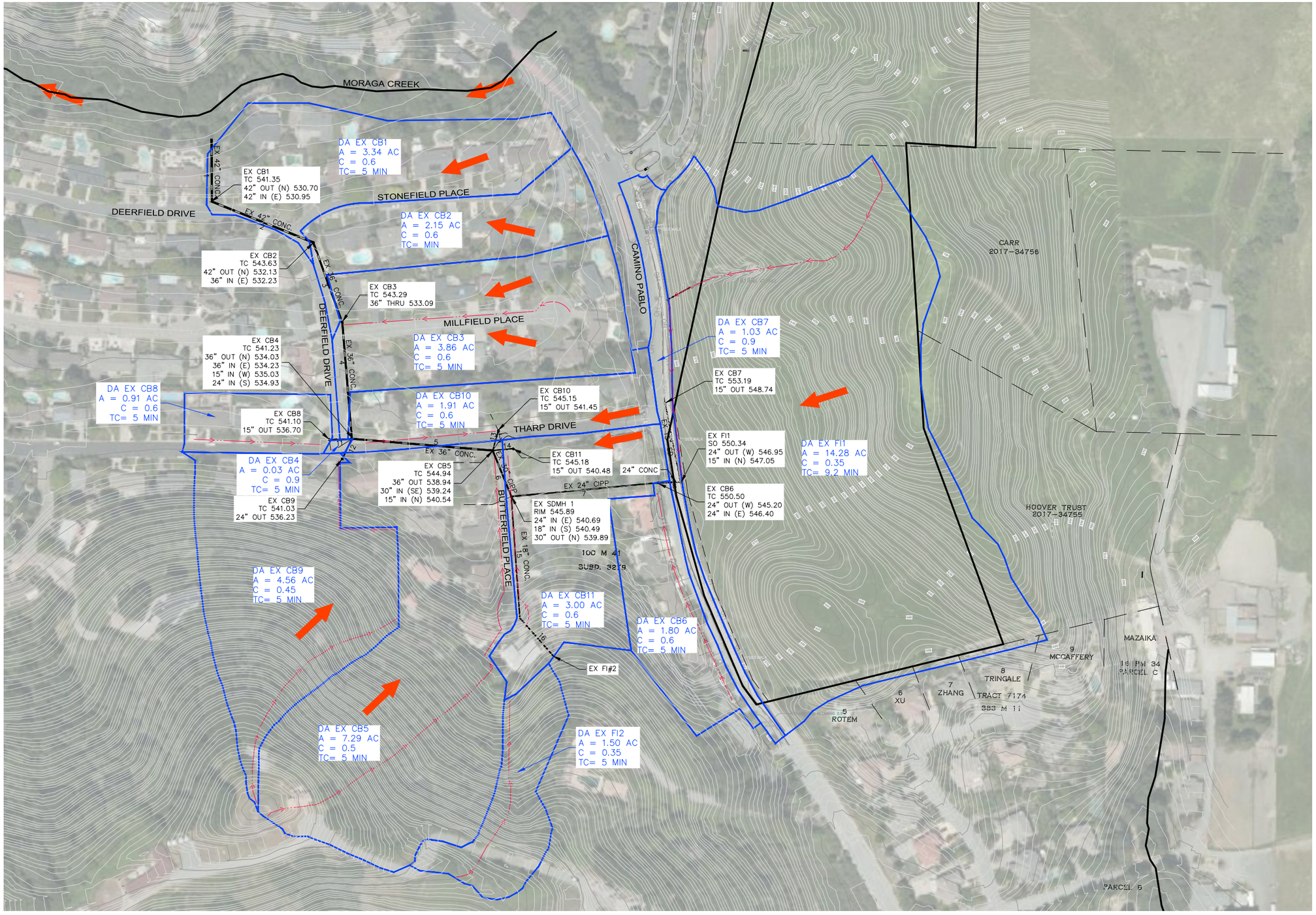
APPENDIX B

1. PRE-DEVELOPMENT HYDROLOGY MAP

(1-11x17 map for quick reference and 1-full size map)

2. POST-DEVELOPMENT HYDROLOGY MAP

(1-11x17 map for quick reference and 1-full size map)



100' 0' 50' 100' 200'

1 INCH = 100 FEET

CAMINO PABLO

PRE-DEVELOPMENT HYDROLOGY MAP

FEBRUARY 10, 2020

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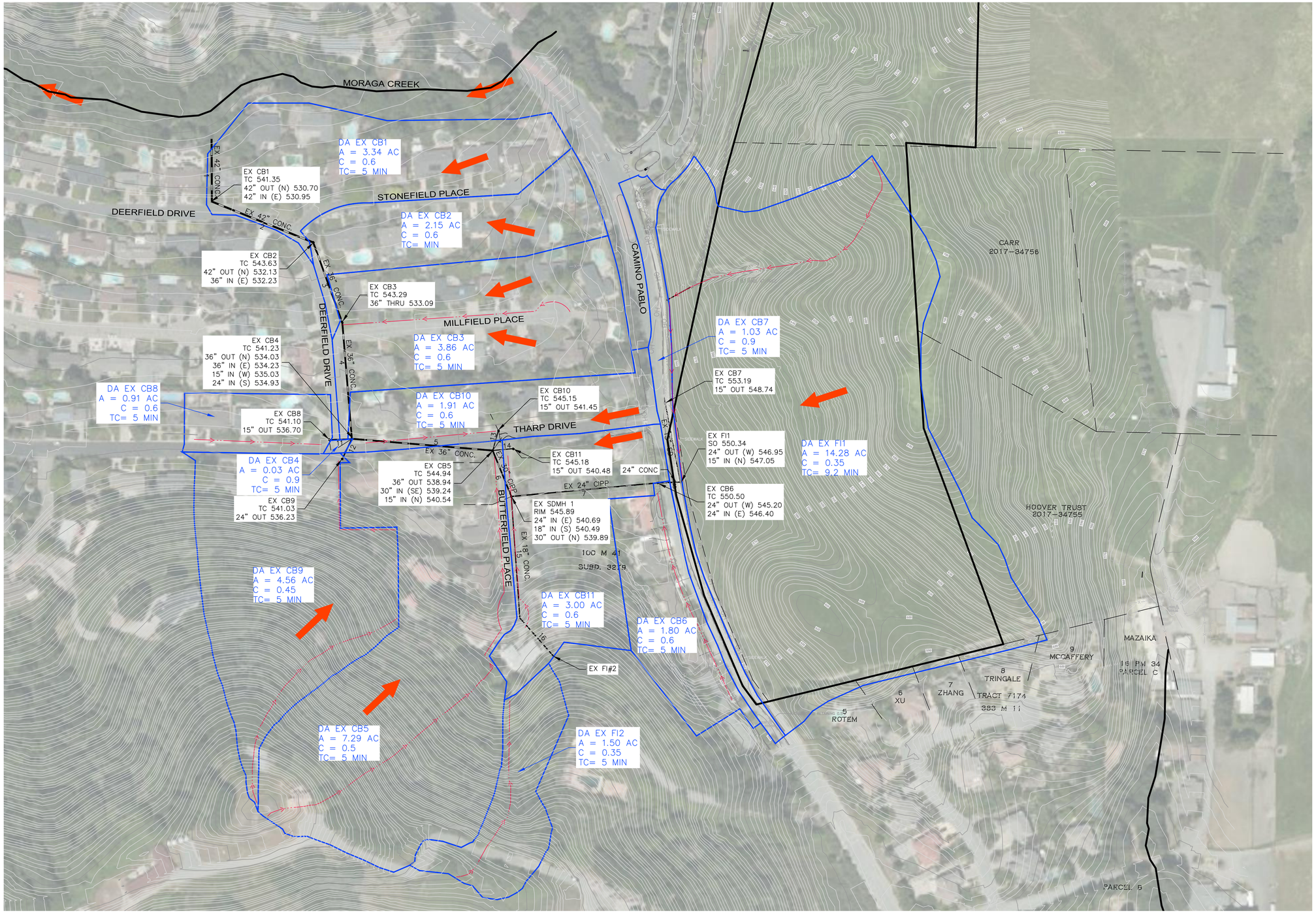
dk JOB# 13-1060



CAMINO PABLO

PRE-DEVELOPMENT HYDROLOGY MAP

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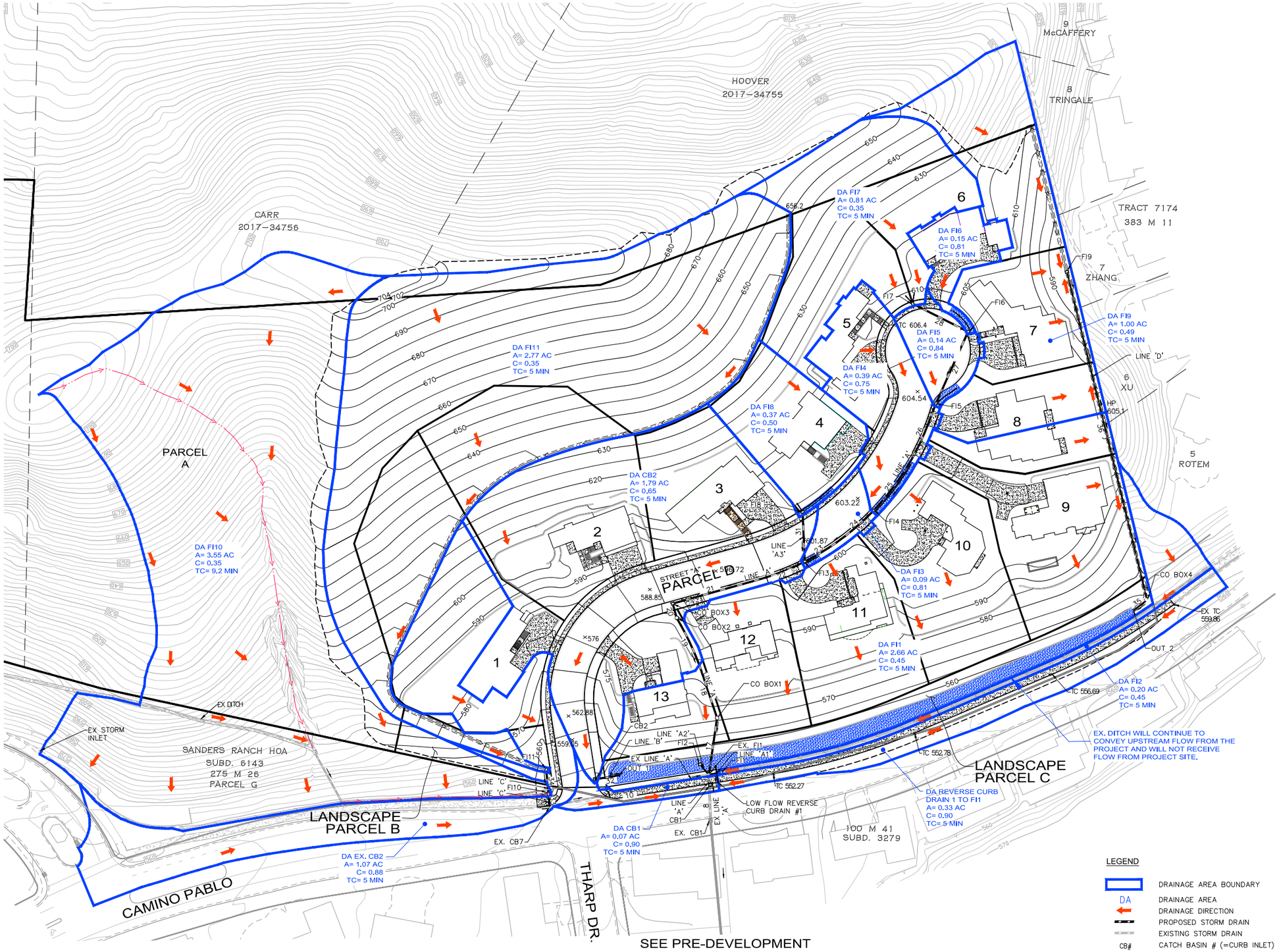
dk JOB# 13-1060



SEE PRE-DEVELOPMENT
HYDROLOGY MAP FOR
OFFSITE PIPES

NOTE:
ALL BUILDINGS AND DRIVEWAYS AS A PART OF
THIS PLAN ARE CONCEPTUAL.

LEGEND

	DRAINAGE AREA BOUNDARY
DA	DRAINAGE AREA
	DRAINAGE DIRECTION
	PROPOSED STORM DRAIN
	EXISTING STORM DRAIN
CB#	CATCH BASIN # (=CURB INLET)
CO BOX#	CLEANOUT BOX #
FI#	FIELD INLET #
LINE#	STORM DRAIN LINE #
OUT	OUTFALL AT BIORETENTION FILTER
	STORM DRAIN DIRECTION

CAMINO PABLO

POST-DEVELOPMENT HYDROLOGY MAP

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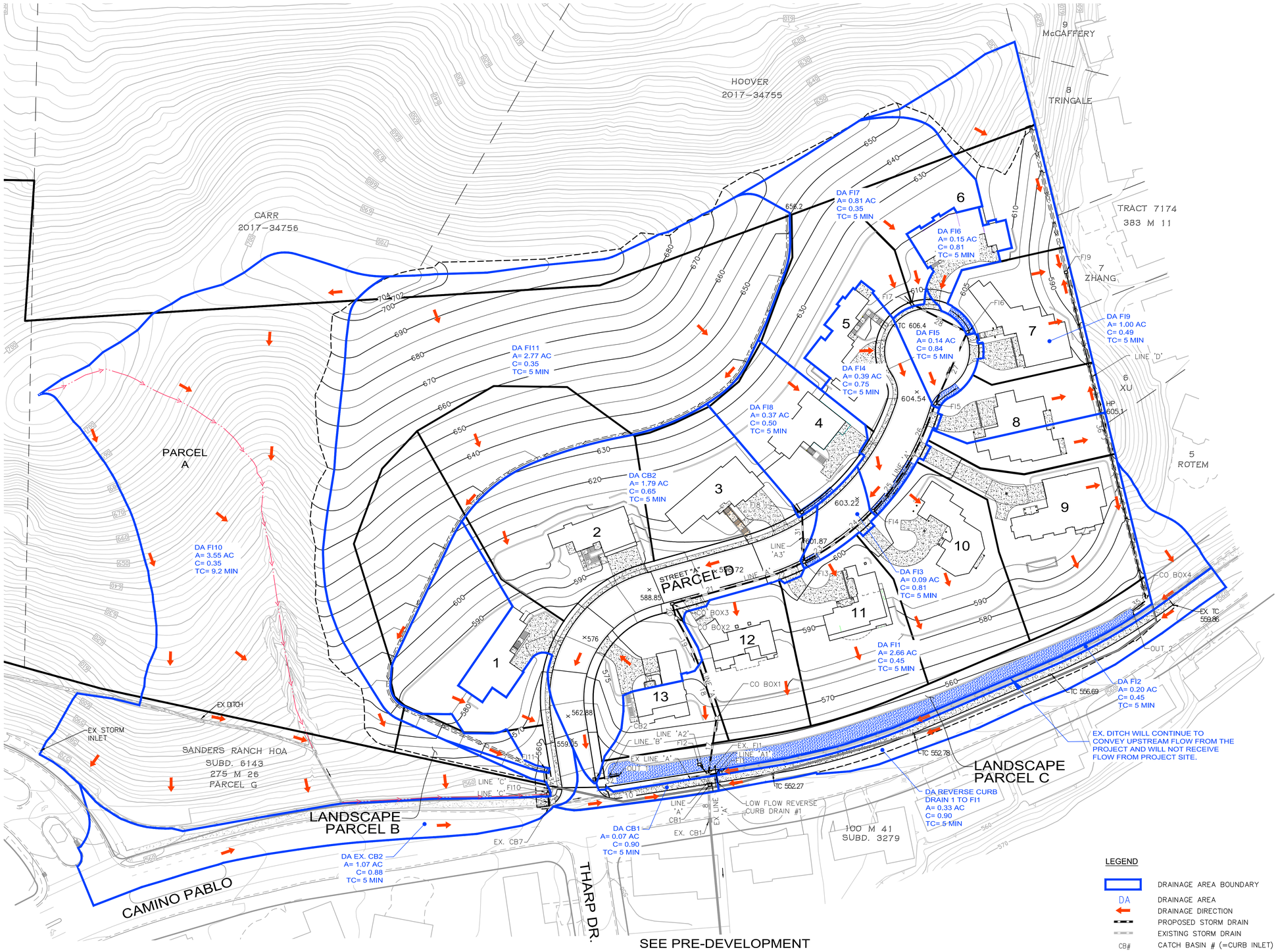
dk JOB# 13-1060-12



50' 0' 25' 50' 100'

1 INCH = 50 FEET

SEE PRE-DEVELOPMENT
HYDROLOGY MAP FOR
OFFSITE PIPES

NOTE:
ALL BUILDINGS AND DRIVEWAYS AS A PART OF
THIS PLAN ARE CONCEPTUAL.

LEGEND

	DRAINAGE AREA BOUNDARY
DA	DRAINAGE AREA
	DRAINAGE DIRECTION
	PROPOSED STORM DRAIN
	EXISTING STORM DRAIN
CB#	CATCH BASIN # (=CURB INLET)
CO BOX#	CLEANOUT BOX #
FI#	FIELD INLET #
LINE#	STORM DRAIN LINE #
OUT	OUTFALL AT BIORETENTION FILTER
	STORM DRAIN DIRECTION

CAMINO PABLO

POST-DEVELOPMENT HYDROLOGY MAP

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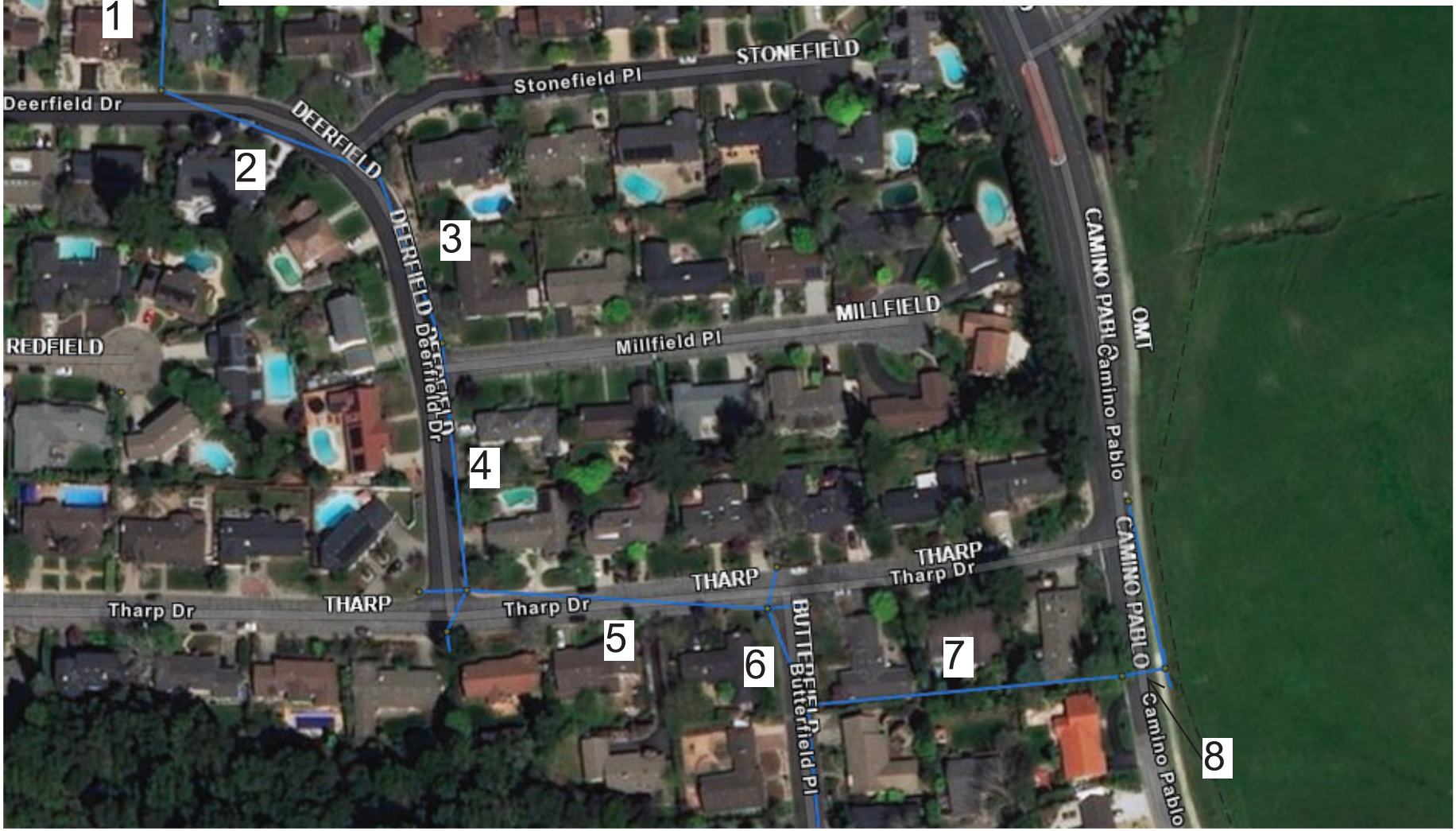
APPENDIX C
OFFSITE STORM DRAIN MAP

	Material	Condition	Diameter (in.)	Upstrm Elev (ft.)	Upstrm Inv Evev (ft.)	Dnstrm Elev (ft.)	Dnstrm Inv Elev (ft.)	Length
1	RCP	Good	42	435.09	425.29	?	?	133.2
2	RCP	Good	42	437.3	426.6	435.09	425.39	234.11
3	RCP	Good	36	437.03	427.33	437.3	426.8	182.55
4	RCP	Good	30	435.98	429.78	437.13	427.33	249.51
5	RCP	Good	36	438.6	433.4	435.98	429.68	304.03
6	RCP	Good	30	440.15	434.15	438.6	433.4	106.58
7	RCP	Good	24	444.15	439.33	440.15	434.95	319.31
8	RCP	Good	24	446.1	446.1	444.03	440.53	44.35



DRAFT

The information shown here was taken from GIS data and is for information purposes only. The Town of Moraga makes no guarantees of the accuracy shown herein.

APPENDIX D
CONTRA COSTA COUNTY RUNOFF COEFFICIENTS

CCCFCD STANDARD - RUNOFF COEFFICIENTS

Rational Formula

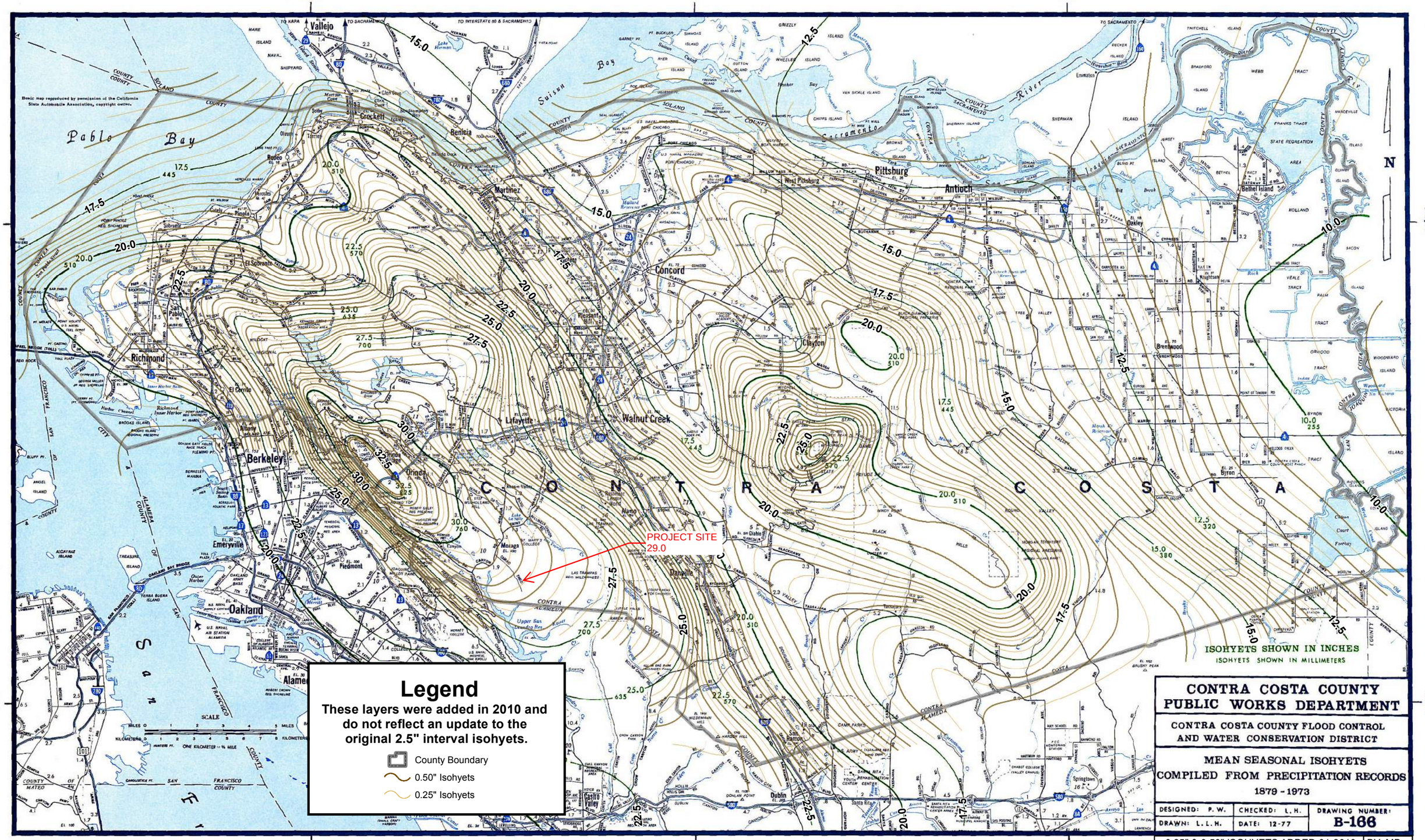
Land Use	Runoff Coefficient	Average Impervious Area (%)	Time of Concentration-Roof to Gutter (min)
Residential:			
R - 6	.50 - .70	76	3 - 5
R - 10	.45 - .60	53	5 - 7
R - 20	.40 - .50	35	6 - 8
R - 40	.35 - .45	25	8 - 10
Apartment	.60 - .80		3 - 10
Commercial	.70 - .95		3 - 8
Industrial	.60 - .90		3 - 10
Open	.20 - .40		
Street:			
Asphalt	.75 - .95		
Concrete	.80 - .95		
Drives and Walks	.80 - .95		
Roofs	.75 - .95		

Legend

R - 6 = 6,000 ft^2 Lot
R - 10 = 10,000 ft^2 Lot
R - 20 = 20,000 ft^2 Lot
R - 40 = 40,000 ft^2 Lot

Note: For Contra Costa County Land Uses use the highest runoff coefficient in the range. This more closely approximates the peak flows calculated by the Unit Hydrograph method developed for Contra Costa County and calibrated with local rainfall and runoff data.

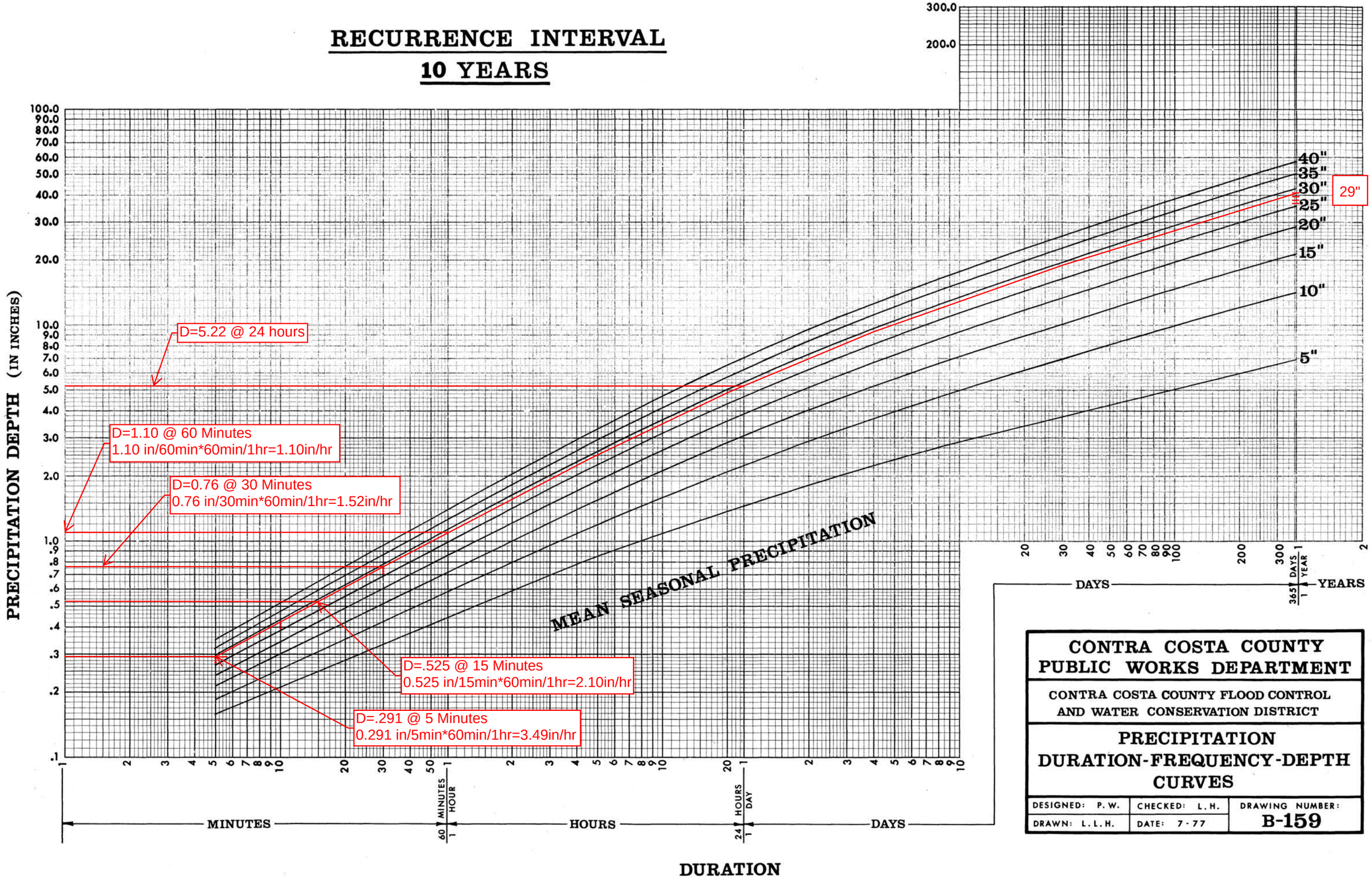
APPENDIX E
CONTRA COSTA COUNTY MEAN SEASONAL ISOHYETS


122°15′
122°00′
121°45′
38°00′
37°45′
Pablo Bay
Suisun Bay
Sacramento River
San Joaquin River
C O N T R A C O S T A
Vallejo
Crockett
Benicia
Martinez
Pittsburg
Antioch
Concord
Pleasant Hill
Walnut Creek
Lafayette
Orinda
Moraga
Danville
San Ramon
Dublin
Clayton
Brentwood
Oakley
Richmond
Berkeley
Emeryville
Oakland
Alameda
Piedmont
Pinole
Hercules
Rodeo
El Sobrante
San Pablo
El Cerrito
Albany
Alamo
Castro Valley
Byron
Bethel Island
PROJECT SITE
29.0
ISOHYETS SHOWN IN INCHES
ISOHYETS SHOWN IN MILLIMETERS
Legend
These layers were added in 2010 and do not reflect an update to the original 2.5" interval isohyets.
County Boundary
0.50" Isohyets
0.25" Isohyets
CONTRA COSTA COUNTY
PUBLIC WORKS DEPARTMENT
CONTRA COSTA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
MEAN SEASONAL ISOHYETS
COMPILED FROM PRECIPITATION RECORDS
1879 - 1973
DESIGNED: P. W.
CHECKED: L. H.
DRAWING NUMBER:
B-166
DRAWN: L. L. H.
DATE: 12-77
0.25" & 0.50" ISOHYETS ADDED 01-2010
BY: MB

APPENDIX F

10-YEAR PRECIPITATION DURATION - FREQUENCY- DEPTH CURVE

RECURRENCE INTERVAL
10 YEARS



CONTRA COSTA COUNTY
PUBLIC WORKS DEPARTMENT

CONTRA COSTA COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

PRECIPITATION
DURATION-FREQUENCY-DEPTH
CURVES

DESIGNED: P. W.	CHECKED: L. H.	DRAWING NUMBER:
DRAWN: L. L. H.	DATE: 7-77	B-159

APPENDIX G
STORMWATER STUDIO 10-YEAR IDF CURVE

IDF Report

IDF filename: CAMINO PABLO IDF 10 year.idf

Stormwater Studio 2019 v 3.0.0.15

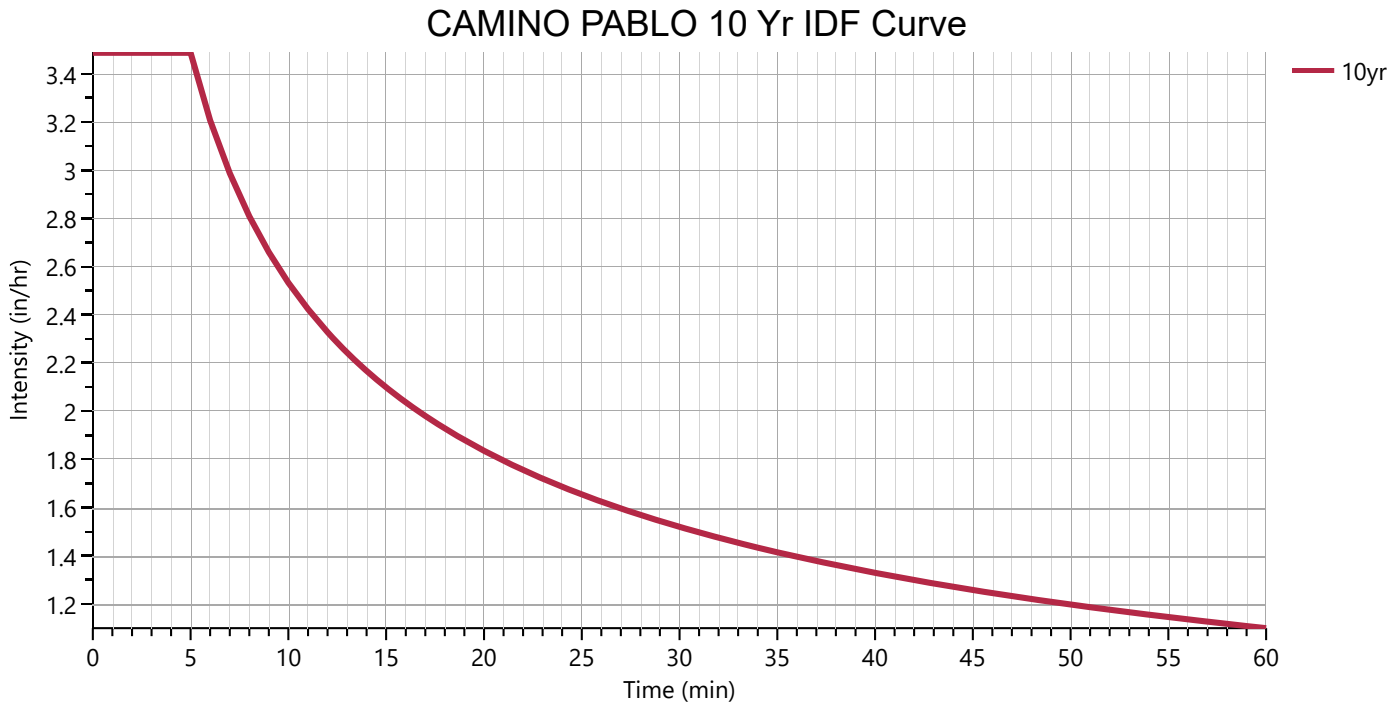
02-09-2020

Equation Coefficients	Intensity = B / (Tc + D)^E (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	15-yr	50-yr	100-yr	
B	0.0000	0.0000	0.0000	0.0000	7.4706	0.0000	0.0000	0.0000	
D	0.0000	0.0000	0.0000	0.0000	0.1000	0.0000	0.0000	0.0000	
E	0.0000	0.0000	0.0000	0.0000	0.4677	0.0000	0.0000	0.0000	

Minimum Tc = 5 minutes

Tc (min)	Intensity Values (in/hr)								
	1-yr	2-yr	3-yr	5-yr	10-yr	15-yr	50-yr	100-yr	
Cf	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
5	0	0	0	0	3.49	0	0	0	
10	0	0	0	0	2.53	0	0	0	
15	0	0	0	0	2.10	0	0	0	
20	0	0	0	0	1.84	0	0	0	
25	0	0	0	0	1.65	0	0	0	
30	0	0	0	0	1.52	0	0	0	
35	0	0	0	0	1.41	0	0	0	
40	0	0	0	0	1.33	0	0	0	
45	0	0	0	0	1.26	0	0	0	
50	0	0	0	0	1.20	0	0	0	
55	0	0	0	0	1.15	0	0	0	
60	0	0	0	0	1.10	0	0	0	

Cf = Correction Factor applied to Rational Method runoff coefficient.



APPENDIX H
FIELD INLET TIME OF CONCENTRATION CALCULATIONS

TR55 Worksheet

Project Name: Camino Pablo-Post Development

Stormwater Studio 2019 v 3.0.0.15

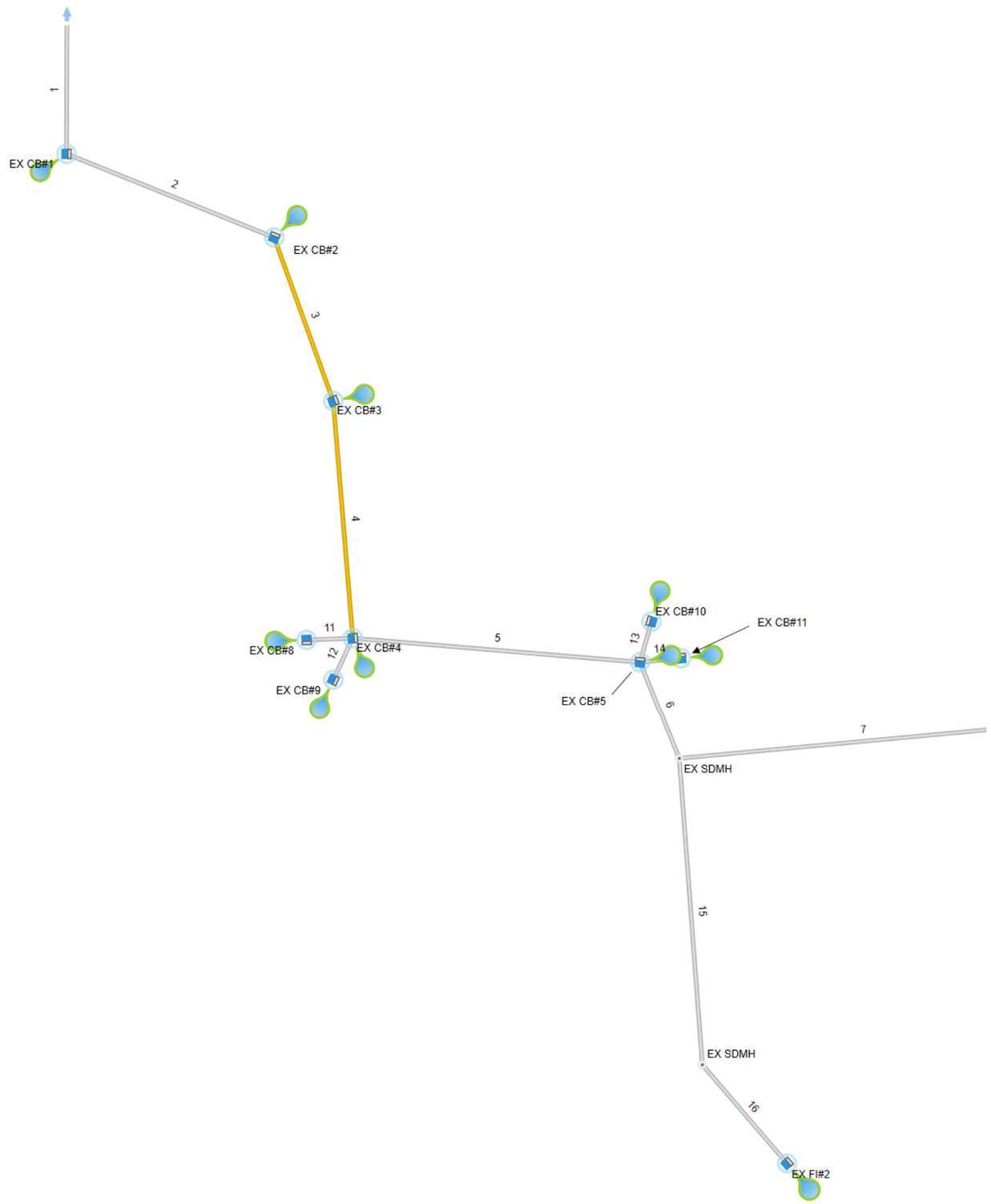
02-09-2020

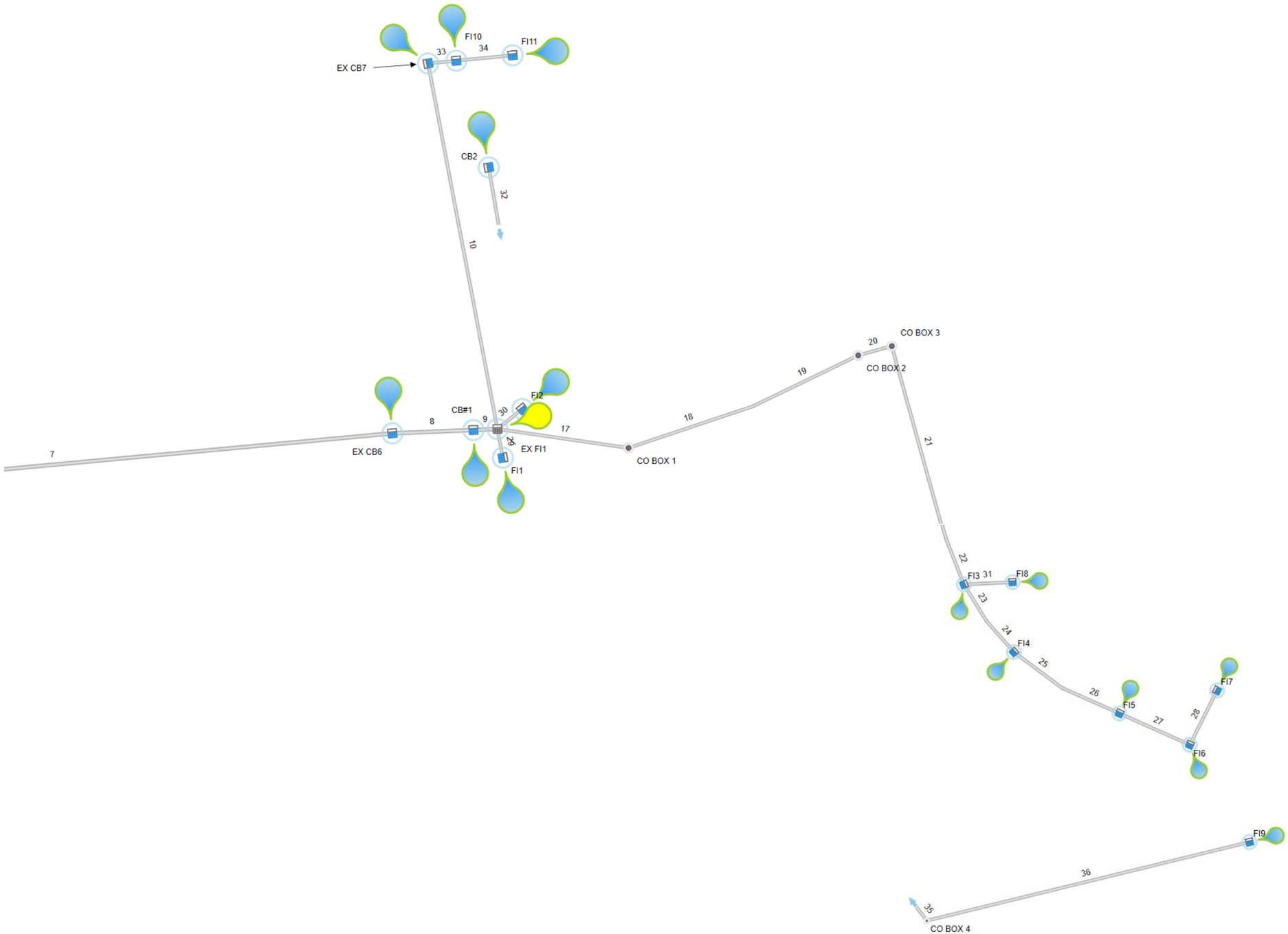
Line No. 33

FI10

Description	Segments			
	A	B	C	Tc (min)
Sheet Flow				
Description				
Manning's n	0.240	0.000	0.000	
Flow Length (ft)	90			
2-yr, 24-hr Precip. (in)	3.080	0.000	0.000	
Land Slope (%)	8.5			
Travel Time (min)	**7.49**	**0.00**	**0.00**	**7.49**
Shallow Concentrated Flow				
Flow Length (ft)	469			
Watercourse Slope (%)	24.9			
Surface Description	Unpaved	Paved	Paved	
Average Velocity (ft/s)	8.05			
Travel Time (min)	**0.97**	**0.00**	**0.00**	**0.97**
Channel Flow				
X-sectional Flow Area (sqft)	1.16			
Wetted Perimeter (ft)	3.4			
Channel Slope (%)	1.1			
Manning's n	0.014	0.000	0.000	
Velocity (ft/s)	5.43			
Flow Length (ft)	225			
Travel Time (min)	**0.69**	**0.00**	**0.00**	**0.69**
Total Travel Time				**9.16 min**

APPENDIX I
10 - YEAR HYDROLOGY COMPUTATIONS


1
EX CB#1
2
EX CB#2
3
EX CB#3
4
11
EX CB#8
12
EX CB#4
5
EX CB#9
13
EX CB#10
14
EX CB#11
EX CB#5
9
7
EX SDMH
15
EX SDMH
16
EX FI#2


FI10
FI11
EX CB7
33
34
CB2
32
10
CO BOX 3
20
CO BOX 2
19
FI2
CB#1
8
9
30
17
18
7
EX CB6
29
EX FI1
CO BOX 1
FI1
21
22
FI3
31
FI8
23
24
FI4
25
26
FI5
27
28
FI7
FI6
FI9
36
35
CO BOX 4

HYO Report

Stormwater Studio 2019 v 3.0.0.15

Project Name: Camino Pablo-Post Development

02-10-2020

Line No.	Inlet ID	Line ID	Area ID	Drain Area (ac)	Runoff Coeff (C)	Incr CxA	Total C x A	Tc System (min)	i Syst (in/hr)	Flow Rate (cfs)	Line Size (in)	Vel Ave (ft/s)	Grnd/Rim Elev Up (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (ft/ft)	Line Length (ft)	Pipe Travel (min)	Capac. Full (cfs)	Line Eff (q/Q)	Vel Factor (v/V)	Cover Up (ft)	Known Q (cfs)
1	EX CB1	EX A	DA EX CB1	3.340	0.50	1.67	23.66	13.5	2.20	52.07	42	5.55	540.85	530.70	530.03	0.005	133.99	0.40	66.06	79%	0.81	6.65	0.00
2	EX CB2	EX A	DA EX CB2	2.150	0.60	1.29	21.99	12.9	2.25	49.53	42	5.93	543.13	532.13	530.95	0.005	234.86	0.66	66.22	75%	0.86	7.50	0.00
3	EX CB3	EX A	DA EX CB3	3.860	0.60	2.32	20.70	12.4	2.29	47.41	36	6.71	542.79	533.09	532.23	0.0047	182.35	0.46	42.53	111%	1.11	6.70	0.00
4	EX CB4	EX A	DA EX CB4	0.030	0.90	0.03	18.38	11.7	2.35	43.22	36	6.12	540.73	534.03	533.09	0.0038	249.51	0.68	38.01	114%	1.14	3.70	0.00
5	EX CB5	EX A	DA EX CB5	7.290	0.50	3.65	15.75	11.0	2.43	38.23	36	6.59	544.54	538.94	534.23	0.0156	302.52	0.77	77.27	49%	0.60	2.60	0.00
6	EX SDMH	EX A		0.000	0.00	0.00	9.16	10.6	2.46	22.58	30	4.94	545.89	539.89	538.94	0.009	106.10	0.36	36.04	63%	0.67	3.50	0.00
7	EX CB6	EX A	DA EX CB6	1.800	0.60	1.08	8.64	10.0	2.54	21.93	24	8.38	550.00	545.20	540.69	0.0144	314.14	0.66	25.16	87%	1.05	2.80	0.00
8	CB1	EX A	DA CB1	0.070	0.90	0.06	7.56	9.9	2.55	19.27	24	7.49	550.17	546.82	546.40	0.0113	37.46	0.08	22.31	86%	1.05	1.35	0.00
9	EX FI1	EX A	DA EX FI#1	0.000	0.00	0.00	7.50	9.8	2.55	19.13	24	6.09	550.34	546.95	546.68	0.0248	11.08	0.03	33.09	58%	0.58	1.39	0.00
10	EX CB7	EX A	DA EX CB7	1.070	0.88	0.94	3.15	9.2	2.63	8.29	18	4.69	552.69	548.74	547.05	0.0098	171.96	0.61	9.67	86%	0.86	2.45	0.00
11	EX CB8	EX A1	DA EX CB8	0.910	0.60	0.55	0.55	5.0	3.49	1.90	15	1.55	540.60	536.70	535.03	0.0343	48.72	0.52	11.10	17%	0.17	2.65	0.00
12	EX CB9	EX A2	DA EX CB9	4.560	0.45	2.05	2.05	5.0	3.49	7.15	24	2.28	540.53	536.23	534.93	0.027	48.21	0.35	34.49	21%	0.21	2.30	0.00
13	EX CB10	EX A3	DA EX CB10	1.910	0.60	1.15	1.15	5.0	3.49	4.00	15	4.06	544.65	541.45	540.54	0.0205	44.32	0.18	8.59	47%	0.58	1.95	0.00
14	EX CB11	EX A4	DA TO CB11	3.000	0.60	1.80	1.80	5.0	3.49	6.28	15	5.11	544.68	540.48	539.24	0.0286	43.37	0.14	10.14	62%	0.62	2.95	0.00
15	EX SDMH	EX B		0.000	0.00	0.00	0.53	7.6	2.88	1.51	18	2.03	578.00	566.82	540.89	0.10	259.31	2.13	30.83	5%	0.12	9.68	0.00
16	EX FI2	EX B	DA EX FI2	1.500	0.35	0.53	0.53	7.0	2.99	1.57	18	7.83	610.00	597.48	566.82	0.28	109.50	0.59	51.60	3%	0.27	11.02	0.00
17	CO BOX 1	A		0.000	0.00	0.00	1.07	8.3	2.76	2.96	18	1.68	571.00	547.18	547.00	0.003	60.93	0.61	5.30	56%	0.56	22.32	0.00
18		A		0.000	0.00	0.00	1.07	8.0	2.82	3.02	18	2.86	0.00	562.46	547.28	0.2499	60.74	0.35	48.75	6%	0.10	n/a	0.00
19	CO BOX 2	A		0.000	0.00	0.00	1.07	7.7	2.85	3.06	18	8.80	590.00	575.95	562.46	0.2499	53.99	0.22	48.74	6%	0.32	12.55	0.00
20	CO BOX 3	A		0.000	0.00	0.00	1.07	7.7	2.87	3.08	18	7.09	591.50	579.21	576.05	0.20	15.80	0.07	43.60	7%	0.29	10.79	0.00
21		A		0.000	0.00	0.00	1.07	7.3	2.94	3.15	18	6.79	0.00	586.81	579.31	0.08	93.79	0.40	27.57	11%	0.44	n/a	0.00
22	FI3	A	DA FI3	0.090	0.81	0.07	1.07	7.0	2.98	3.20	18	6.58	601.62	591.09	586.81	0.08	53.49	0.22	27.58	12%	0.42	9.03	0.00
23		A		0.000	0.00	0.00	0.82	6.8	3.03	2.47	18	4.66	0.00	592.33	591.19	0.0249	45.78	0.23	15.39	16%	0.54	n/a	0.00
24	FI4	A	DA FI4	0.390	0.75	0.29	0.82	6.6	3.07	2.50	18	4.71	602.56	593.46	592.33	0.0249	45.33	0.20	15.40	16%	0.54	7.60	0.00
25		A		0.000	0.00	0.00	0.52	6.2	3.16	1.65	18	2.73	0.00	594.86	593.56	0.0201	64.77	0.40	13.82	12%	0.35	n/a	0.00
26	FI5	A	DA FI5	0.140	0.84	0.12	0.52	5.9	3.24	1.69	18	4.09	603.78	596.22	594.86	0.02	67.88	0.34	13.80	12%	0.52	6.06	0.00
27	FI6	A	DA FI6	0.150	0.81	0.12	0.41	5.4	3.36	1.36	18	3.42	603.86	597.15	596.32	0.01	83.33	0.46	9.73	14%	0.62	5.21	0.00
28	FI7	A	DA FI7	0.810	0.35	0.28	0.28	5.0	3.49	0.99	18	3.50	608.96	598.57	597.25	0.02	65.86	0.41	13.81	7%	0.45	8.89	0.00
29	FI1	A1	DA FI1	0.200	0.45	0.09	0.09	5.0	3.49	0.31	18	0.26	551.85	548.85	547.45	0.1035	13.52	0.88	31.37	1%	0.01	1.50	0.00
30	FI2	A2	DA FI2	5.780	0.55	3.18	3.18	5.0	3.49	11.08	18	6.61	552.00	549.00	547.20	0.1232	14.61	0.04	34.23	32%	0.34	1.50	0.00
31	FI8	A3	DA FI8	0.370	0.50	0.19	0.19	5.0	3.49	0.65	18	1.56	602.89	593.83	591.19	0.0502	52.57	0.56	21.85	3%	0.13	7.56	0.00
32	CB2	B	DA CB2	1.810	0.65	1.18	1.18	5.0	3.49	4.10	18	2.34	556.00	552.50	552.40	0.0038	26.59	0.19	5.98	69%	0.69	2.00	0.00
33	FI10	C	DA FI10	3.550	0.35	1.24	2.21	9.2	2.64	5.84	18	3.30	555.00	549.50	549.00	0.0377	13.27	0.07	18.93	31%	0.31	4.00	0.00
34	FI11	C	DA FI11	2.770	0.35	0.97	0.97	5.0	3.49	3.38	18	3.03	558.00	550.50	549.50	0.0387	25.87	0.14	19.17	18%	0.28	6.00	0.00

Notes: IDF File = CAMINO PABLO IDF 10 year.idf, Return Period = 10-yrs.

Project File: HYO-1360.sws

HYO Report

Stormwater Studio 2019 v 3.0.0.15

Project Name: Camino Pablo-Post Development

02-10-2020

Line No.	Inlet ID	Line ID	Area ID	Drain Area (ac)	Runoff Coeff (C)	Incr CxA	Total C x A	Tc System (min)	i Syst (in/hr)	Flow Rate (cfs)	Line Size (in)	Vel Ave (ft/s)	Grnd/Rim Elev Up (ft)	Invert Up (ft)	Invert Dn (ft)	Line Slope (ft/ft)	Line Length (ft)	Pipe Travel (min)	Capac. Full (cfs)	Line Eff (q/Q)	Vel Factor (v/V)	Cover Up (ft)	Known Q (cfs)
35	CO BOX 4	D		0.000	0.00	0.00	0.49	7.0	2.99	1.46	12	1.89	562.50	558.89	558.80	0.0049	18.27	0.16	2.32	63%	0.64	2.61	0.00
36	FI9	D	DA FI9	1.000	0.49	0.49	0.49	5.0	3.49	1.71	12	6.00	585.00	581.00	558.89	0.0617	358.63	1.99	8.21	21%	0.57	3.00	0.00

Notes: IDF File = CAMINO PABLO IDF 10 year.idf, Return Period = 10-yrs.

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APPENDIX J
10 - YEAR HYDRAULIC COMPUTATIONS

HYA Report

Stormwater Studio 2019 v 3.0.0.15

Project Name: Camino Pablo-Post Development

02-10-2020

Line No.	To Line	Inlet ID	Flow Rate (cfs)	Line Size (in)	Vel Dn (ft/s)	Vel Up (ft/s)	Invert Up (ft)	EGL Up (ft)	HGL Up (ft)	Line Length (ft)	n-value Pipe	Sf Ave (ft/ft)	Energy Loss (ft)	HGL Dn (ft)	HGL Junct (ft)	Grnd/Rim Elev Up (ft)	Free-board (ft)	Minor Loss (ft)	Minor Loss (ft)
1	Outfall	EX CB1	52.07	42	5.41	5.68	530.70	534.38	533.87	133.99	0.014	0.003	0.390	533.53	533.97	540.85	6.88	0.12	0.12
2	1	EX CB2	49.53	42	5.29	6.56	532.13	535.36	534.69	234.86	0.014	0.003	0.704	534.22	534.91	543.13	8.22	0.26	0.26
3	2	EX CB3	47.41	36	6.71	6.71	533.09	537.00	536.30	182.35	0.014	0.006	1.069	535.23	536.44	542.79	6.35	0.18	0.18
4	3	EX CB4	43.22	36	6.12	6.11	534.03	538.63	538.05	249.51	0.014	0.005	1.216	536.83	538.17	540.73	2.56	0.12	0.12
5	4	EX CB5	38.23	36	5.41	7.76	538.94	541.85	540.91	302.52	0.014	0.005	2.918	538.48	540.91	544.54	3.63	0.00	0.00
6	5	EX SDMH	22.58	30	4.60	5.29	539.89	542.35	541.92	106.10	0.014	0.004	0.375	541.65	542.01	545.89	3.88	0.34	0.34
7	6	EX CB6	21.93	24	8.89	7.87	545.20	547.82	546.86	314.14	0.014	0.011	4.510	542.16	546.86	550.00	3.14	0.00	0.00
8	7	CB1	19.27	24	7.62	7.35	546.82	549.22	548.38	37.46	0.014	0.009	0.423	547.90	548.38	550.17	1.79	0.00	0.00
9	8	EX FI1	19.13	24	6.09	6.09	546.95	549.53	548.95	11.08	0.014	0.008	0.078	548.87	549.07	550.34	1.27	0.12	0.12
10	9	EX CB7	8.29	18	4.69	4.69	548.74	551.02	550.68	171.96	0.014	0.007	1.244	549.44	550.75	552.69	1.94	0.10	0.10
11	4	EX CB8	1.90	15	1.55	1.55	536.70	538.81	538.77	48.72	0.014	0.001	0.049	538.73	538.78	540.60	1.82	0.02	0.02
12	4	EX CB9	7.15	24	2.28	2.28	536.23	538.84	538.76	48.21	0.014	0.001	0.056	538.70	538.77	540.53	1.76	0.03	0.03
13	5	EX CB10	4.00	15	3.30	4.82	541.45	542.61	542.25	44.32	0.014	0.006	0.699	541.74	542.25	544.65	2.40	0.00	0.00
14	5	EX CB11	6.28	15	5.12	5.11	540.48	542.49	542.08	43.37	0.014	0.011	0.475	541.60	542.16	544.68	2.52	0.22	0.22
15	6	EX SDMH	1.51	18	0.86	3.20	566.82	567.45	567.29	259.31	0.014	0.003	24.748	542.69	567.29	578.00	10.71	0.00	0.00
16	15	EX FI2	1.57	18	12.43	3.24	597.48	598.12	597.96	109.50	0.014	0.005	30.656	567.01	597.96	610.00	12.04	0.00	0.00
17	9	CO BOX 1	2.96	18	1.68	1.68	547.18	549.72	549.67	60.93	0.014	0.001	0.056	549.62	549.68	571.00	21.32	0.02	0.02
18	17		3.02	18	1.71	4.01	562.46	563.37	563.12	60.74	0.014	0.003	13.621	549.71	563.12	0.00	....	....	....
19	18	CO BOX 2	3.06	18	13.58	4.03	575.95	576.87	576.62	53.99	0.014	0.006	13.490	562.74	576.62	590.00	13.38	0.00	0.00
20	19	CO BOX 3	3.08	18	10.16	4.03	579.21	580.13	579.88	15.80	0.014	0.005	3.150	576.39	579.88	591.50	11.62	0.00	0.00
21	20		3.15	18	9.52	4.07	586.81	587.74	587.49	93.79	0.014	0.005	7.493	579.67	587.49	0.00	....	....	....
22	21	FI3	3.20	18	9.08	4.09	591.09	592.03	591.77	53.49	0.014	0.006	4.280	587.19	591.77	601.62	9.85	0.00	0.00
23	22		2.47	18	5.58	3.74	592.33	593.15	592.93	45.78	0.014	0.004	1.087	591.64	592.93	0.00	....	....	....
24	23	FI4	2.50	18	5.66	3.76	593.46	594.28	594.06	45.33	0.014	0.006	1.130	592.78	594.06	602.56	8.50	0.00	0.00
25	24		1.65	18	2.17	3.29	594.86	595.52	595.35	64.77	0.014	0.004	1.217	594.23	595.35	0.00	....	....	....
26	25	FI5	1.69	18	4.87	3.31	596.22	596.89	596.72	67.88	0.014	0.005	1.360	595.24	596.72	603.78	7.06	0.00	0.00
27	26	FI6	1.36	18	3.73	3.10	597.15	597.74	597.60	83.33	0.014	0.005	0.829	596.71	597.60	603.86	6.26	0.00	0.00
28	27	FI7	0.99	18	4.19	2.81	598.57	599.07	598.95	65.86	0.014	0.005	1.315	597.54	598.95	608.96	10.01	0.00	0.00
29	9	FI1	0.31	18	0.18	0.33	548.85	549.64	549.64	13.52	0.014	0.000	0.000	549.64	549.64	551.85	2.21	0.00	0.00
30	9	FI2	11.08	18	6.27	6.94	549.00	551.02	550.27	14.61	0.014	0.013	1.134	549.27	550.27	552.00	1.73	0.00	0.00
31	22	FI8	0.65	18	0.64	2.49	593.83	594.23	594.14	52.57	0.014	0.003	2.198	592.03	594.14	602.89	8.75	0.00	0.00
32	Outfall	CB2	4.10	18	2.32	2.35	552.50	554.03	553.94	26.59	0.014	0.002	0.044	553.90	553.96	556.00	2.04	0.04	0.04
33	10	FI10	5.84	18	3.30	3.30	549.50	551.24	551.07	13.27	0.014	0.004	0.048	551.02	551.10	555.00	3.90	0.08	0.08
34	33	FI11	3.38	18	1.91	4.14	550.50	551.47	551.21	25.87	0.014	0.004	0.132	551.28	551.26	558.00	6.74	0.28	0.28

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35	Outfall	CO BOX 4	1.46	12	1.86	1.91	558.89	559.89	559.83	18.27	0.014	0.002	0.033	559.80	559.84	562.50	2.66	0.04	0.04
36	35	FI9	1.71	12	8.17	3.82	581.00	581.78	581.55	358.63	0.014	0.005	21.822	559.20	581.55	585.00	3.45	0.00	0.00

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Appendix F

Noise Assessment

SOUTH CAMINO PABLO ANNEXATION PROJECT NOISE AND VIBRATION ASSESSMENT

Moraga, California

December 4, 2015

Prepared for:

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Project: 15-182

INTRODUCTION

The South Camino Pablo Annexation project consists of a 13-unit single-family residential subdivision on approximately 8 acres clustered in the southwest portion of the site, approximately 16 acres of preserved open space along Camino Pablo and Sanders Ranch Road, and the creation of a 9-acre reserved parcel east of the subdivision for possible future development with one single-family home. This area is not included in the area currently suggested for annexation, based on the desire of the property owner for it to remain under County jurisdiction, similar to the remainder of the Carr Ranch property.

This report evaluates the project's potential to result in significant noise or vibration impacts with respect to applicable California Environmental Quality Act (CEQA) Guidelines. The report is divided into two sections: 1) the Setting Section provides a brief description of the fundamentals of environmental noise and groundborne vibration, summarizes applicable regulatory criteria, and discusses the results of the ambient noise monitoring survey completed to document existing noise conditions, and 2) the Impacts and Mitigation Measures Section describes the significance criteria used to evaluate project impacts, provides a discussion of each project impact, and presents mitigation measures, where necessary, to provide a compatible project in relation to adjacent noise sources and land uses.

SETTING

Fundamentals of Environmental Noise

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (*frequency*) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel (dB)* is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA)*. This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a

method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called L_{eq}. The most common averaging period is hourly, but L_{eq} can describe any series of noise events of arbitrary duration.

The scientific instrument used to measure noise is the *sound level meter*. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 pm - 10:00 pm) and a 10 dB addition to nocturnal (10:00 pm - 7:00 am) noise levels. The *Day/Night Average Sound Level* (L_{dn}) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

Fundamentals of Groundborne Vibration

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One method is the Peak Particle Velocity (PPV). The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. In this report, a PPV descriptor with units of mm/sec or in/sec is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce.

The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying. Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels, such as people in an urban environment, may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

TABLE 1 Definition of Acoustical Terms Used in this Report

Term	Definition
Decibel, dB	A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals.
Sound Pressure Level	Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e. g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter.
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Equivalent Noise Level, L_{eq}	The average A-weighted noise level during the measurement period.
L_{max}, L_{min}	The maximum and minimum A-weighted noise level during the measurement period.
L_{01}, L_{10}, L_{50}, L_{90}	The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period.
Day/Night Noise Level, L_{dn} or DNL	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 pm and 7:00 am.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 pm to 10:00 pm and after addition of 10 decibels to sound levels measured in the night between 10:00 pm and 7:00 am.
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
Intrusive	That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

TABLE 2 Typical Noise Levels in the Environment

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110 dBA	Rock band
Jet fly-over at 1,000 feet		
	100 dBA	
Gas lawn mower at 3 feet		
	90 dBA	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	80 dBA	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	70 dBA	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	60 dBA	
		Large business office
Quiet urban daytime	50 dBA	Dishwasher in next room
Quiet urban nighttime	40 dBA	Theater, large conference room
Quiet suburban nighttime		
	30 dBA	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	20 dBA	
		Broadcast/recording studio
	10 dBA	
	0 dBA	

Source: Technical Noise Supplement (TeNS), California Department of Transportation, September 2013.

TABLE 3 Reactions of People and Damage to Buildings from Continuous or Frequent Intermittent Vibration Levels

Velocity Level, PPV (in/sec)	Human Reaction	Effect on Buildings
0.01	Barely perceptible	No effect
0.04	Distinctly perceptible	Vibration unlikely to cause damage of any type to any structure
0.08	Distinctly perceptible to strongly perceptible	Recommended upper level of the vibration to which ruins and ancient monuments should be subjected
0.1	Strongly perceptible	Virtually no risk of damage to normal buildings
0.3	Strongly perceptible to severe	Threshold at which there is a risk of damage to older residential dwellings such as plastered walls or ceilings
0.5	Severe - Vibrations considered unpleasant	Threshold at which there is a risk of damage to newer residential structures

Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013.

Regulatory Background - Noise

The State of California and the Town of Moraga have established regulatory criteria that are applicable in this assessment. The State's CEQA Guidelines, Appendix G, are used to assess the potential significance of impacts pursuant to local General Plan policies, Municipal Code standards, or the applicable standards of other agencies. A summary of the applicable regulatory criteria is provided below.

State CEQA Guidelines. The CEQA contains guidelines to evaluate the significance of effects of environmental noise attributable to a proposed project. Under CEQA, noise impacts would be considered significant if the project would result in:

(a) Exposure of persons to or generation of noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies;

(b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;

(c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;

(d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;

(e) For a project located within an airport land use plan or where such a plan has not been adopted within two miles of a public airport or public use airport, if the project would expose people residing or working in the project area to excessive noise levels; or

(f) For a project within the vicinity of a private airstrip, if the project would expose people residing or working in the project area to excessive noise levels.

Of these guidelines, items (e) and (f) are not applicable because the project is not located within an airport land use plan or in the vicinity of a private airstrip. Therefore, checklist items (e), and (f) are not carried forward for further analysis.

Town of Moraga General Plan and Municipal Code. Noise standards applicable to the proposed project include Moraga General Plan policies and Moraga Municipal Code standards, which are summarized below.

The Open Space and Conservation Element of the Moraga General Plan establishes noise policies with the objective of a peaceful and tranquil community. The following General Plan policies are relevant to the proposed project:

OS6.2 Noise Levels. Ensure that noise from all sources is maintained at levels that will not adversely affect adjacent properties or the community, especially during evening and early morning hours. Reasonable exceptions may be made in the interest of public safety.

OS6.3 Noise Sensitive Uses. Locate uses where they will be most acoustically compatible with elements of the man-made and natural environment.

OS6.4 Noise Impacts of New Development. Ensure that new development will not raise levels above acceptable levels on the Town's arterials and major local streets.

OS6.5 Acoustical Data with Development Applications. Require the submittal of acoustical data, when and where appropriate, as part of the development application process so that the noise impacts of proposed uses can be properly evaluated and mitigated.

OS6.6 Temporary Noise Sources. Permit temporary noise-generating activities such as construction only for the shortest reasonable duration and in locations that will have the least possible adverse effect.

While it establishes noise policies, the Moraga General Plan does not identify quantified noise and land use compatibility standards for proposed land uses. Therefore, the standards set forth in the *Guidelines for the Preparation and Content of the Noise Element of the General Plan* published by the Governor's Office of Planning and Research are used to assess the compatibility of land uses with the noise environment. These guidelines identify an ambient noise level of 60 dBA L_{dn} as "normally acceptable" for single-family residential land uses. Ambient noise levels up to 70 dBA L_{dn} are considered "conditionally acceptable," where new development may be permitted for its specified use only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features are included in the design of the project. Noise levels between 70 dBA L_{dn} and 75 dBA L_{dn} are considered "normally unacceptable."

Chapter 7.12 of the Moraga Municipal Code serves to prohibit unnecessary, excessive, and annoying noise from all sources subject to the Town's police power. With regard to temporary construction activities, Section 7.12.090 of the Moraga Municipal Code prohibits construction work within a residential zone or within a 500-foot radius between the hours of 5:00 pm and 8:00 am.

Existing Noise Environment

The project site is located east of Camino Pablo, between Sanders Ranch Road on the north and a single-family residential subdivision on the south. Residential land uses border the project site to the west and south. Noise monitoring was completed at the site between September 15, 2015 and September 17, 2015 in order to quantify existing ambient noise levels. The noise monitoring survey included one long-term noise measurement (LT-1) along Camino Pablo and two short-term measurements (ST-1 and ST-2), as shown in Figure 1. The existing noise environment at the site and in the vicinity results primarily from traffic along Camino Pablo.

Long-term noise measurement LT-1 was along the westernmost boundary of the site approximately 30 feet from the centerline of Camino Pablo. Hourly average noise levels ranged from 47 to 61 dBA L_{eq} during the day and from 27 to 49 dBA L_{eq} at night. The L_{dn} at this location was 54 dBA on Wednesday, September 16, 2015. The daily trends in noise levels at LT-1 are shown on Figures 2-4.

Short-term noise measurements ST-1 and ST-2 were made in the vicinity of existing noise-sensitive residential land uses bordering the site. Table 4 summarizes the data collected at the short-term measurement locations.

TABLE 4 Summary of Short-Term Noise Measurement Data

Noise Measurement Location (Date, Time)	L_{max}	$L_{(1)}$	$L_{(10)}$	$L_{(50)}$	$L_{(90)}$	L_{eq}	L_{dn}
ST-1: ~ Approximately 50 feet west of the center of Camino Pablo at Tharp Drive. (9/17/2015, 12:00-12:10 pm)	63	57	49	42	38	47	52
ST-2: ~ End of Sky View Court. (9/17/2015, 11:40-11:50 am)	55	48	44	40	37	41	<50

Note: L_{dn} approximated by correlating to corresponding period at long-term site.

NOISE IMPACTS AND MITIGATION MEASURES

Significance Criteria

Paraphrasing from Appendix G of the CEQA Guidelines, a project would normally result in significant noise impacts if noise levels generated by the project conflict with adopted environmental standards or plans, if the project would generate excessive groundborne vibration

levels, or if ambient noise levels at sensitive receivers would be substantially increased over a permanent, temporary, or periodic basis. The following criteria were used to evaluate the significance of environmental noise resulting from the project:

- A significant noise impact would be identified if the project would expose persons to or generate noise levels that would exceed applicable noise standards presented in the General Plan or Municipal Code.

- A significant impact would be identified if the construction of the project would expose persons to excessive vibration levels. Groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in cosmetic damage to normal buildings and would be considered excessive.

- A significant impact would be identified if traffic generated by the project would substantially increase noise levels at sensitive receivers in the vicinity. A substantial increase would occur if: a) the noise level increase is 5 dBA L_{dn} or greater, with a future noise level of less than 60 dBA L_{dn}, or b) the noise level increase is 3 dBA L_{dn} or greater, with a future noise level of 60 dBA L_{dn} or greater.

- A significant noise impact would be identified if construction related noise would temporarily increase ambient noise levels at sensitive receivers. Hourly average noise levels intermittently exceeding 60 dBA L_{eq}, and the ambient by at least 5 dBA L_{eq}, for a period of one year or more, would constitute a significant temporary noise increase at adjacent residential land uses.

Impact 1: **Noise and Land Use Compatibility.** The future noise environment at the project site would be considered "normally acceptable" with respect to the proposed residential land uses. **This is a less-than-significant impact.**

Future Exterior Noise Environment

Vehicular traffic along Camino Pablo would continue to be the predominant source of noise affecting the project site. Traffic noise levels along Camino Pablo are calculated to increase by up to 1 dBA L_{dn} above existing conditions assuming future plus project traffic conditions. Traffic noise levels are calculated to reach 55 dBA L_{dn} at the westernmost project boundary (approximately 30 feet from the center of Camino Pablo) and would be considered "normally acceptable" with the proposed residential land uses. Future exterior noise levels at the location of the residential pads, approximately 100 to 150 feet from the center of Camino Pablo, are calculated to be 50 dBA L_{dn} or less, and would also be considered "normally acceptable" with the proposed residential land uses. This is a less-than-significant impact.

Future Interior Noise Environment

The Governor's Office of Planning and Research establishes 60 dBA L_{dn} as the "normally acceptable" exterior noise level for single-family residential land uses in order to achieve an acceptable interior noise level of 45 dBA L_{dn} without the incorporation of special noise

insulation features such as forced-air mechanical ventilation systems or sound-rated construction methods into the design of the residential units. Typical residential construction methods, with the windows partially open for ventilation, provide for interior noise levels that are 15 dBA lower than exterior noise levels.

Future exterior noise levels at the location of the nearest residential pads, approximately 100 to 150 feet from the center of Camino Pablo, would be 50 dBA L_{dn} or less. Interior noise levels would be 35 dBA L_{dn} or less indoors assuming typical residential construction methods. The calculated interior noise levels would be below the maximum allowable interior sound level of 45 dBA L_{dn}. This is a less-than-significant impact.

Mitigation 1: None required.

Impact 2: **Construction Vibration.** Vibration levels generated during construction activities may at times be perceptible at neighboring residential land uses, but vibration levels would not be excessive causing cosmetic damage to buildings. **This is a less-than-significant impact.**

The construction of the project may generate perceptible vibration when heavy equipment or impact tools (e.g. jackhammers, hoe rams, etc.) are used. Construction activities would include excavation, grading, site preparation work, foundation work, and new building framing and finishing.

The California Department of Transportation recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened. No ancient buildings or buildings that are documented to be structurally weakened adjoin the project site. Therefore, groundborne vibration levels exceeding 0.3 in/sec PPV would have the potential to result in a significant vibration impact.

Table 5 presents typical vibration levels that could be expected from construction equipment at a distance of 25 feet. Project construction activities such as drilling, the use of jackhammers, rock drills and other high-power or vibratory tools, and rolling stock equipment (tracked vehicles, compactors, etc.) may generate substantial vibration in the immediate vicinity. Jackhammers typically generate vibration levels of 0.035 in/sec PPV and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Vibration levels from typical construction activities would be expected to be 0.2 in/sec PPV or less at a distance of 25 feet, below the 0.3 in/sec PPV significance threshold used to assess potential cosmetic damage to buildings that are structurally sound. The nearest residential structures to the site are located 50 feet or further from the shared property line. Vibration levels at a distance of 50 feet would be 0.1 in/sec PPV or less. Vibration generated by construction activities near the common property line with Sky View Court residential land uses would at times be perceptible, however, would be infrequent and only during the allowable daytime construction period. This is a less-than-significant impact.

TABLE 5 Vibration Source Levels for Construction Equipment

Equipment		PPV at 25 ft. (in/sec)	Approximate L_v at 25 ft. (VdB)
Pile Driver (Impact)	upper range	1.158	112
	typical	0.644	104
Pile Driver (Sonic)	upper range	0.734	105
	typical	0.170	93
Clam shovel drop		0.202	94
Hydromill (slurry wall)	in soil	0.008	66
	in rock	0.017	75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006.

Mitigation 2: None required.

Impact 3: **Project-Generated Noise:** Noise resulting from project generated traffic would not substantially increase ambient noise levels in the area. **This is a less-than-significant impact.**

Traffic volume information contained in the project's transportation analysis was reviewed to calculate the change in traffic noise levels along Camino Pablo attributable to the operation of the project. Traffic volumes under the "Existing" and "Existing Plus Project" traffic scenarios were compared to calculate the relative increase in traffic noise attributable to the proposed project. A noise impact would be identified at noise-sensitive land uses where the project would result in a noise level increase of 3 dBA L_{dn} or more where exterior noise levels would exceed the normally acceptable noise level standard (60 dBA L_{dn}) or if existing plus project noise levels would be 5 dBA L_{dn} or greater where noise levels would remain at or below the normally acceptable noise level. For reference, a 3 dBA L_{dn} noise increase would be expected if the project would double existing traffic volumes along a roadway.

A comparison of the "Existing" and "Existing Plus Project" traffic scenarios shows that traffic volumes on all roadways serving the project site would only be slightly increased with the project as compared to existing conditions. Traffic noise levels on area roadways are calculated to increase by 1 dBA L_{dn} or less as a result of the project. Existing traffic noise levels would not be substantially increased over a permanent basis, therefore, the impact related to project generated traffic would be less-than-significant.

Mitigation 3: None required.

Impact 4: **Temporary Construction Noise.** Existing noise-sensitive land uses would not be exposed to construction noise levels in excess of the significance thresholds for a period of more than one year. **This is a less-than-significant impact.**

The construction of the project is expected to substantially increase noise levels over a temporary basis at nearby sensitive land uses. Construction activities can generate considerable amounts of noise, especially during earth-moving activities when heavy equipment is used. The typical range of maximum noise levels would be 80 to 90 dBA L_{max} at a distance of 50 feet (see Table 6). Hourly average noise levels generated by construction are about 81 dBA to 88 dBA L_{eq} measured at a distance of 50 feet from the center of a busy construction site. Hourly average construction noise levels associated with the erection of the residential units, such as hammer- and drilling-related noise, range from approximately 63 to 71 dBA at a distance of 50 feet. The noise levels associated with construction of the residential units would be substantially less than the noise levels associated with grading and pavement activities during project site preparation. Construction generated noise levels drop off at a rate of about 6 dBA per doubling of distance between the source and receptor. Shielding provided by barriers or structures can provide an additional 5 to 10 dBA noise reduction at distant receptors.

Noise impacts resulting from construction depend on the noise levels generated by various pieces of construction equipment, the timing and duration of noise generating activities, and the distance between construction noise sources and noise sensitive receptors. Construction noise impacts primarily occur when construction activities occur during noise-sensitive times of the day (early morning, evening, or nighttime hours), the construction occurs in areas immediately adjoining noise sensitive land uses, or when construction durations last over extended periods of time. Where noise from construction activities exceeds 60 dBA L_{eq} and exceeds the ambient noise environment by at least 5 dBA L_{eq} at noise-sensitive uses in the project vicinity for a period greater than one year, the impact would be considered significant.

The project would be built in one phase lasting approximately six months to one year. The highest noise levels would be generated during site preparation, excavation, grading, and trenching. Heavy construction equipment used to complete these tasks would include a loader, scrapers, trenching equipment, dump trucks, a compactor, a motor grader, water trucks, a generator, a paving machine, and dozers. Noise generated during the construction of the residential structures is generally lower as less heavy construction equipment is required to complete the task. Once construction moves indoors, minimal noise would be generated at off-site locations.

The nearest existing residences are located approximately 50 feet to the south and would be exposed to hourly average noise levels ranging from 81 to 88 dBA L_{eq} during the busiest construction periods along the southern boundary of the site. At residences to the west, located about 100 feet from the westernmost project boundary, construction noise levels would range from about 75 to 82 dBA L_{eq} during the busiest periods where construction occurs along the western boundary of the site.

TABLE 6 CONSTRUCTION EQUIPMENT 50-FOOT NOISE EMISSION LIMITS

Equipment Category	L_{max} Level (dBA)[1,2]	Impact/Continuous
Arc Welder	73	Continuous
Auger Drill Rig	85	Continuous
Backhoe	80	Continuous
Bar Bender	80	Continuous
Boring Jack Power Unit	80	Continuous
Chain Saw	85	Continuous
Compressor[3]	70	Continuous
Compressor (other)	80	Continuous
Concrete Mixer	85	Continuous
Concrete Pump	82	Continuous
Concrete Saw	90	Continuous
Concrete Vibrator	80	Continuous
Crane	85	Continuous
Dozer	85	Continuous
Excavator	85	Continuous
Front End Loader	80	Continuous
Generator	82	Continuous
Generator (25 KVA or less)	70	Continuous
Gradall	85	Continuous
Grader	85	Continuous
Grinder Saw	85	Continuous
Horizontal Boring Hydro Jack	80	Continuous
Hydra Break Ram	90	Impact
Impact Pile Driver	105	Impact
Insitu Soil Sampling Rig	84	Continuous
Jackhammer	85	Impact
Mounted Impact Hammer (hoe ram)	90	Impact
Paver	85	Continuous
Pneumatic Tools	85	Continuous
Pumps	77	Continuous
Rock Drill	85	Continuous
Scraper	85	Continuous
Slurry Trenching Machine	82	Continuous
Soil Mix Drill Rig	80	Continuous
Street Sweeper	80	Continuous
Tractor	84	Continuous
Truck (dump, delivery)	84	Continuous
Vacuum Excavator Truck (vac-truck)	85	Continuous
Vibratory Compactor	80	Continuous
Vibratory Pile Driver	95	Continuous
All other equipment with engines larger than 5 HP	85	Continuous

Notes:

1 Measured at 50 feet from the construction equipment, with a “slow” (1 sec.) time constant.

2 Noise limits apply to total noise emitted from equipment and associated components operating at full power while engaged in its intended operation.

3 Portable Air Compressor rated at 75 cfm or greater and that operates at greater than 50 psi.

Reasonable regulation of the hours of construction, as well as regulation of the arrival and operation of heavy equipment and the delivery of construction material, are necessary to protect the health and safety of persons, promote the general welfare of the community, and maintain the quality of life. Noise generated by project construction would not be expected to exceed 60 dBA L_{eq} and exceed ambient noise levels at receivers to the west or south by more than 5 dBA L_{eq} for a period greater than one year resulting in a less-than-significant impact.

Construction activities will be conducted in accordance with the provisions of the Moraga Municipal Code which prohibits construction work within a residential zone or within a 500-foot radius between the hours of 5:00 pm and 8:00 am. Given the relatively low ambient noise environment in the project vicinity, the following construction best management practices are recommended to reduce construction noise levels emanating from the site and minimize disruption and annoyance at existing noise-sensitive receptors in the project vicinity.

Construction Best Management Practices

Develop a construction noise control plan, including, but not limited to, the following available controls:

- Construct residential units at the west and south boundaries of the site as early as possible during the construction so that the intervening buildings will provide acoustical shielding for existing residential land uses. Constructing units along the western and southern boundaries of the site would provide approximately 10 dB of noise reduction during the remainder of project construction activities.

- Construct temporary noise barriers, where feasible, to screen stationary noise-generating equipment when located within 200 feet of adjoining sensitive land uses. Temporary noise barrier fences would provide a 5 dBA noise reduction if the noise barrier interrupts the line-of-sight between the noise source and receiver and if the barrier is constructed in a manner that eliminates any cracks or gaps.
- All equipment driven by internal combustion engines shall be equipped with mufflers, which are in good condition and appropriate for the equipment.

- The construction contractor shall utilize “quiet” models of air compressors and other stationary noise sources where technology exists.

- Unnecessary idling of internal combustion engines shall be prohibited.

- Construction staging areas shall be established at locations that will create the greatest distance between the construction-related noise sources and noise-sensitive receptors nearest the project site during all project construction.

- Locate stationary noise sources as far from sensitive receptors as feasible. If they must be located near receptors, adequate muffling (with enclosures where feasible and appropriate) will be used. Any enclosure openings or venting will face away from sensitive receptors.

- Locate material stockpiles as well as maintenance/equipment staging and parking areas as far as feasible from residential receptors.

- Control noise from construction workers' radios to a point where they are not audible at existing residences bordering the project site.

- Neighbors located adjacent to the construction site shall be notified of the construction schedule in writing.

- Designate a project liaison that will be responsible for responding to noise complaints during the construction phase. The name and phone number of the liaison will be conspicuously posted at construction areas and on all advanced notifications. This person will take steps to resolve complaints, including periodic noise monitoring, if necessary. Results of noise monitoring will be presented at regular project meetings with the project contractor, and the liaison will coordinate with the contractor to modify any construction activities that generated excessive noise levels to the extent feasible.

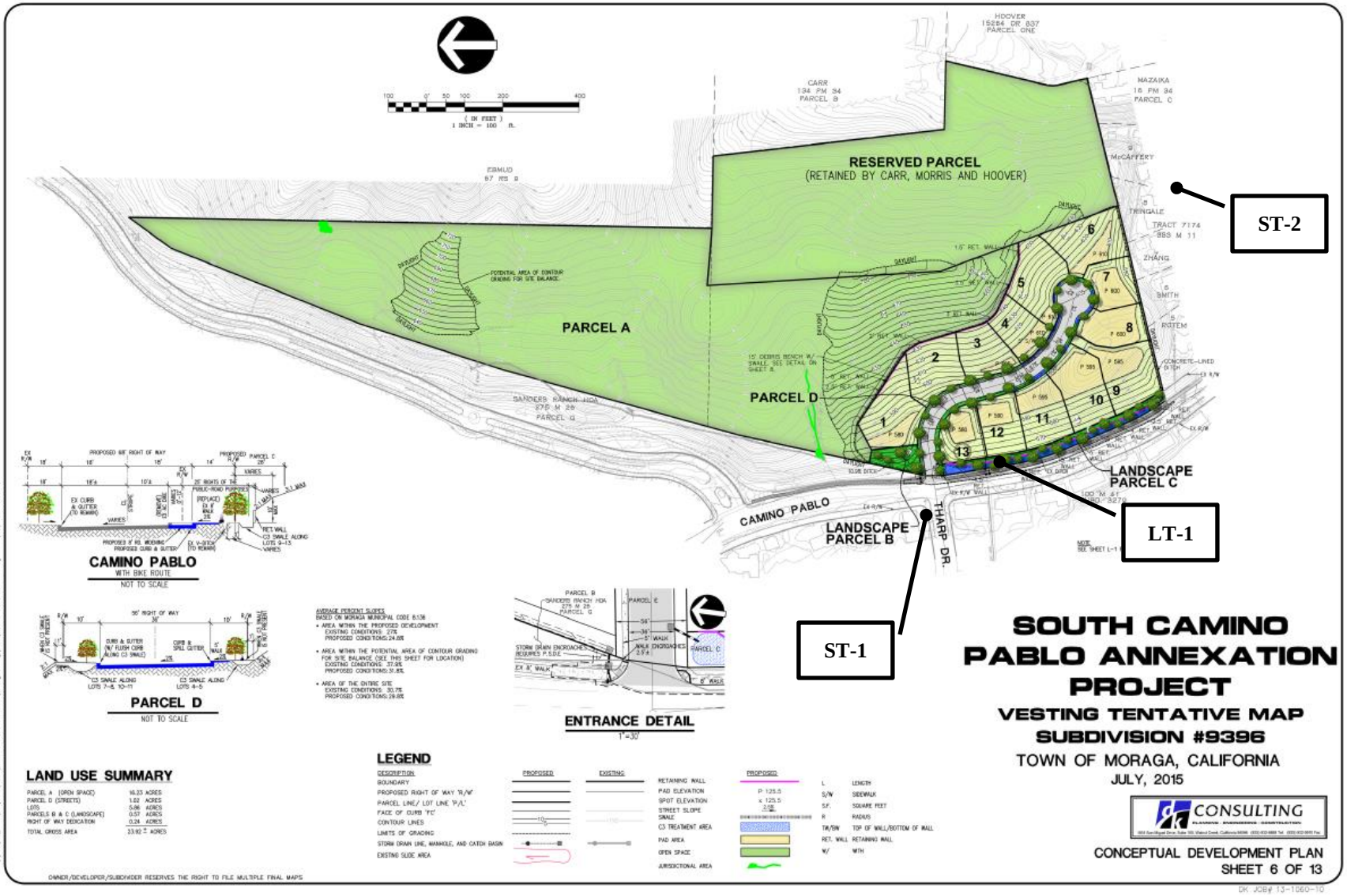
- Require a reporting program that documents complaints received, actions taken to resolve problems, and effectiveness of these actions.

- Hold a preconstruction meeting with the job inspectors and the general contractor/on-site project manager to confirm that noise controls and practices (including construction hours, construction schedule, and noise coordinator) are implemented.

The implementation of the reasonable and feasible controls outlined above would reduce construction noise levels emanating from the site by 5 to 10 dBA in order to minimize disruption and annoyance. With the implementation of these controls, as well as the Municipal Code limits on allowable construction hours, and considering the relatively short duration of the noise generating construction period, the substantial temporary increase in ambient noise levels would be less-than-significant.

Mitigation 4: No additional mitigation is required.

Figure 1 Noise Monitoring Locations



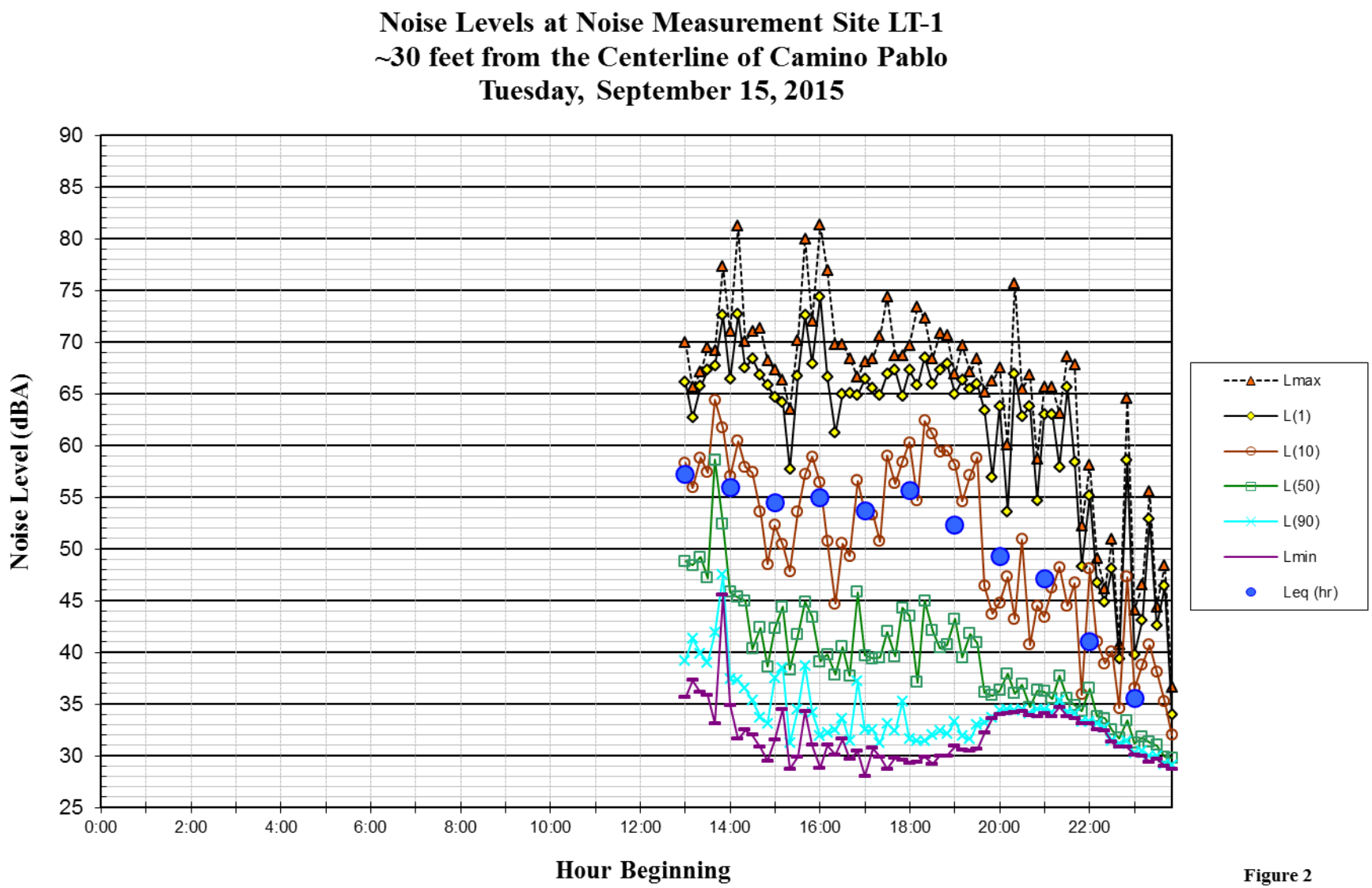

Noise Levels at Noise Measurement Site LT-1
~30 feet from the Centerline of Camino Pablo
Tuesday, September 15, 2015
Noise Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 2

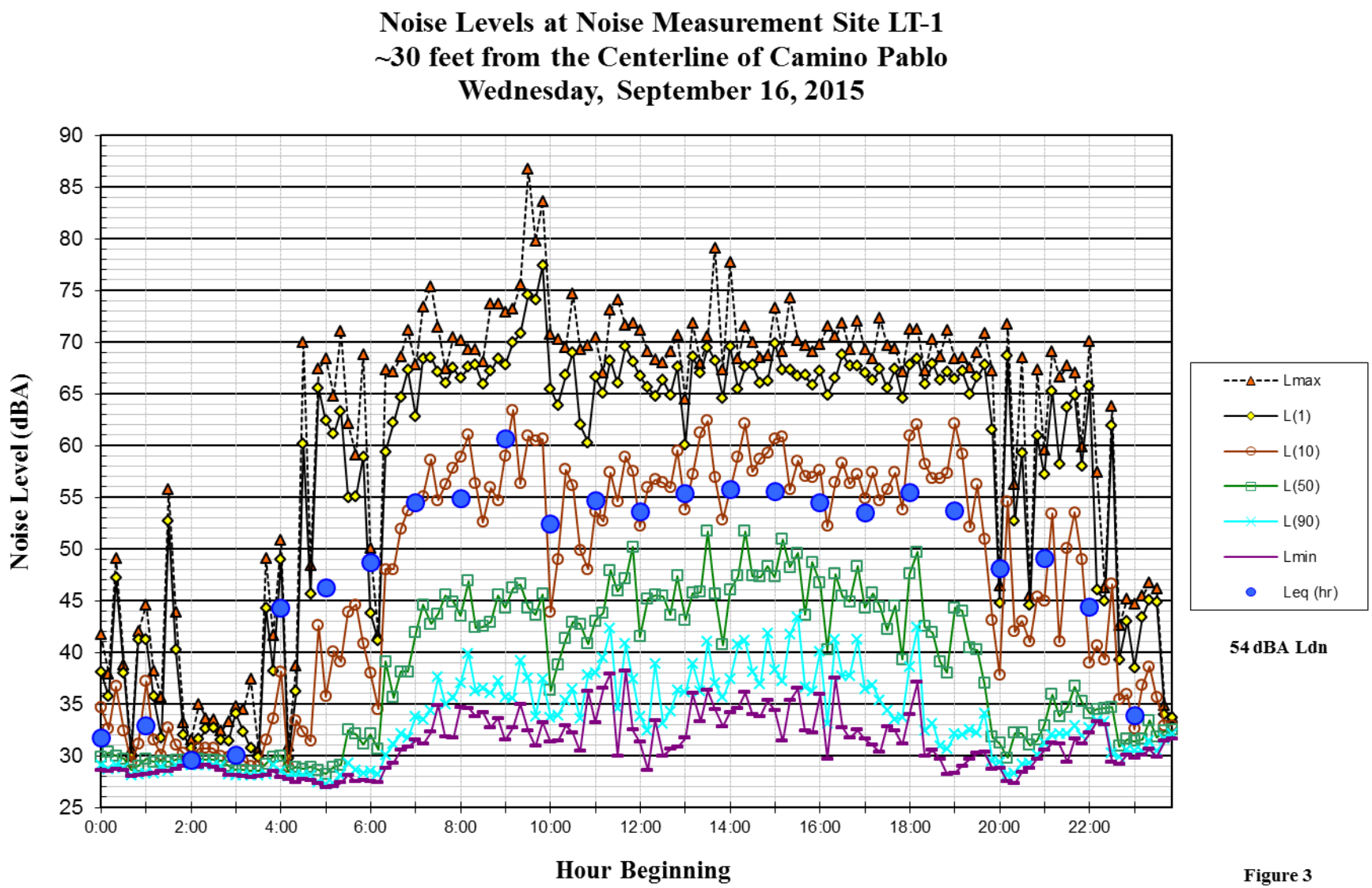
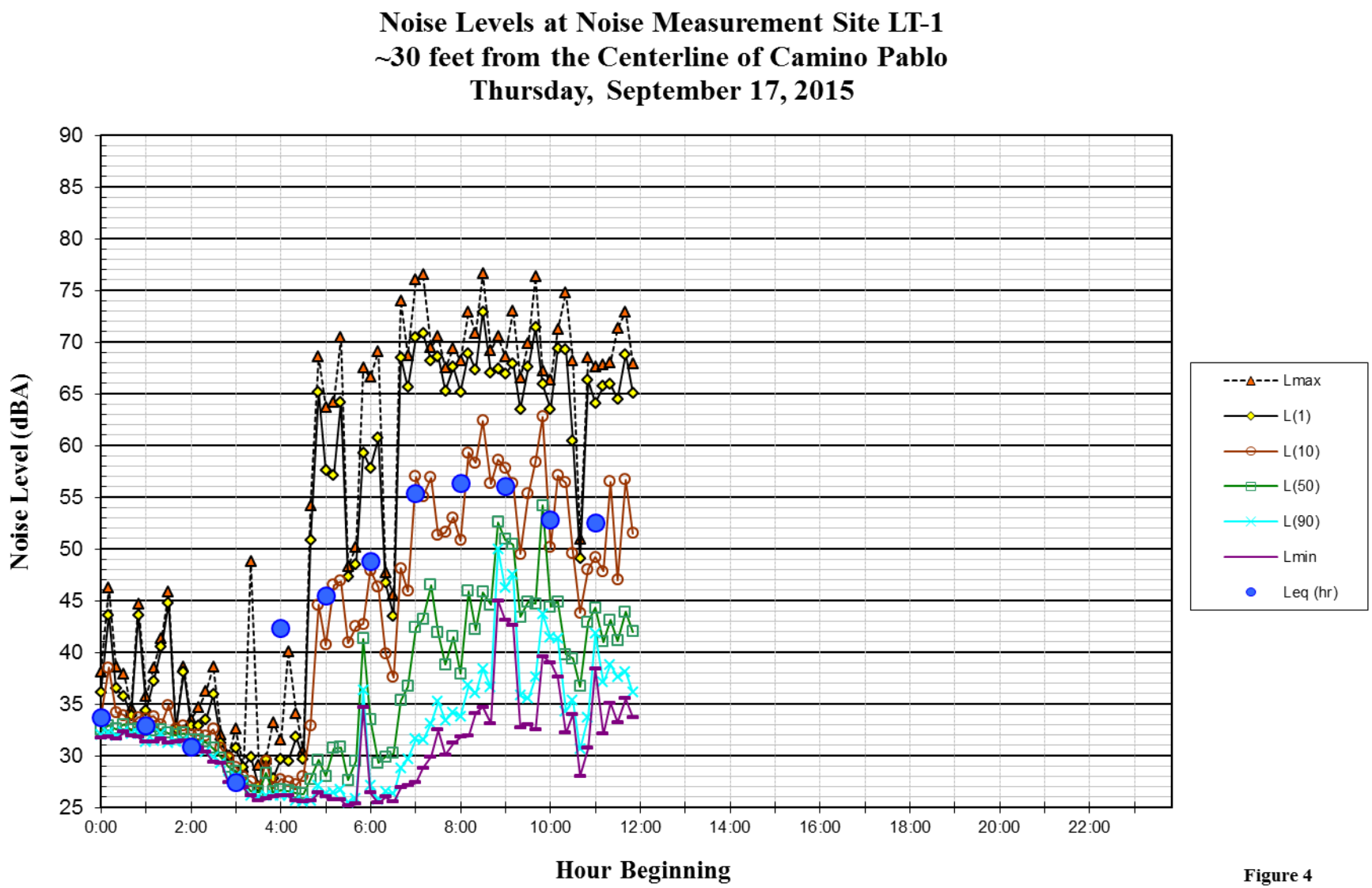

Noise Levels at Noise Measurement Site LT-1
~30 feet from the Centerline of Camino Pablo
Wednesday, September 16, 2015
Noise Level (dBA)
90
85
80
75
70
65
60
55
50
45
40
35
30
25
0:00
2:00
4:00
6:00
8:00
10:00
12:00
14:00
16:00
18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)
54 dBA Ldn

Figure 3


Noise Levels at Noise Measurement Site LT-1
~30 feet from the Centerline of Camino Pablo
Thursday, September 17, 2015
Noise Level (dBA)
90
85
80
75
70
65
60
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45
40
35
30
25
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18:00
20:00
22:00
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Lmin
Leq (hr)

Figure 4

Appendix G

Transportation Impact Assessment Memos

FEHR PEERS

MEMORANDUM

Date: September 18, 2015

To: Doug Herring, Douglas Herring & Associates

From: Kathrin Tellez, Fehr & Peers

Subject: Camino Pablo Subdivision Transportation Analysis

WC15-3267

This memorandum presents the results of our transportation assessment for the Camino Pablo subdivision development (project), including project description, analysis parameters, existing conditions, project conditions, and site plan review.

PROJECT DESCRIPTION

The project site is located on the east side of Camino Pablo, south of Sanders Ranch Road in an unincorporated portion of Contra Costa County, adjacent to the Town of Moraga, as shown on **Figure 1** (all figures are attached at the end of this memorandum). The project is within the County's Urban Limit Line and as part of the project, the approximately 24-acre site would be annexed into the City of Moraga. The County designates the site as agricultural land, while the Town of Moraga has designated a portion of the site open space with the remaining portion designated for 1-dwelling unit per acre.

The project proposes to construct 13 single family homes on approximately 6-acres, provide approximately 16 acres of open space, with the remaining acreage set aside for streets, landscaping and right-of-way dedication. Access to the site would be provided by a new roadway that would connect to Camino Pablo at Tharp Drive. The site is currently vacant. A conceptual project site plan is shown on **Figure 2**.

ANALYSIS PARAMETERS

Study Area and Analysis Scenarios

The transportation assessment includes weekday morning (7 to 9 AM) and evening (4 to 6 PM) peak period analyses to coincide with the time periods when adjacent street traffic demands are greatest and the project generates the most traffic. The study addresses existing and long-term traffic conditions at the Tharp Drive at Camino Pablo intersection. In addition to an assessment of peak hour intersection operations, daily traffic volumes and roadway speeds were collected on Camino Pablo, north of Tharp Road.

Significance Criteria

The following thresholds of significance have been developed and used in the Town of Moraga for transportation assessments. These thresholds apply to the CEQA Checklist criteria as shown below:

A. Would the Project conflict with an applicable plan, ordinance or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit?

    1. Would the operations of a signalized study intersection decline from acceptable (as defined in Table 1) to unacceptable based on the HCM LOS method with the addition of Project traffic;

    2. Would the Project deteriorate already unacceptable operations at a signalized intersection by adding traffic;

    3. Would the operations of an unsignalized study intersection decline from acceptable (as defined in Table 1) to unacceptable with the addition of Project traffic, <u>and</u> would the installation of a traffic signal at based on the *Manual on Uniform Traffic Control Devices* (MUTCD) Peak Hour Signal Warrant (Warrant 3), be warranted;

4. Would construction traffic from the Project have a significant, though temporary, impact on the environment, or would Project construction substantially affect traffic flow and circulation, parking, and pedestrian safety;

B. Would the Project conflict with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads and highways[1]?

C. Would the Project result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that result in substantial safety risks;

D. Would the Project substantially increase traffic hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment)?

E. Would the project result in inadequate emergency access?

F. Would the Project conflict with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decrease the performance or safety of such facilities?

1. Would the Project generate added transit ridership that would increase the peak hour average ridership at a BART station by three (3) percent where average waiting time at fare gates would exceed one minute

[1] An assessment of potential project impacts on CMP roadways is required for projects that generate more than 100 peak hour trips. As this project generates less than 100 peak hour trips (see Table 2), no further assessment is required.

TABLE 1
ROADWAY LEVEL OF SERVICE STANDARDS

Intersection Type	LOS Standard	V/C Ratio	HCM Control Delay Per Vehicle (Seconds)[2]
Signalized Intersection[1]	LOS C	0.75 to 0.79	28 to 35 seconds
All-Way Stop Control[3] Overall Intersection	LOS D	N/A	30 to 35 seconds
One- and Two-Way Stop Control[3] Overall Intersection Side Street Traffic	LOS C LOS E	N/A N//A	20 to 25 seconds 43 to 50 seconds

Notes:
1. Town of Moraga General Plan (2002).
2. HCM control delay per vehicle obtained from 2010 *Highway Capacity Manual*.
3. Town of Moraga Available Roadway Capacity Study, Page 11. (Robert L. Harrison Transportation Planning, January 1999)

EXISTING CONDITIONS

This section describes transportation facilities in the study area, including the surrounding roadway network, and transit, pedestrian, and bicycle facilities in the site vicinity.

Roadway System

Moraga Road/Canyon Road is a two-to-four lane north-south arterial roadway. Moraga Road extends between Moraga Way in the Town of Moraga and Mount Diablo Boulevard in the City of Lafayette. Canyon Road is the extension of Moraga Road south of Moraga Way to Pinehurst Road in Alameda County. The posted speed limit on Moraga Road is 35 miles per hour (MPH). On-street parking is permitted on some portions of this roadway and Class II bicycle lanes and sidewalks are provided through the study area.

Moraga Way is generally a two-lane arterial roadway that extends northwest-southeast between Moraga Road (in the Town of Moraga) and SR 24 in the City of Orinda. Between School Street and

Moraga Road, Moraga Way is a four lane road with left-turn lanes. The posted speed limit on Moraga Way is 35 MPH. On-street parking is permitted on some portions of this roadway and Class II bicycle lanes are provided through the study area. Sidewalks are also provided along some portions of the roadway.

Camino Pablo is a two-lane arterial roadway that has a northwest to southeast orientation. It connects to Canyon Road in the northwest; to the south of the Town of Moraga, Camino Pablo transitions to Brown Ranch Road and is access restricted. Sidewalks are provided on the east side of the roadway and Class II bike lanes are provided in both the northbound and southbound directions from Canyon Road to Tharp Drive. Pedestrian curb ramps, marked crosswalks, and left-turn pockets are provided at some intersections, but not all. On-street parking is permitted on portions of the roadway. The posted speed limit on this roadway is 25 MPH.

Tharp Drive is a two-lane residential collector street that intersects with Camino Pablo. Sidewalks and dedicated bicycle facilities are not provided as it is expected that these modes will share the roadway with vehicles. On-street parking is permitted on both sides of the roadway. The roadway intersects with a number of local streets through a residential neighborhood. A circuitous connection is provided via Tharp Drive and other neighborhood streets to Camino Pablo at Rimer Drive, although this route is longer than the most direct route to the same location on Camino Pablo.

Existing Pedestrian and Bicycle Facilities

Pedestrian facilities include sidewalks, paths, crosswalks, and pedestrian signals. Pedestrian facilities are provided the east side of Camino Pablo in the vicinity of the site. Dedicated pedestrian facilities are not provided on Tharp Drive.

Bicycle facilities in Moraga include the following:

- *Bike paths (Class I)* – Paved trails that are separated from roadways. These facilities are typically shared with pedestrians, although bicycles must yield to pedestrians.
- *Bike lanes (Class II)* – Lanes on roadways designated for use by bicycles through striping, pavement legends, and signs. There may or may not be parking allowed on the roadway.
- *Bike routes (Class III)* – Designated roadways for bicycle use by signs only; may or may not include additional pavement width for cyclists.

Camino Pablo provides Class II bike lanes in both travel directions from Moraga Road to north of Tharp Drive. The bike lanes do not continue south of Tharp Drive and do not run adjacent to the proposed site. Dedicated bicycle facilities are not provided on Tharp Drive.

Existing Transit Service

Transit service in the immediate project area is limited to dial-a-ride service. A County Connection bus stop that is served by Route 6 is located approximately 2 miles from the site. Route 6 connects to Saint Mary's college as well as the Orinda and Lafayette BART stations. Parking is also available at the BART stations, which are both located approximately 7 miles from the project site.

Existing Roadway Operations

Weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak period intersection vehicle turning movement counts were conducted in September 2015 at the intersection identified for inclusion in the study. Daily traffic data and a speed survey of Camino Pablo were also collected. For the study intersection, the single hour with the highest traffic volumes during the count periods was identified. The peak hour volumes for weekday morning and evening are presented on **Figure 3** along with the existing lane configuration and traffic control. Daily traffic volumes and speed data are also summarized. The traffic count data are provided in the Appendix.

The operations of roadway facilities for vehicles are typically described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS A, representing free flow conditions with minimal delay, to LOS F, representing over-capacity conditions. LOS E represents "at-capacity" operations. Operations are designated as LOS F when volumes exceed capacity, resulting in stop-and-go conditions. **Appendix A** describes the LOS analysis method for vehicles. Pedestrian and bicycle activity was factored into the analysis.

Results of the existing conditions analysis are presented in **Table 2**, which shows the Camino Pablo at Tharp Drive intersection operates with minimal delay during peak hours.

Average daily traffic volumes on Camino Pablo north of Tharp Drive are approximately 1,170 vehicles per day. The average travel speed is 29 miles per hour and the 85th percentile speed is 34 miles per hour. The posted speed limit is 25 miles per hour.

TABLE 2
INTERSECTION LEVEL OF SERVICE RESULTS

Intersection	Peak Hour	Existing		Existing Plus Project		Near-Term		Near-Term Plus Project	
		Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[3]	Delay[1]	LOS[2]
1. Tharp Drive at Camino Pablo	AM	3 (9)	A (A)	4 (10)	A (A)	3 (9)	A (A)	4 (10)	A (A)
	PM	3 (9)	A (A)	4 (9)	A (A)	3 (9)	A (A)	4 (9)	A (A)

Notes:
1. Delay presented in seconds per vehicle; delay presented as intersection average (worst approach)
2. LOS = Level of Service.

Source: Fehr & Peers, September 2015.

Accident Data

Accident data for Camino Pablo at Tharp Drive was also collected from the following sources:

1. Transportation Injury Mapping System (TIMS)
2. Statewide Integrated Traffic Records System (SWITRS)

There was one reported accident at intersection of Tharp Drive at Camino Pablo in the last 5 years. The primary collision factor was unsafe speed and the driver hit an object. No injuries were reported.

PROJECT CONDITIONS

Project Trip Generation

Trip generation refers to the process of estimating the amount of vehicular traffic a project might add to the local roadway network. In addition to estimates of daily traffic, estimates are also created for the peak one-hour periods during the morning (AM) and evening (PM) commute hours, when traffic volumes on adjacent streets are typically at their highest.

Table 3 shows the estimated trip generation for the project. In terms of ITE trip generation, which represents the total trip generation of the project for all travel modes, the project is expected to generate approximately 160 weekday daily trips, including about 19 morning and 17 evening peak hour trips. Based on the site location and surrounding land uses, all trips are expected to be vehicle trips.

TABLE 3
TRIP GENERATION ESTIMATES

Use	Size	Daily	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Residential[1]	13 Units	160	5	14	19	11	6	17

1. Based on *Trip Generation* (9th Edition) trip generation rates for land use 210, Single Family Homes
Source: Fehr & Peers, September 2015

Project Trip Distribution and Assignment

Project trip distribution refers to the directions of approach and departure that vehicles would access the site. It is expected that all traffic would arrive to the site from Camino Pablo to the northwest. The vehicle traffic expected to be generated by the project was then assigned to streets in the local roadway system for the weekday daily, AM and PM peak hours. The resulting added daily and peak hour trips to the roadway system are on **Figure 4**. These trips were added to existing traffic volumes, also presented on Figure 4.

Future Conditions

Land use development within the Town of Moraga and adjacent communities has the potential to increase traffic on roadways within the area. A review of approved and pending developments[2] in the area indicates that there are no projects that would take access from Camino Pablo, potentially increasing traffic in the area. Traffic growth projections from the Contra Costa Transportation Authority (CCTA) travel demand model indicates a potential annual traffic growth rate of less than 0.50 percent per year. Although not much change in travel patterns on Camino Pablo at Tharp Drive is expected, the existing through traffic volumes on Camino Pablo were increased by 0.50 percent per year for 25 years to approximate future conditions. Project traffic was then added to the resulting daily and peak hour traffic forecasts as shown on Figure 5.

[2] http://www.moraga.ca.us/dept/planning/Major%20Projects/major-projects-matrix

Intersection Operations

Intersection operations were evaluated using the same methods as for Existing conditions for the weekday AM and PM peak hours based on the volumes presented on Figure 3 with the results presented in Table 2.

Results of the future conditions analysis are presented in Table 2, which shows that the Tharp Drive at Camino Pablo intersection that would provide access to the project site is expected to continue to operate at Level of Service A with minimal vehicle delay during both the morning and evening peak hours in the existing and future conditions.

A supplemental assessment was also conducted to determine intersection operations if all-way stop-control was installed. The intersection would experience an average delay of less than 10 seconds per vehicle during both peak hours in the existing and future condition with installation of all-way stop-control.

Roadway Operations

Traffic counts were conducted over a 72-hour period (Tuesday through Thursday) on Camino Pablo just north of Tharp Drive in September 2015 with clear skies and area schools in session. Counts collected during the school year are representative of typical traffic conditions for the majority of the year. The average daily traffic volumes on these roadways are summarized below in Table 4. Camino Pablo experiences traffic volumes consistent with residential collectors of less than 3,000 vehicles per day. Traffic volumes were fairly consistent on the days of data collection, with a variation in daily volume of approximately two percent. The projected level of daily traffic from the project was added to the existing traffic volume to estimate daily traffic on Camino Pablo with the project. As shown in Table 4, the project could increase daily traffic to approximately 1,330, which while potentially noticeable to existing roadway users, is well within the roadway capacity.

TABLE 4
EXISTING DAILY TRAFFIC ANALYSIS

Roadway	Existing Weekday Conditions			Project Conditions	
	Average Daily Traffic[1]	Peak Hourly Traffic[2]	Daily Fluctuation[3]	Daily Project Traffic	Total Daily Traffic with Project
Camino Pablo, North of Tharp Drive	1,170	120	±2%	160	1,330

Notes: 1. Average daily two-way traffic measured over three days.
2. Average peak hour volume from the three weekdays of data collection.
3. Percent difference between the two days of data collection.

Source: Fehr & Peers, 2015.

Traffic volumes could increase in the future regardless of the development of this project. As shown in Table 5, future traffic volumes could increase to approximately 1,320 vehicles per day. With the addition of project traffic, the resulting volumes could be 1,480. Similar to the existing condition, this level of traffic is well within the roadway capacity.

TABLE 5
FUTURE DAILY TRAFFIC ANALYSIS

Roadway	Future Average Daily Traffic[1]	Project Conditions	
		Project Traffic	Total Daily Traffic with Project
Camino Pablo, North of Tharp Drive	1,320	160	1,480

Notes: 1. Represents existing traffic increased by an annual rate of 0.5 percent over 25 years.

Source: Fehr & Peers, 2015.

SITE ACCESS AND CIRCULATION

This section discusses site access and internal circulation for vehicles, pedestrians, bicycles, and emergency vehicles based on the site plan presented previously on Figure 2. A sight distance evaluation was also conducted for the new roadway connection from the project site to Camino Pablo at Tharp Drive.

Vehicle Access and Circulation

A new roadway, beginning at the intersection of Camino Pablo at Tharp Drive and terminating in a cul-de-sac would be constructed as part of the project and provide access to the proposed 13 single-family homes. Operations of the site access intersection were evaluated in previous sections. The intersection is expected to operate acceptably as either a side-street or all-way stop-controlled intersection.

The proposed roadway is set to be 36 feet wide. Based on the roadway width, parking would be permitted on both sides of the roadway.

A sight distance assessment was conducted for vehicles turning to/from the new roadway connection on Camino Pablo. For this assessment, the stopping sight distance and corner sight distance were reviewed. Stopping sight distance is defined as the distance required by a driver of a vehicle, traveling at a given speed, to bring the vehicle to a stop after an object on the road becomes visible and in advance of reaching the object. Corner sight distance is defined as the intersection line of sight maintained between the driver of a vehicle waiting at the crossroad and the driver of an approaching vehicle. Although the existing speed limit is 25 mph on Camino Pablo at the intersection with Tharp Drive, the analysis was conducted using the observed 85th percentile travel speed of approximately 35 mph, resulting in a minimum stopping sight distance of 250 feet and a corner sight distance of 390 feet for left turns and 335 feet for right turns per *A Policy on Geometric Design of Highways and Stree*ts, a publication of the American Association of State Highway and Transportation Officials (AASHTO). These minimum criteria are satisfied with the proposed project roadway location, as shown on **Figure 6**.

> ***Recommendation***: Maintain landscaping at the northeast and southeast corner of the future roadway connection with Camino Pablo to maintain sight distance for drivers.

A grade assessment was completed for the proposed project roadway. The project intends to follow the existing contour of the site with moderate adjustments. The project roadway intersects Camino Pablo on a down sloping grade of approximately 6 percent. Within the site, maximum slopes would be approximately 15 percent.

Recommendation: As the location of driveways is not shown, it is recommended that grade changes occur between driveways such that the roadway is flat at driveways to facilitate residential access. Some vehicles parked on street may be required to curb their wheels.

Emergency Vehicle Access

Emergency vehicle access would be provided from Camino Pablo and the new project roadway. Based on the cul-de-sac radius and design, it appears that emergency vehicles would be able to travel through the site and turn at the cul-de-sac.

Recommendation: Consult with the fire department regarding emergency vehicle access and circulation through the site.

Pedestrian Facilities

The conceptual plans include a 5-foot wide sidewalk on one side of the project roadway. The sidewalks would connect into the existing sidewalk along the Camino Pablo project frontage. Curb ramps will also be constructed at the intersection of Camino Pablo and the Project Roadway. Sidewalks would also be constructed along the eastside of Camino Pablo, with a landscape stop on the eastside of the sidewalk. The project currently does not propose sidewalks or curb ramps to be installed on Tharp Drive.

Recommendation: Considering placing the landscape buffer between the sidewalk and the roadway. Provide directional curb ramps.

Bicycle Facilities

Class II bicycle lanes currently exist along Camino Pablo north of Tharp Drive. There are no dedicated bicycle facilities south of Tharp Drive on Camino Pablo. As part of the project Camino Pablo would be widened along the project frontage to permit the provision of bicycle lanes. There are no designated bicycle facilities planned on the project roadway, but bicycles would be permitted in the vehicular travel way. No bicycle parking is shown on the site plan, but it is anticipated that future residents would be able to store bicycles within their private garages.

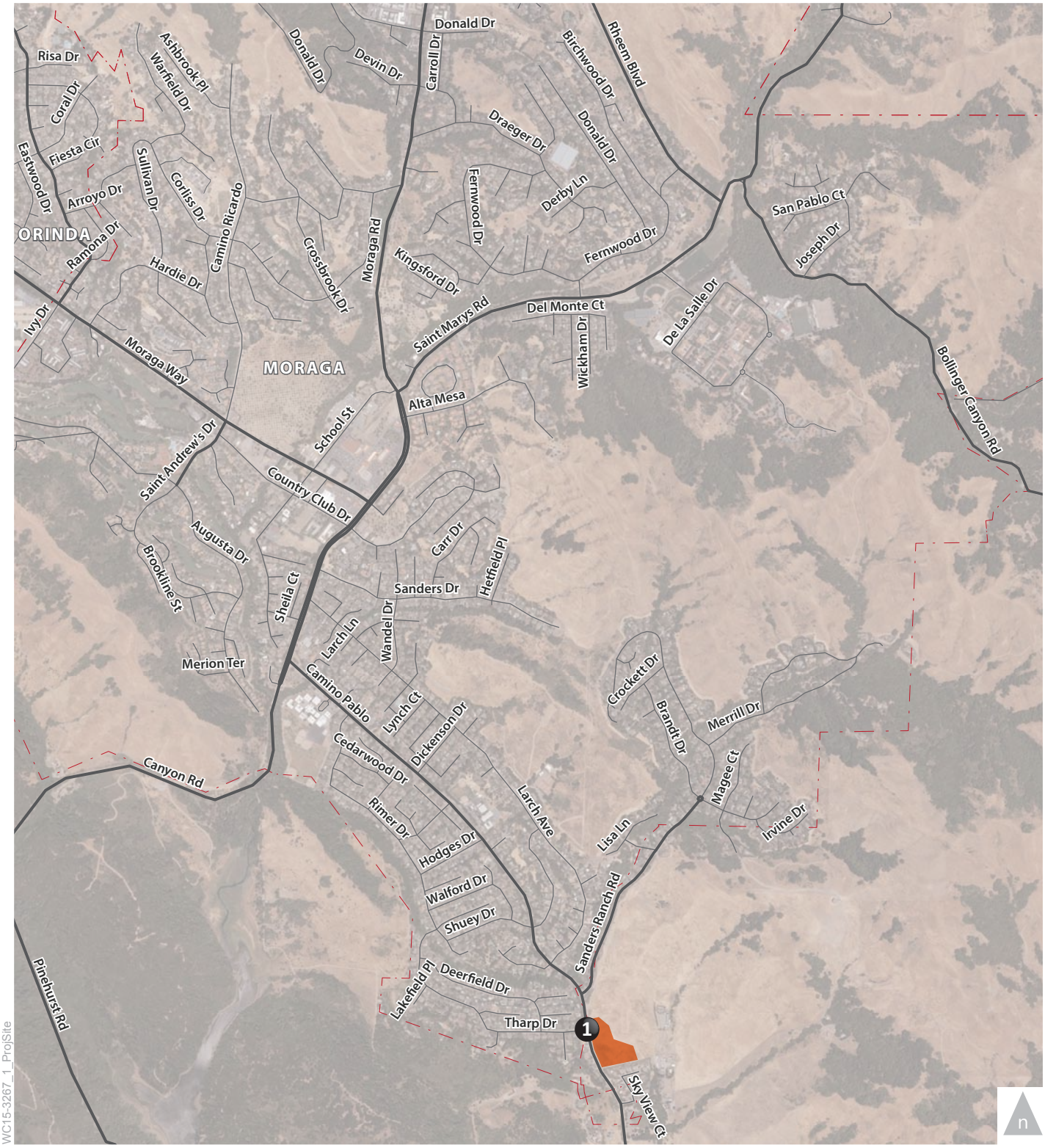
Parking

The Town Municipal Code (Section 8.76.100) outlines off-street parking requirements for various land uses, including residential uses. For the project site, each dwelling unit must have two covered off-street automobile parking spaces for each parcel. Dwelling units in zones of 3 dwelling units per acre and with less than 45 feet of frontage are also required to have two guest parking spaces that are either open or covered and with adequate turn around space. Parking for each of the homes within the Project site would be provided by an attached, two to three car garage and accompanying driveway. The garages would meet the minimum dimensions for parking spaces as described in the Town Code and the driveways meet the requirements for the guest parking spaces. There would also be on-street parking throughout the development. Based on this review, there is sufficient parking provided within the Project site.

This completes our transportation assessment for the Camino Pablo residential development. Please call Kathrin at 925-930-7100 if you have questions.

Attachments:

Figure 1	Site Vicinity
Figure 2	Conceptual Project Site Plan
Figure 3	Existing Weekday Daily, AM and PM Peak Hour Intersection Turning Movement Volumes and Intersection Lane Configurations/Traffic Control
Figure 4	Existing Plus Project Peak Hour Intersection Turning Movement Volumes
Figure 5	Future Without and With Project Daily and Peak Hour Intersection Turning Movement Volumes
Figure 6	Sight Distance Assessment
Attachment A	Level of Service Analysis Methods
Attachment B	Traffic Count Worksheets
Attachment C	Level of Service Worksheets



LEGEND

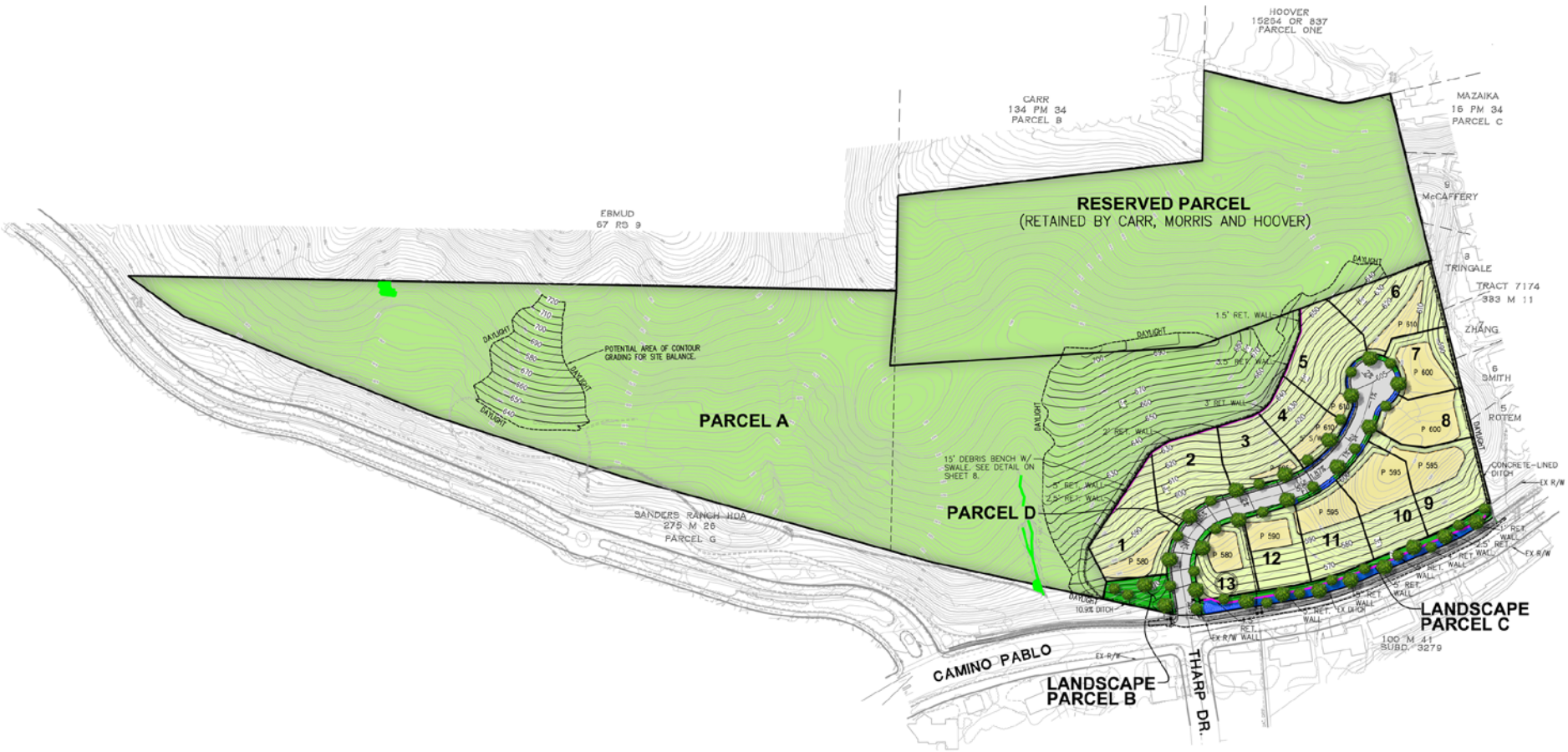
Project Site

Study Intersection

Town of Moraga

Figure 1

Project Site and Study Intersection Location

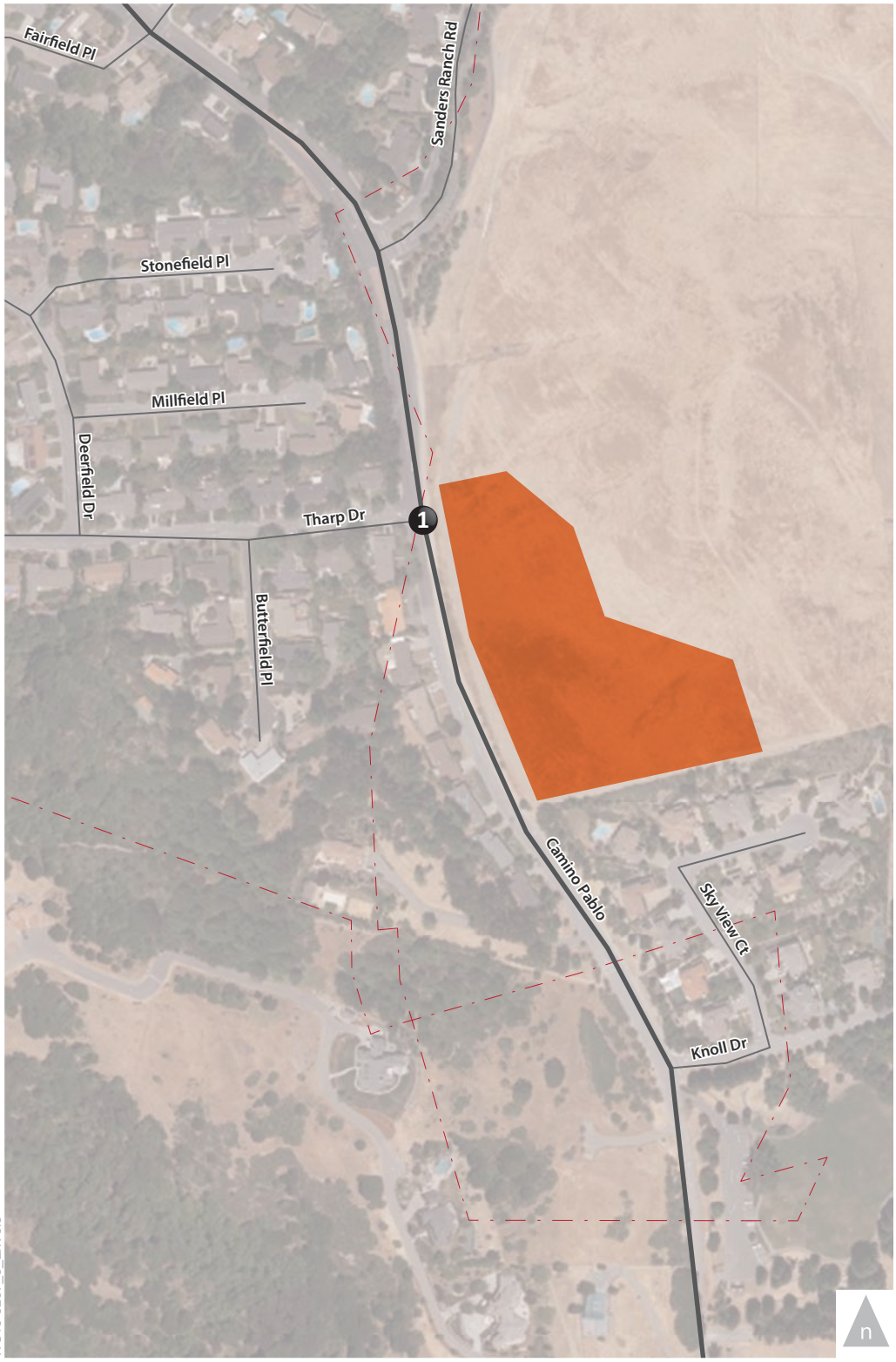


WC15-3267_2_SitePlan

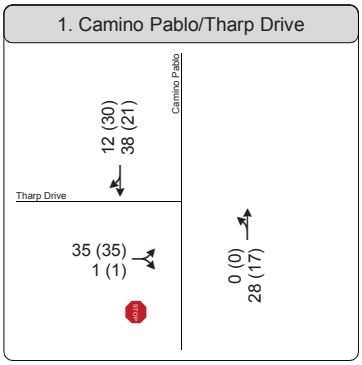
Site Plan Source: dk Consulting

Figure 2

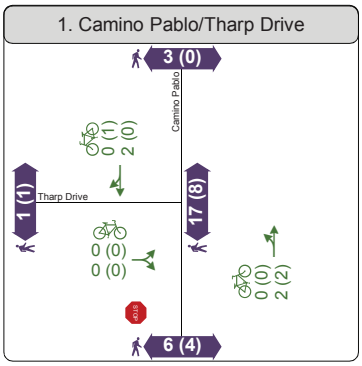
Conceptual Project Site Plan



Existing



Pedestrian and Bicycle



WC15-3267_3_ExVols

LEGEND

Project Site

Study Intersection

Town of Moraga

XX (YY) AM (PM) Peak Hour Traffic Volumes

Study Intersection

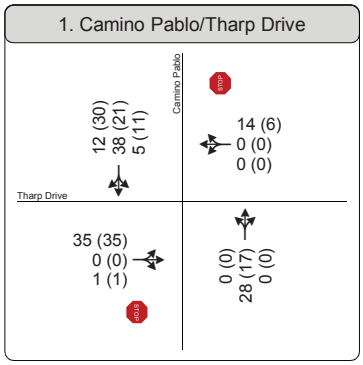
x (y) AM (PM) Peak Hour Pedestrian Volumes

x (y) AM (PM) Peak Hour Bicycle Volumes

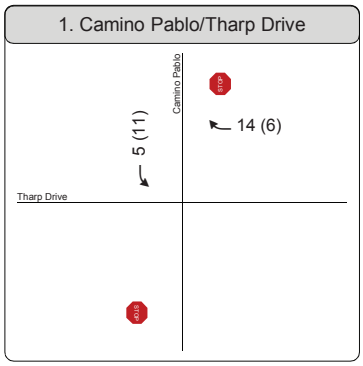
Figure 3

Existing Peak Hour Intersection Traffic Volumes, Lane Configuration and Traffic Controls

Existing Plus Project



Project Trip Assignment



WC15-3267_4_Ex+ProjVols

LEGEND

Project Site | # Study Intersection | Town of Moraga

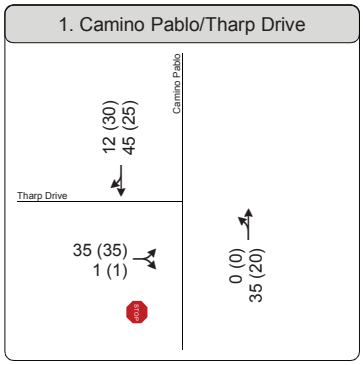
XX (YY) AM (PM) Peak Hour Traffic Volumes | Study Intersection

Figure 4

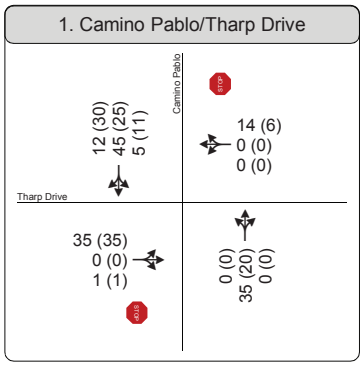
Existing Plus Project

Peak Hour Intersection Traffic Volumes, Lane Configuration and Traffic Controls

Future



Future Plus Project



WC15-3267_5_FutVols

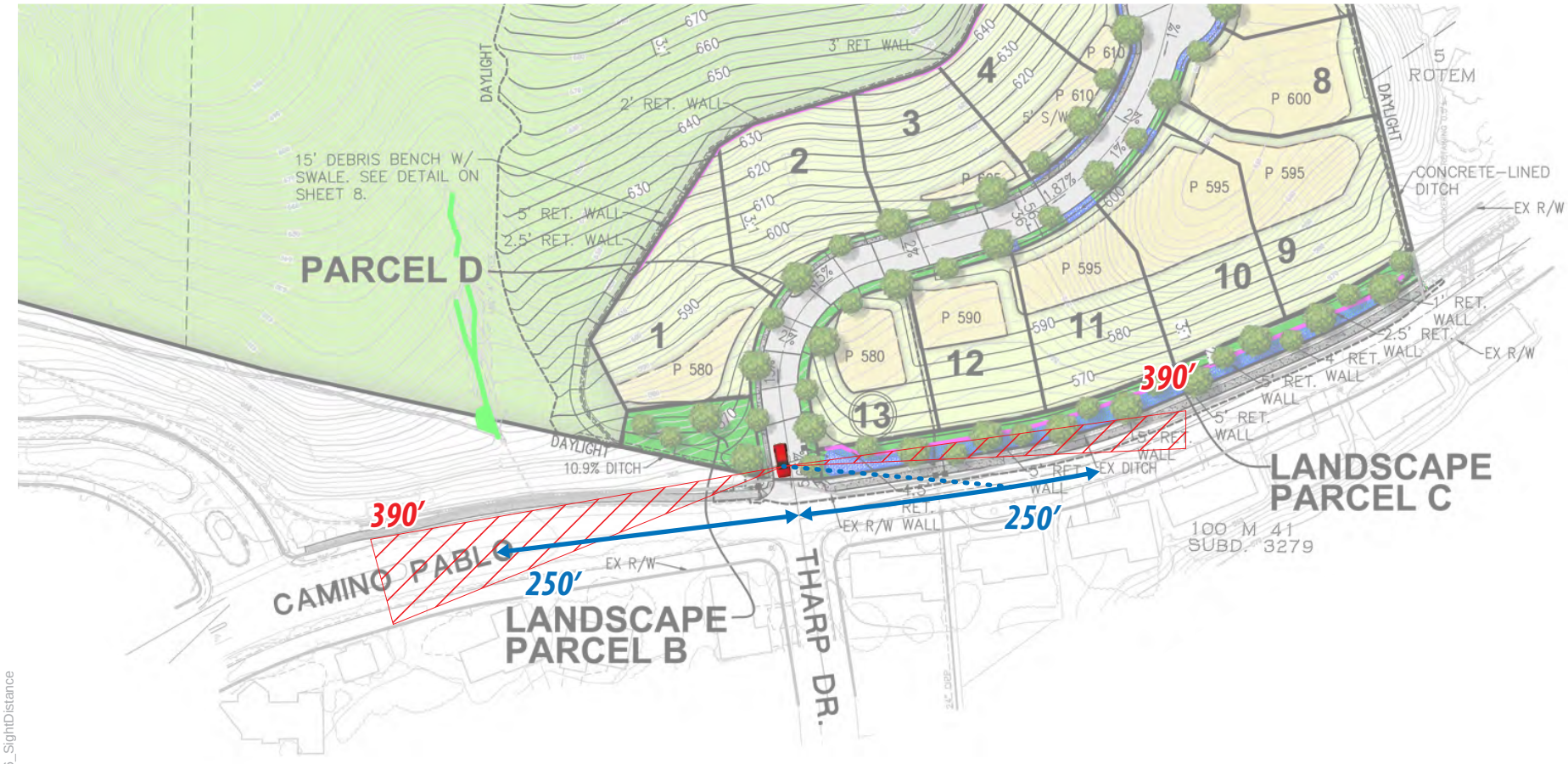
LEGEND

Project Site | # Study Intersection | Town of Moraga

XX (YY) AM (PM) Peak Hour Traffic Volumes | Study Intersection

Figure 5

Future and Future Plus Project
Peak Hour Intersection Traffic Volumes, Lane Configuration and Traffic Controls



WC15-3267_6_SightDistance

Site Plan Source: dk Consulting

LEGEND

Stopping Sight Distance at 35 mph = 250′

Corner Sight Distance at 35 mph = 390′

Figure 6

Sight Distance Assessment

ATTACHMENT A – INTERSECTION ANALYSIS METHODS

The operations of roadway facilities are for vehicles described with the term "level of service" (LOS). LOS is a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels of service are defined ranging from LOS A (i.e., free-flow operating conditions) to LOS F (over capacity operating conditions). LOS E corresponds to operations "at capacity." When volumes exceed capacity, stop-and-go conditions result and operations are designated as LOS F. The Town of Moraga level of service standards are presented in Table 1.

Traffic conditions at unsignalized intersections were evaluated using the method from Chapters 19 and 20 of the 2010 *Highway Capacity Manual*. With this method, operations are defined by the average control delay per vehicle (measured in seconds) for each movement that must yield the right-of-way. At two-way or side street-controlled intersections, the control delay (and LOS) is calculated for each controlled movement, as well as the left-turn movement from the major street, and the entire intersection. For controlled approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. The delays for the entire intersection and for the movement or approach with the highest delay are reported. **Table A-1** summarizes the relationship between delay and LOS for unsignalized intersections.

TABLE A-1
UNSIGNALIZED INTERSECTION LOS CRITERIA

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Little or no delays	≤ 10.0
B	Short traffic delays	> 10.0 to 15.0
C	Average traffic delays	> 15.0 to 25.0
D	Long traffic delays	> 25.0 to 35.0
E	Very long traffic delays	> 35.0 to 50.0
F	Extreme traffic delays with intersection capacity exceeded	> 50.0

Source: *Highway Capacity Manual* (Transportation Research Board, 2010)

FEHR PEERS

DRAFT FINAL MEMORANDUM

Date: June 15, 2020

To: Doug Herring, Douglas Herring & Associates

From: Kathrin Tellez, Fehr & Peers

Subject: Camino Pablo Subdivision Transportation Analysis

WC20-3724

This memorandum presents the results of our transportation assessment for the Camino Pablo subdivision development (project), including project description, regulatory setting, existing conditions, project conditions, and site plan review. A review of the CEQA checklist is also provided.

PROJECT DESCRIPTION

The project site is located on the east side of Camino Pablo, south of Sanders Ranch Road in an unincorporated portion of Contra Costa County, adjacent to the Town of Moraga, as shown on **Figure 1** (all figures are attached at the end of this memorandum). The project is within the County's Urban Limit Line and as part of the project, the approximately 24-acre undeveloped site would be annexed into the Town of Moraga. The County designates the site as agricultural land, while the Town of Moraga has designated a portion of the site as open space with the remaining portion designated for 1-dwelling unit per acre. The project would require a General Plan Amendment to change the portion of the proposed development area currently designated as Residential, 1 Dwelling Unit Per Acre (1-DUA) to Residential, 3 Dwelling Units Per Acre (3-DUA).

The proposed project consists of 13 single-family detached homes on approximately 8.5 acres, with individual lots ranging in size from 15,105 square feet to 40,027 square feet, with an average size of approximately 22,367 square feet. A total of six 1-bedroom accessory dwelling units (ADUs) are included, one each on Lots 1, 2, 4, 5, 6, and 10. The remaining 15.4 acres would be preserved as permanent open space.

Access to the site would be provided by a new roadway that would connect to Camino Pablo at Tharp Drive. As part of the project, changing the designation of Camino Pablo from major arterial

to a collector is proposed, with a bike route installed where there are no bicycle facilities, from Sanders Ranch to the southern terminus of Camino Pablo. This change would also require a General Plan Amendment. The applicant would install 'Share the Road' signage and striping along this portion of Camino Pablo.

A conceptual project site plan is shown on **Figure 2**.

REGULATORY SETTING AND ANALYSIS PARAMETERS

Significance criteria are used to determine whether a project's impact on the environment is considered significant and therefore requires mitigation under the requirements of the California Environmental Quality Act (CEQA). Pursuant to recent updates to the CEQA guidelines, effective December 28, 2018, the use of vehicle delay based metrics as measured by level of service (LOS) and other similar metrics, generally no longer constitutes a significant environmental impact under CEQA. After July 1, 2020, vehicle miles of travel has been identified by the Office of Planning and Research (OPR) as the most appropriate metric to evaluate a project's transportation impacts.

CEQA Significance Thresholds

For this study, based on the updated Appendix G Environmental Checklist Form, Town of Moraga and Lamorinda Action Plan policies, a significant transportation-related impact could occur if the project would:

A. Conflict with a program, plan, ordinance or policy addressing the circulation system, including roadway, transit, bicycle and pedestrian facilities?

   Roadway System – The project would create a significant impact related to the roadway system if any of the following criterion is met:

   1. At unsignalized intersections, the project results in any of the traffic signal warrants included in the *CA Manual on Uniform Traffic Control Devices* (MUTCD) to be satisfied, or for a location where any of the warrants are satisfied prior to the project, the project increases overall travel through the intersection by more than 1 percent.

   2. The project creates the potential for excessive vehicle queue spillback that could periodically block or interfere with pedestrian, bicycle or transit facilities.

Transit System – The project would create a significant impact related to transit service if the following criterion is met:

1. The project interferes with existing transit facilities or precludes the construction of planned transit facilities.

Bicycle System – The project would create a significant impact related to the bicycle system if any of the following criteria are met:

1. Disrupt existing bicycle facilities; or
2. Interfere with planned bicycle facilities; or
3. Create inconsistencies with adopted bicycle system plans, guidelines, policies, or standards.

Pedestrian System – The project would create a significant impact related to the pedestrian system if any of the following criteria are met:

1. Disrupt existing pedestrian facilities; or
2. Interfere with planned pedestrian facilities; or
3. Create inconsistencies with adopted pedestrian system plans, guidelines, policies, or standards.

B. Conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)[1]

C. Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)

D. Result in inadequate emergency access

As vehicle miles of travel (VMT) assessments are not required to be completed until after July 1, 2020, no VMT assessment was conducted since this analysis was completed prior to July 1, 2020.

[1] This section of the CEQA Guidelines relates to the evaluation of vehicle miles of travel (VMT).

General Plan Consistency

The Town of Moraga strives to maintain a balanced transportation system, which includes maintaining traffic operations within a certain delay range, based on policies contained in the General Plan. Additionally, a projects effect on overall travel operations provides decision makers with additional information to consider in the entitlement process, and allows for the identification of potential improvements or project changes that should be incorporated in a project to minimize the overall effects on the surrounding community.

The following criteria has been applied to analyze the project's consistency with the General Plan. Intersection or roadway improvements may be required under the following circumstances:

1. Would the operations of a signalized study intersection decline from acceptable (as defined in Table 1) to unacceptable based on the HCM LOS method with the addition of project traffic?

2. Would the project deteriorate already unacceptable operations at a signalized intersection by adding traffic?

3. If the addition of project traffic at a study intersection results in the 95th percentile vehicle queue exceeding the available storage or would increase 95th percentile queue by more than two vehicles where the queue already exceeds the available storage space?

4. Would construction traffic from the project substantially affect traffic flow and circulation, parking, and pedestrian safety?

5. Would the project conflict with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads and highways[2]?

The Town of Moraga General Plan Policy GM 1.4 establishes a Level of Service (LOS) "C" standard for roads in Moraga, which is applied to signalized intersection operations. At unsignalized

[2] An assessment of potential project impacts on CMP roadways is required for projects that generate more than 100 peak hour trips or require a General Plan Amendment. Although the project generates less than 100 peak hour trips (see Table 2), a General Plan Amendment would be required to construct the project as proposed.

intersections, application of a LOS C policy could result in over-sized intersections and unwarranted traffic signals that would be costly to install and maintain, and provide little benefit to vehicle operations. Therefore, a LOS E standard has been applied to the controlled approaches of a two-way stop-controlled intersection, with an overall LOS C standard, and a LOS D standard has been applied at all-way stop-controlled intersections. Table 1 presents the LOS standards, consistent with the Town of Moraga General Plan and thresholds used in the General Plan EIR. General Plan Policy GM 1.5 requires that developers include mitigation measures to ensure such standards are met (note that for delay-based standards, identified mitigation would not be CEQA mitigation).

TABLE 1
ROADWAY LEVEL OF SERVICE STANDARDS

Intersection Type	LOS Standard	V/C Ratio	HCM Control Delay Per Vehicle (Seconds)[2]
Signalized Intersection[1]	LOS C	0.75 to 0.79	28 to 35 seconds
All-Way Stop Control[3] Overall Intersection	LOS D	N/A	30 to 35 seconds
One- and Two-Way Stop Control[3] Overall Intersection Side Street Traffic	 LOS C LOS E	 N/A N/A	 20 to 25 seconds 43 to 50 seconds

Notes:
1. Town of Moraga General Plan (2002).
2. HCM control delay per vehicle obtained from the 6th Edition of the *Highway Capacity Manual*.
3. Town of Moraga General Plan EIR (2002).

EXISTING CONDITIONS

This section describes transportation facilities in the study area, including the surrounding roadway network, and transit, pedestrian, and bicycle facilities in the site vicinity.

Roadway System

Moraga Road/Canyon Road is a two-to-four lane north-south arterial roadway. Moraga Road extends between Moraga Way in the Town of Moraga and Mount Diablo Boulevard in the City of Lafayette. Canyon Road is the extension of Moraga Road south of Moraga Way to Pinehurst Road in Alameda County. The posted speed limit on Moraga Road is 35 miles per hour (MPH). On-street

parking is permitted on some portions of this roadway and Class II bicycle lanes and sidewalks are provided through the study area.

Moraga Way is generally a two-lane arterial roadway that extends northwest-southeast between Moraga Road (in the Town of Moraga) and SR 24 in the City of Orinda. Between School Street and Moraga Road, Moraga Way is a four-lane road with left-turn lanes. The posted speed limit on Moraga Way is 35 MPH. On-street parking is permitted on some portions of this roadway and Class II bicycle lanes are provided through the study area. Sidewalks are also provided along some portions of the roadway.

Camino Pablo is a two-lane arterial roadway that has a northwest to southeast orientation. It connects to Canyon Road in the northwest; to the south of the Town of Moraga, Camino Pablo transitions to Brown Ranch Road and access is restricted. Sidewalks are provided on the east side of the roadway and Class II bike lanes are provided in both the northbound and southbound directions from Canyon Road to Tharp Drive. Pedestrian curb ramps, marked crosswalks, and left-turn pockets are provided at some intersections, but not all. On-street parking is permitted on portions of the roadway. The posted speed limit on this roadway is 25 MPH.

Tharp Drive is a two-lane residential collector street that intersects with Camino Pablo. Sidewalks and dedicated bicycle facilities are not provided as it is expected that these modes will share the roadway with vehicles. On-street parking is permitted on both sides of the roadway. The roadway intersects with a number of local streets through a residential neighborhood. A circuitous connection is provided via Tharp Drive and other neighborhood streets to Camino Pablo at Rimer Drive, although this route is longer than the most direct route to the same location on Camino Pablo.

Existing Pedestrian and Bicycle Facilities

Pedestrian facilities include sidewalks, paths, crosswalks, and pedestrian signals. Pedestrian facilities are provided on the east side of Camino Pablo in the vicinity of the site. Dedicated pedestrian facilities are not provided on Tharp Drive.

Bicycle facilities in Moraga include the following:

- *Bike paths (Class I)* – Paved trails that are separated from roadways. These facilities are typically shared with pedestrians, although bicycles must yield to pedestrians.

- *Bike lanes (Class II)* – Lanes on roadways designated for use by bicycles through striping, pavement legends, and signs. There may or may not be parking allowed on the roadway.
- *Bike routes (Class III)* – Designated roadways for bicycle use by signs only; may or may not include additional pavement width for cyclists.

Camino Pablo provides Class II bike lanes in both travel directions from Moraga Road to north of Tharp Drive. The bike lanes do not continue south of Tharp Drive and do not continue along the frontage of the proposed site. Dedicated bicycle facilities are also not provided on Tharp Drive. Camino Pablo south of Tharp Drive is designated as a Bicycle Route in the *Moraga Walk | Bike Plan*, October 2016.

Existing Transit Service

Transit service in the immediate project area is limited to dial-a-ride service. A County Connection bus stop that is served by Route 6 is located approximately 2 miles from the site on Moraga Way, east of Moraga Road, and on Moraga Road, north of Moraga Way. Route 6 connects to Saint Mary's college as well as the Orinda and Lafayette BART stations. Parking is also available at the BART stations, which are both located approximately 7 miles from the project site.

Existing Roadway Operations

Weekday morning (7:00 to 9:00 AM) and evening (4:00 to 6:00 PM) peak period intersection vehicle turning movement counts were conducted in September 2015 at the intersection identified for inclusion in the study – the intersection of Camino Pablo at Tharp Drive. This intersection was selected for inclusion in the study as all project traffic would access this intersection. Based on guidance provided by the Contra Costa Transportation Authority (CCTA), signalized intersections where a project could add more than 50-trips during an one peak hour is typically evaluated. As the project is expected to generate less than 20 trips in any one hour (see Table 2), no additional intersections were selected for evaluation and the projects effect on the operation of other intersections is expected to be negligible.

Daily traffic data and a speed survey of Camino Pablo were also collected. For the study intersection, the single hour with the highest traffic volumes during the count periods was identified. The daily traffic volumes along Camino Pablo and peak hour intersection volumes are presented on **Figure 3** along with the existing lane configuration and traffic control of the intersection. The traffic count data are attached. Although the traffic count data was collected in 2015, these counts are considered representative of current non-shelter-in-place conditions along Camino Pablo as no

development has occurred along the corridor that would change overall travel patterns at the Camino Pablo at Tharp Drive intersection.

The operations of roadway facilities for vehicles are typically described with the term level of service (LOS). LOS is a qualitative description of traffic flow based on such factors as speed, travel time, delay, and freedom to maneuver. Six levels are defined from LOS A, representing free flow conditions with minimal delay, to LOS F, representing over-capacity conditions. LOS E represents "at-capacity" operations. Operations are designated as LOS F when volumes exceed capacity, resulting in stop-and-go conditions. **Attachment A** describes the LOS analysis method for vehicles. Pedestrian and bicycle activity was factored into the analysis.

Results of the existing conditions analysis are presented in **Table 2**, which shows the Camino Pablo at Tharp Drive intersection operates with minimal delay during peak hours, and is within the LOS standard set by the Town of Moraga.

TABLE 2
INTERSECTION LEVEL OF SERVICE RESULTS

Intersection	Peak Hour	Existing		Existing Plus Project		Future		Future Plus Project	
		Delay[1]	LOS[2]	Delay[1]	LOS[2]	Delay[1]	LOS[3]	Delay[1]	LOS[2]
1. Tharp Drive at Camino Pablo	AM	3 (9)	A (A)	4 (10)	A (A)	3 (9)	A (A)	3 (10)	A (A)
	PM	3 (9)	A (A)	4 (9)	A (A)	3 (9)	A (A)	4 (9)	A (A)

Notes:
1. Delay presented in seconds per vehicle; delay presented as intersection average (worst approach) base on the HCM 6th Edition Method.
2. LOS = Level of Service.
Source: Fehr & Peers, June 2020.

Average daily traffic volumes on Camino Pablo north of Tharp Drive are approximately 1,170 vehicles per day. The average travel speed is 29 miles per hour and the 85th percentile speed[3] is 34 miles per hour. The posted speed limit is 25 miles per hour.

[3] The 85th percentile speed represents the speed that 85 percent of motorists drive at or under. The 85th percentile speed is typically used for setting speed limits.

Collision Data

Collision data for Camino Pablo at Tharp Drive was also collected from the following sources:

1. Transportation Injury Mapping System (TIMS)
2. Statewide Integrated Traffic Records System (SWITRS)

There was one reported collision at intersection of Tharp Drive at Camino Pablo between 2010 and the end of 2019. The primary collision factor was unsafe speed and the driver hit an object. No injuries were reported. At the intersection of Sanders Ranch Road, there was one reported collision in 2015 and one in 2019; in both collisions, a pedestrian and motor vehicle were involved. In both collisions, failure to follow traffic signs was the primary collision factor.

PROJECT CONDITIONS

Project Trip Generation

Trip generation refers to the process of estimating the amount of vehicular traffic a project might add to the local roadway network. In addition to estimates of daily traffic, estimates are also created for the peak one-hour periods during the morning (AM) and evening (PM) commute hours, when traffic volumes on adjacent streets are typically at their highest.

Table 3 shows the estimated trip generation for the project. In terms of ITE trip generation, which represents the total trip generation of the project for all travel modes, the project is expected to generate approximately 200 weekday daily trips, including about 17 morning and 17 evening peak hour trips. Based on the site location and surrounding land uses, all trips are expected to be vehicle trips.

TABLE 3
TRIP GENERATION ESTIMATES

Use	Size	Daily	AM Peak Hour			PM Peak Hour		
			In	Out	Total	In	Out	Total
Single Family [1]	13-units	160	3	11	14	9	5	14
Accessory Dwelling Units [2]	6-units	40	1	2	3	2	1	3
	Total	200	4	13	17	11	6	17

Notes:
1. ITE Land Use Category 210 – Single Family Homes (Adj. Streets, 7:00 – 9:00 AM, 4:00 – 6:00 PM) based on suburban locations:
   Weekday Daily: Ln(T) = 0.92 Ln(X) + 2.71
   Weekday AM Peak Hour: T = 0.71 (X) + 4.8; Enter = 25%; Exit = 75%
   Weekday PM Peak Hour: Ln(T) = 0.96 Ln(X) + 0.20; Enter = 63%; Exit = 37%
2. ITE land use category 220 – Multi-Family Housing low-Rise (Adj. Streets, 7:00 – 9:00 AM, 4:00 – 6:00 PM) based on suburban locations:
   Weekday Daily: T = 7.32 (X)
   Weekday AM Peak Hour: T = 0.46 (X); Enter = 23%; Exit = 77%
   Weekday PM Peak Hour: T = 0.56 (X); Enter = 63%; Exit = 37%

Source: *Trip Generation Manual* (10th Edition), ITE; Fehr & Peers.

Project Trip Distribution and Assignment

Project trip distribution refers to the directions of approach and departure that vehicles would access the site. It is expected that all traffic would arrive to the site from Camino Pablo to the northwest. The vehicle traffic expected to be generated by the project was then assigned to streets in the local roadway system for the weekday daily, AM and PM peak hours. The resulting added daily and peak hour trips to the roadway system are on **Figure 4**. These trips were added to existing traffic volumes, also presented on Figure 4.

Future Conditions

Land use development within the Town of Moraga and adjacent communities has the potential to increase traffic on roadways within the area. A review of approved and pending developments[4] in the area indicates that there are no projects that would take access from Camino Pablo, potentially increasing traffic in the immediate study area. Traffic growth projections from the Contra Costa Transportation Authority (CCTA) travel demand model indicates a potential annual traffic growth

[4] http://www.moraga.ca.us/dept/planning/Major%20Projects/major-projects-matrix

rate of less than 0.50 percent per year for the area around Camino Pablo. Although not much change in travel patterns on Camino Pablo at Tharp Drive is expected, the existing through traffic volumes on Camino Pablo were increased by 0.50 percent per year for 25 years to approximate future conditions. Project traffic was then added to the resulting daily and peak hour traffic forecasts as shown on Figure 5.

Intersection Operations

Intersection operations were evaluated using the same methods as for existing conditions for the weekday AM and PM peak hours based on the volumes presented on Figure 3 with the results presented in Table 2.

Results of the future conditions analysis are presented in Table 2, which shows that the Tharp Drive at Camino Pablo intersection that would provide access to the project site is expected to continue to operate at an overall LOS A with minimal vehicle delay during both the morning and evening peak hours in the existing and future conditions, with the addition of project traffic.

A supplemental assessment was also conducted to evaluate intersection operations if all-way stop-control was installed. The intersection would experience an average delay of less than 10 seconds per vehicle during both peak hours in the existing and future condition considering the addition of project traffic as an all-way stop-control intersection.

Roadway Operations

Traffic counts were conducted over a 72-hour period (Tuesday through Thursday) on Camino Pablo just north of Tharp Drive in September 2015 with clear skies and area schools in session. Counts collected during the school year are representative of typical traffic conditions for the majority of the year. The average daily traffic volumes on these roadways are summarized in Table 4. Camino Pablo experiences traffic volumes consistent with residential collectors of less than 3,000 vehicles per day. Traffic volumes were fairly consistent on the days of data collection, with a variation in daily volume of approximately two percent. The average travel speed is 29 miles per hour and the 85th percentile speed is 34 miles per hour. The posted speed limit is 25 miles per hour.

The projected level of daily traffic from the project was added to the existing traffic volume to estimate daily traffic on Camino Pablo with the project. As shown in **Table 4**, the project could increase daily traffic to approximately 1,370, which while potentially noticeable to existing roadway users, is well within the roadway capacity.

TABLE 4
EXISTING DAILY TRAFFIC ANALYSIS

Roadway	Existing Weekday Conditions			Project Conditions	
	Average Daily Traffic[1]	Peak Hourly Traffic[2]	Daily Fluctuation[3]	Daily Project Traffic	Total Daily Traffic with Project
Camino Pablo, North of Tharp Drive	1,170	120	±2%	200	1,370

Notes:
1. Average daily two-way traffic measured over three days.
2. Average peak hour volume from the three weekdays of data collection.
3. Percent difference between the two days of data collection.

Source: Fehr & Peers, 2020.

Traffic volumes could increase in the future regardless of the development of this project. As shown in **Table 5**, future traffic volumes could increase to approximately 1,320 vehicles per day. With the addition of project traffic, the resulting volumes could be 1,520. Similar to the existing condition, this level of traffic is well within the roadway capacity.

TABLE 5
FUTURE DAILY TRAFFIC ANALYSIS

Roadway	Future Average Daily Traffic[1]	Project Conditions	
		Project Traffic	Total Daily Traffic with Project
Camino Pablo, North of Tharp Drive	1,320	200	1,520

Notes:
1. Represents existing traffic increased by an annual rate of 0.5 percent over 25 years.

Source: Fehr & Peers, 2020.

The traffic volumes on Camino Pablo south Sanders Ranch to the southern terminus of Camino Pablo are projected to be well within the capacity of a collector roadway, and the change in designation from an arterial to a collector roadway would not expect to result in adverse effects to vehicle travel from a roadway capacity perspective.

SITE ACCESS AND CIRCULATION

This section discusses site access and internal circulation for vehicles, pedestrians, bicycles, and emergency vehicles based on the site plan presented previously on Figure 2. A sight distance evaluation was also conducted for the new roadway connection from the project site to Camino Pablo at Tharp Drive. One potentially significant impact was identified based on the CEQA significance criteria on Pages 2 and 3 ; mitigation to reduce this impact to a less-than-significant level was developed. Several recommendations were identified to improve site access and circulation for all travel modes. These recommendations could be added as Conditions of Approval, but not incorporating these recommendations would not result in a significant impact under CEQA.

Vehicle Access and Circulation

A new roadway, beginning at the intersection of Camino Pablo at Tharp Drive and terminating in a cul-de-sac would be constructed as part of the project and provide access to the proposed 13 single-family homes and 6 accessory dwelling units. Operations of the site access intersection were evaluated in previous sections. The intersection is expected to operate acceptably as either a side-street or all-way stop-controlled intersection.

The proposed roadway would be 36 feet wide within a 56-foot right-of-way. The proposed 36-foot curb-to-curb width would permit parking on both sides of the street while leaving 20-feet clear for two-way travel and/or emergency vehicle access. A five-foot sidewalk and five-foot landscape buffer would be provided on one side of the street, with a ten-foot landscape buffer on the other side of the street. The roadway would end in a cul-de-sac approximately 700 feet from Camino Pablo.

A sight distance assessment was conducted for vehicles turning to/from the new roadway connection on Camino Pablo. For this assessment, the stopping sight distance and corner sight distance were reviewed. Stopping sight distance is defined as the distance required by a driver of a vehicle, traveling at a given speed, to bring the vehicle to a stop after an object on the road becomes visible and in advance of reaching the object. Corner sight distance is defined as the intersection line of sight maintained between the driver of a vehicle waiting at the crossroad and the driver of an approaching vehicle. Although the existing speed limit is 25 mph on Camino Pablo at the intersection with Tharp Drive, the analysis was conducted using the observed 85th percentile travel speed of approximately 35 mph, resulting in a minimum stopping sight distance of 250 feet and a corner sight distance of 385 feet for turns from the proposed project roadway per the *Caltrans Highway Design Manual* (6th Edition). Actual sight distance north and south of the driveway is

greater than 385 feet, satisfying the minimum criteria with the proposed project roadway location, as shown on **Figure 6**.

> ***Recommendation***: Maintain landscaping at the northeast and southeast corner of the future roadway connection with Camino Pablo to maintain sight distance for drivers or modify the landscaping plan to eliminate plants that could grow taller than 3 feet.

A grade assessment was completed for the proposed project roadway. The project intends to follow the existing contour of the site with moderate adjustments. The project roadway intersects Camino Pablo on a down sloping grade of approximately 6 percent. Within the site, maximum slopes would be approximately 15 percent. California Fire Code, as enforced by the Contra Costa County protection district, allows roadway grades of up to 20 percent, with a grooved concrete surface required for grades between 16 and 20 percent. The maximum grade proposed within the site is 15 percent. State law requires that parked vehicles curb their wheels when grades exceed 3 percent.

> ***Recommendation***: Consider installing signage reminding drivers to curb the wheels of parked vehicles.

Driveway locations have been identified, and a driveway compliance analysis has been conducted, with details provided in Attachment D. Based on this assessment, all driveways are within the maximum driveway slope (less than 20 percent). All driveways are less than 150-feet in length and do not require a turnaround area.

Emergency Vehicle Access

Emergency vehicle access would be provided from Camino Pablo and the new project roadway. The California Fire Code, as enforced by the Contra Costa County protection district, provides guidance on the maximum length of a cul-de-sac and minimum turn radius. For roadways between 151 and 750 feet, such as the proposed project roadway, a 90-foot diameter cul-de-sac is required. This requirement is satisfied by the proposed design, which would also permit on-street parking within the cul-de-sac bulb. An auto-turn assessment confirms that fire trucks would be able to turn around in the cul-de-sac. Additionally, all homes would be equipped with automatic fire sprinkler systems.

Pedestrian Facilities

The conceptual plans include a 5-foot wide sidewalk on one side of the project roadway. The sidewalks would connect into the existing sidewalk along the Camino Pablo project frontage, which would be reconstructed as part of the project along the project frontage, with an 8-foot sidewalk

cross-section adjacent to a storm water basin and landscaping. Curb ramps will also be constructed at the intersection of Camino Pablo and the Project Roadway. Sidewalks would also be constructed along the eastside of Camino Pablo, with a landscape strip on the eastside of the sidewalk. The project currently does not propose sidewalks or curb ramps to be installed on Tharp Drive.

> ***Recommendation:*** Provide directional curb ramps to orient pedestrians to the path of travel along Camino Pablo at the project roadway. Alternatively, consider installing all-way stop-control at the intersection of Tharp Drive and Camino Pablo with crosswalks across all legs of the intersection.

Bicycle Facilities

Class II bicycle lanes currently exist along Camino Pablo north of Tharp Drive. There are no dedicated bicycle facilities south of Tharp Drive on Camino Pablo. As part of the project, changing the designation of Camino Pablo from major arterial to a collector is proposed, with a bike route installed after the Sanders Ranch intersection to the southern terminus of Camino Pablo. This change would require a General Plan Amendment. The applicant would install 'Share the Road' signage and striping to alert drivers that there may be bicyclists within the travel way. Should the designation of Camino Pablo not be changed from a minor arterial to a collector, installation of Class II bicycle lanes would be required. Although the posted speed limit on Camino Pablo at Tharp Drive is 25 MPH, the observed 85th percentile travel speed is 35 MPH, which is higher than the desired vehicle speed on a bicycle route of no more than 25-miles per hour, based on Federal Highway Administration guidance for bicycle facilities. Roadway volumes on this portion of Camino Pablo are within the thresholds for bicycle routes –less than 2,000 vehicles per day.

Impact Statement 1: The designation of Camino Pablo from south of Sanders Ranch to the southern terminus of Camino Pablo as a collector roadway and installation of bicycle route signage and striping on roadway portions that do not already have designated bicycle facilities could result in a traffic hazard as the 85th percentile vehicle speeds on Camino Pablo in the vicinity of Tharp Drive are in excess of the recommended speeds for bicycle routes (current 85th percentile speed is 35 miles per hour and desired speed on bicycle routes based on FHWA guidance is less than 25 miles per hour). This could create a hazardous condition for bicyclists, resulting in a significant impact (Impact 1), based on the CEQA significance criteria.

> ***Mitigation Measure 1:*** Implement speed reduction measures on Camino Pablo south of Sanders Ranch Road to the southern terminus to reduce the 85th percentile travel speed to 25 miles per hour to the satisfaction of the Town. Alternatively, eliminate on-street parking to

allow for the provision of Class II bicycle lanes along the project frontage. Implementation of this measure would reduce the impact to a less-than-significant level.

Parking

The Town Municipal Code (Section 8.76.100) outlines off-street parking requirements for various land uses, including residential uses. For the project site, each dwelling unit must have two covered off-street automobile parking spaces for each parcel. Dwelling units in zones of 3 dwelling units per acre and with less than 45 feet of frontage are also required to have two guest parking spaces that are either open or covered and with adequate turn around space, which includes the ability to back out of a driveway. Parking for each of the homes within the Project site would be provided by an attached, two to three car garage and accompanying driveway. The garages would meet the minimum dimensions for parking spaces as described in the Town Code and the driveways meet the requirements for the guest parking spaces. Parcels with planned ADUs have off-street parking areas that do not block access to the covered garages. There would also be on-street parking throughout the development on both sides of the street. Based on this review, there is sufficient parking provided within the Project site.

Construction Assessment

The assessment of construction activity considers construction vehicles (including vehicles removing or delivering fill material, bulldozers, and other heavy machinery, as well as building materials delivery) and construction worker activity. Based on the project plans, the project would be constructed within the contours of the site and large volumes of import and/or export of fill is not expected. Any truck traffic to the site would follow designated truck routes, and project construction would likely stage any large vehicles (i.e., earth-moving equipment, cranes, etc.) on the site prior to beginning site work and remove these vehicles at project completion. Although the level of vehicle traffic generated by construction vehicles is expected to be low, there could be potential conflicts with other roadway users.

Recommendation: Although transportation construction conflicts would be temporary, development of a construction management plan would reduce the potential for construction vehicle conflicts with other roadway users. The plan should include:

- Project staging plan to maximize on-site storage of materials and equipment

- A set of comprehensive traffic control measures, including scheduling of major truck trips and deliveries to avoid peak hours; lane closure proceedings; signs, cones, and other warning devices for drivers; and designation of construction access routes
- Permitted construction hours
- Location of construction staging
- Identification of parking areas for construction employees, site visitors, and inspectors, including on-site locations
- Provisions for street sweeping to remove construction related debris on public streets

CONCLUSIONS

This section provides a summary of the potential project impacts related to roadway network, bicycles, pedestrians, and transit based on the discussions in previous chapters as compared to the significance criteria outlined previously. **Table 6** summarizes potential impacts and mitigations for each topic area.

TABLE 6
CEQA CHECKLIST REVIEW

Significance Criteria	Discussion	Mitigation
A roadway system impact is considered significant if the project would:		
At unsignalized intersections, the project results in any of the traffic signal warrants included in the *CA Manual on Uniform Traffic Control Devices* (MUTCD) to be satisfied, or for a location where any of the warrants are satisfied prior to the project, the project increases overall travel through the intersection by more than 1 percent.	The intersection of Camino Pablo at Tharp Drive would not satisfy signal warrants with the addition of project traffic.	None required.

TABLE 6
CEQA CHECKLIST REVIEW

Significance Criteria	Discussion	Mitigation
The project creates the potential for excessive vehicle queue spillback that could periodically block or interfere with pedestrian, bicycle or transit facilities.	Vehicle queues at the project entry roadway are expected to be negligible and not block or interfere with pedestrian, bicycle or transit facilities. At other locations not evaluated, the added vehicle trip generation is negligible and would not result in an appreciable difference in intersection operations.	None required.
A pedestrian impact is considered significant if the project would:		
Disrupt existing pedestrian facilities	The project would not eliminate existing pedestrian facilities.	None required.
Interfere with planned pedestrian facilities	The project would construct pedestrian facilities along one side of the roadway within the project site, and provide curb ramps at the intersection with Camino Pablo constructed to meet Town standards.	None required.
Create inconsistencies with adopted pedestrian system plans, guidelines, policies, or standards	Sidewalks within the project and along the project boundary would be constructed to current Town standards.	None required.
A bicycle impact is considered significant if the project would:		
Disrupt existing bicycle facilities	The project does not propose to eliminate existing bicycle facilities in the vicinity of project.	None required.

TABLE 6
CEQA CHECKLIST REVIEW

Significance Criteria	Discussion	Mitigation
Interfere with planned bicycle facilities	Class II bicycle facilities are required along all minor arterial roadways, such as Camino Pablo. There are currently not Class II bicycle facilities provided on the portion of Camino Pablo that fronts the project site. With the designation of Camino Pablo from south of Saunders Ranch Road to its southern terminus to a collector roadway proposed as part of the project, Class II bicycle facilities would not be required along the project frontage. Should the General Plan Amendment to change the designation not be approved, this could result in a significant impact.	None required.
Create inconsistencies with adopted bicycle system plans, guidelines, policies, or standards	See discussion above.	None required.
A transit impact is considered significant if the project would:		
The project interferes with existing transit facilities or precludes the construction of planned transit facilities	Construction of the proposed project would not interfere with existing transit routes, nor would it preclude the provision of future transit routes in the study area.	None required.
Other Transportation Effects		
An impact could occur if the project conflicts or is inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?	This section of the CEQA guidelines relates to the assessment of vehicle miles of travel generated by the project. VMT assessments are not required until after July 1, 2020, and therefore is not required for this project.	None required.

TABLE 6
CEQA CHECKLIST REVIEW

Significance Criteria	Discussion	Mitigation
An impact could occur if the project substantially increases traffic hazards due to a design feature (e.g. sharp curves or dangerous intersections) or incompatible uses.	An increase in hazardous road conditions could occur if the site circulation design does not meet adopted standards. Roadways within the project site would be designed to meet Town of Moraga standards. Additionally, sufficient sight distance is provided at the project roadway connection to Camino Pablo. The designation of Camino Pablo from south of Sanders Ranch to the southern terminus of Camino Pablo as a collector roadway and installation of bicycle route signage and striping on roadway portions that do not already have designated bicycle facilities could result in a traffic hazard as the 85th percentile vehicle speeds on Camino Pablo are in excess of the recommended speeds for bicycle routes (current 85th percentile speed is 35 miles per hour and desired speed on bicycle routes based on FHWA guidance is less than 25 miles per hour). This could create a hazardous condition for bicyclists, resulting in a significant impact **(Impact 1**).	**Mitigation Measure 1:** Implement speed reduction measures on Camino Pablo south of Sanders Ranch Road to the southern terminus to reduce the 85th percentile travel speed to 25 miles per hour to the satisfaction of the Town. Alternatively, eliminate on-street parking to allow for the provision of Class II bicycle lanes along the project frontage. Implementation of this measure would reduce the impact to a less-than-significant level.
Result in inadequate emergency access?	Access to the site would be provided from a new roadway connection to Camino Pablo at Tharp Drive, and all fire code requirements are met in terms of roadway length, number of units, roadway grades and interior sprinkler systems.	None required.

Source: Fehr & Peers, 2020.

This completes our transportation assessment for the Camino Pablo residential development. Please call Kathrin at (925) 930-7100 if you have questions.

Attachments:

Figure 1	Site Vicinity
Figure 2	Conceptual Project Site Plan
Figure 3	Existing Weekday Daily, AM and PM Peak Hour Intersection Turning Movement Volumes and Intersection Lane Configurations/Traffic Control
Figure 4	Existing Plus Project Peak Hour Intersection Turning Movement Volumes
Figure 5	Future Without and With Project Daily and Peak Hour Intersection Turning Movement Volumes
Figure 6	Sight Distance Assessment

Attachment A	Level of Service Analysis Methods
Attachment B	Traffic Count Worksheets
Attachment C	Level of Service Worksheets
Attachment D	Driveway Grade Analysis

Project Site Study Intersection Town of Moraga

Figure 1

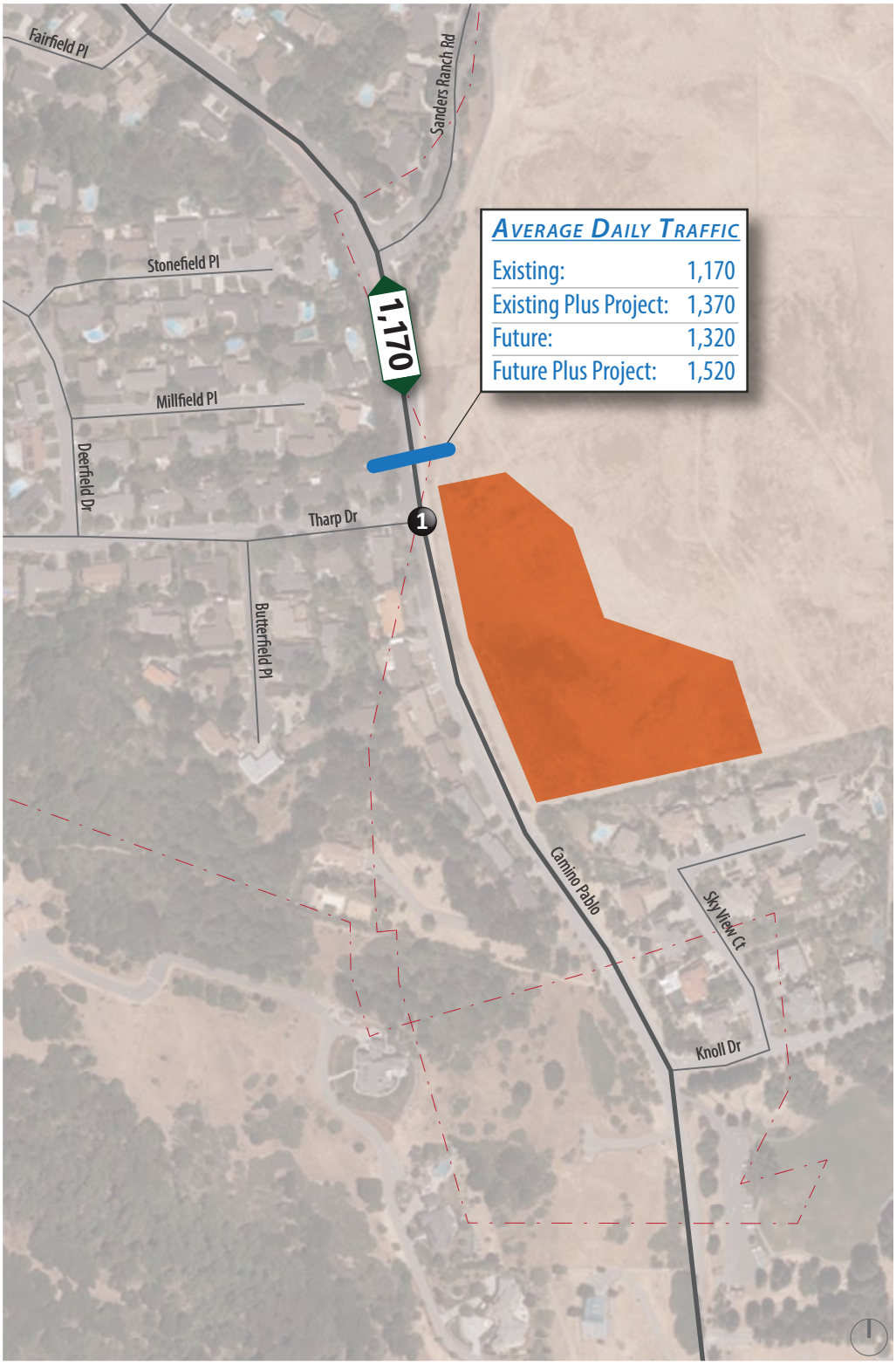
Project Site and Study Intersection Location

WC20-3724_1_StudyArea

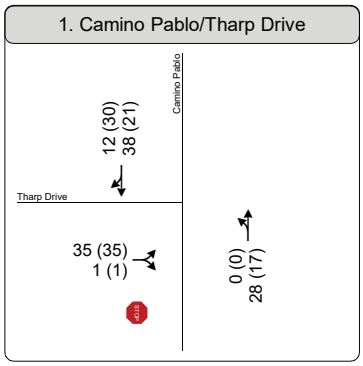
Site Plan Source: Camp & Camp Associates, 11/19/19

Figure 2

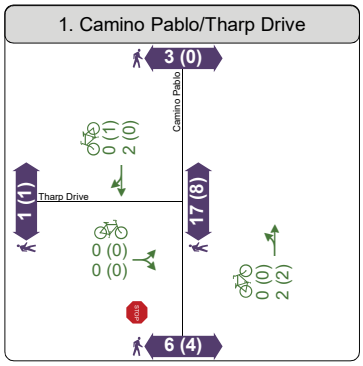
Conceptual Project Site Plan



Vehicle



Pedestrian and Bicycle



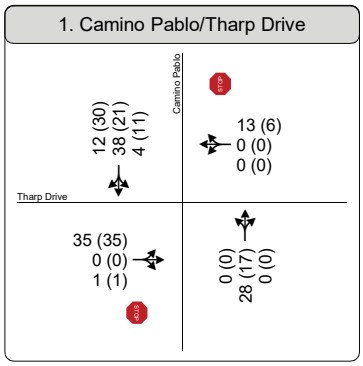
Project Site | # Study Intersection | Town of Moraga | # Daily Traffic Volumes

XX (YY) AM (PM) Peak Hour Traffic Volumes | STOP Study Intersection | x (y) AM (PM) Peak Hour Pedestrian Volumes | x (y) AM (PM) Peak Hour Bicycle Volumes

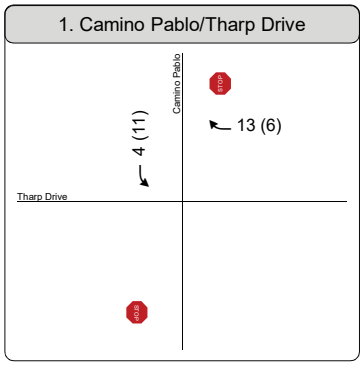
Figure 3

Existing Traffic Volumes, Lane Configuration and Traffic Controls

Existing Plus Project



Project Trip Assignment



Project Site | # Study Intersection | Town of Moraga

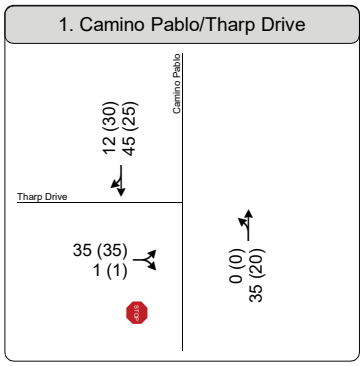
XX (YY) AM (PM) Peak Hour Traffic Volumes | Study Intersection

Figure 4

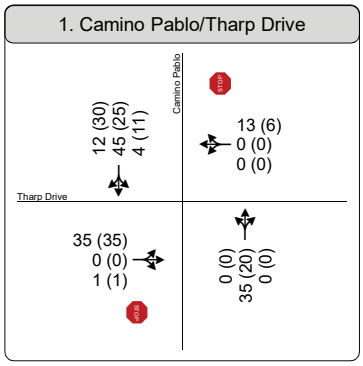
Existing Plus Project
Peak Hour Intersection Traffic Volumes, Lane Configuration and Traffic Controls

WC20-3724_4_Ex+ProjVols

Future



Future Plus Project



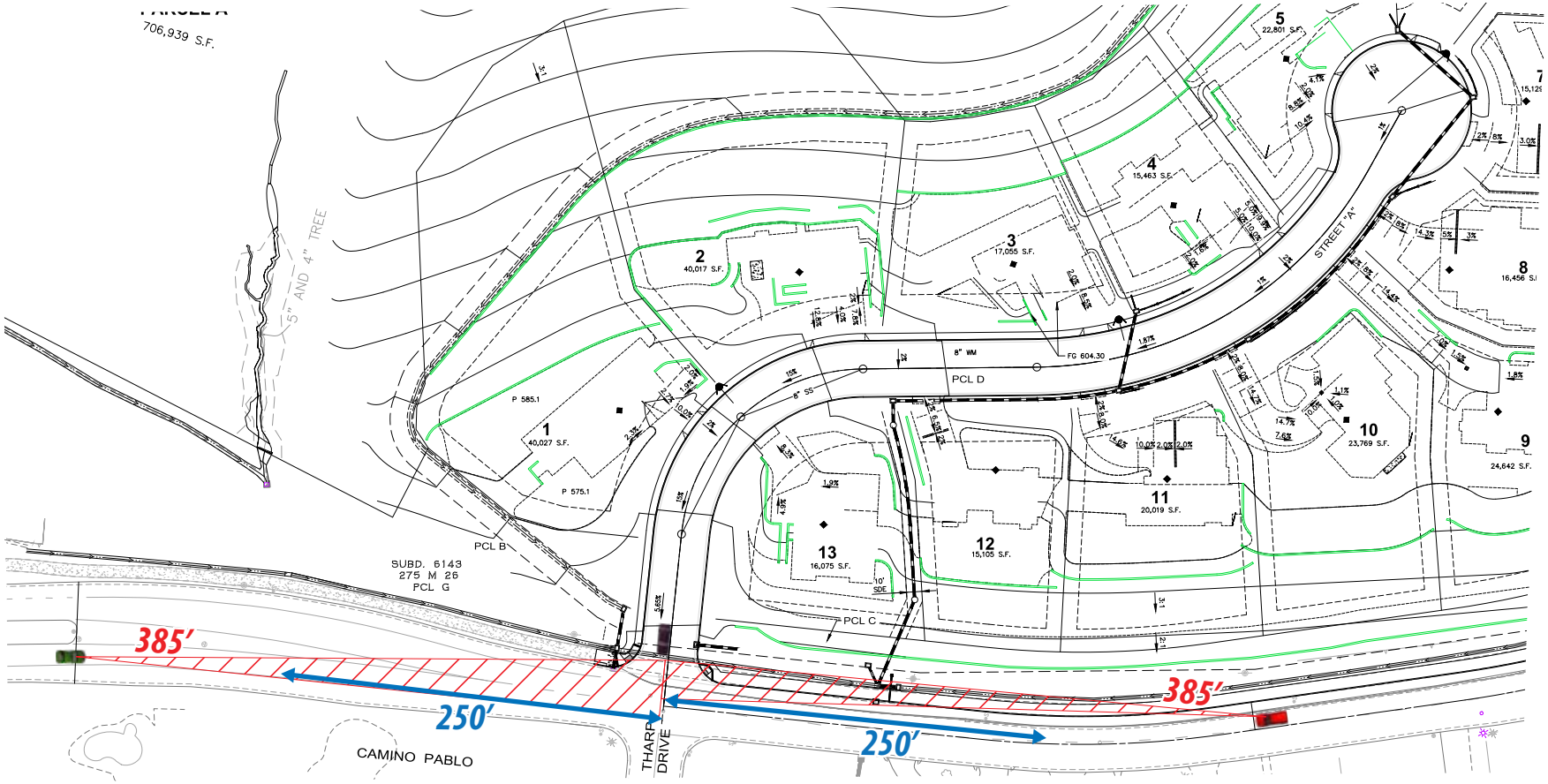
Project Site | # Study Intersection | Town of Moraga

XX (YY) AM (PM) Peak Hour Traffic Volumes | Study Intersection

Figure 5

Future and Future Plus Project
Peak Hour Intersection Traffic Volumes, Lane Configuration and Traffic Controls

WC20-3724_5_FutVols



Required Stopping Sight Distance at 35 mph = 250'

Required Corner Sight Distance at 35 mph = 385'

Figure 6

Sight Distance Assessment

ATTACHMENT A – INTERSECTION ANALYSIS METHODS

The operations of roadway facilities are for vehicles described with the term "level of service" (LOS). LOS is a qualitative description of traffic flow based on factors such as speed, travel time, delay, and freedom to maneuver. Six levels of service are defined ranging from LOS A (i.e., free-flow operating conditions) to LOS F (over capacity operating conditions). LOS E corresponds to operations "at capacity." When volumes exceed capacity, stop-and-go conditions result and operations are designated as LOS F. The Town of Moraga level of service standards are presented in Table 1.

Traffic conditions at unsignalized intersections were evaluated using the method from the 6th Edition *Highway Capacity Manual*. With this method, operations are defined by the average control delay per vehicle (measured in seconds) for each movement that must yield the right-of-way. At two-way or side street-controlled intersections, the control delay (and LOS) is calculated for each controlled movement, as well as the left-turn movement from the major street, and the entire intersection. For controlled approaches composed of a single lane, the control delay is computed as the average of all movements in that lane. The delays for the entire intersection and for the movement or approach with the highest delay are reported. **Table A-1** summarizes the relationship between delay and LOS for unsignalized intersections.

TABLE A-1
UNSIGNALIZED INTERSECTION LOS CRITERIA

Level of Service	Description	Average Control Delay Per Vehicle (Seconds)
A	Little or no delays	≤ 10.0
B	Short traffic delays	> 10.0 to 15.0
C	Average traffic delays	> 15.0 to 25.0
D	Long traffic delays	> 25.0 to 35.0
E	Very long traffic delays	> 35.0 to 50.0
F	Extreme traffic delays with intersection capacity exceeded	> 50.0

Source: *Highway Capacity Manual* (Transportation Research Board, 6th Edition)

ATTACHMENT B – TRAFFIC COUNT WORKSHEETS

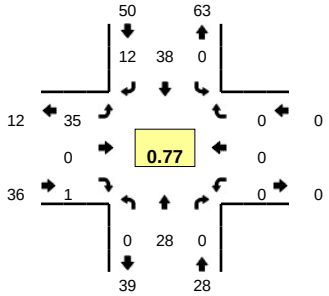
Type of peak hour being reported: Intersection Peak

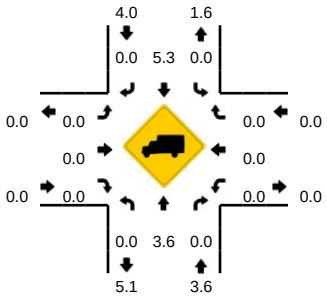
Method for determining peak hour: Total Entering Volume

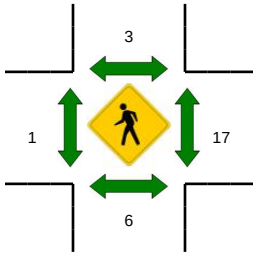
LOCATION: Camino Pablo -- Tharp Dr
CITY/STATE: Moraga, CA

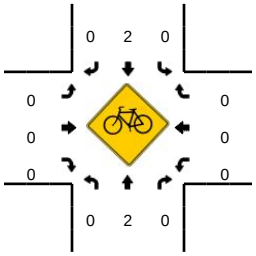
QC JOB #: 13572601
DATE: Tue, Sep 01 2015

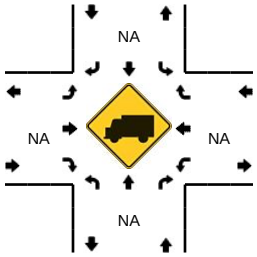
Peak-Hour: 7:50 AM -- 8:50 AM
Peak 15-Min: 8:05 AM -- 8:20 AM

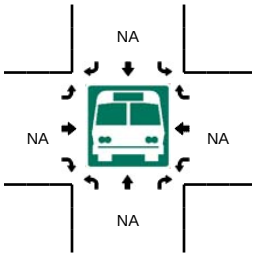












5-Min Count Period Beginning At	Camino Pablo (Northbound)				Camino Pablo (Southbound)				Tharp Dr (Eastbound)				Tharp Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	2	0	0	0	2	0	0	1	0	0	0	0	0	0	0	5	
7:05 AM	0	0	0	0	0	4	1	0	4	0	0	1	0	0	0	0	10	
7:10 AM	0	0	0	0	0	2	2	0	2	0	0	0	0	0	0	0	6	
7:15 AM	0	1	0	0	0	2	1	0	7	0	0	0	0	0	0	0	11	
7:20 AM	0	5	0	0	0	1	0	0	5	0	0	0	0	0	0	0	11	
7:25 AM	0	3	0	0	0	1	0	0	4	0	0	0	0	0	0	0	8	
7:30 AM	0	3	0	0	0	1	2	0	6	0	0	0	0	0	0	0	12	
7:35 AM	0	2	0	0	0	0	0	0	3	0	0	0	0	0	0	0	5	
7:40 AM	0	1	0	0	0	2	1	0	0	0	1	0	0	0	0	0	5	
7:45 AM	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	4	
7:50 AM	0	4	0	0	0	3	0	0	1	0	0	0	0	0	0	0	8	
7:55 AM	0	1	0	0	0	2	1	0	1	0	0	0	0	0	0	0	5	90
8:00 AM	0	2	0	0	0	2	1	0	0	0	0	0	0	0	0	0	5	90
8:05 AM	0	2	0	0	0	5	3	0	4	0	0	0	0	0	0	0	14	94
8:10 AM	0	1	0	0	0	3	2	0	5	0	0	0	0	0	0	0	11	99
8:15 AM	0	2	0	0	0	3	0	0	7	0	0	0	0	0	0	0	12	100
8:20 AM	0	4	0	0	0	4	1	0	4	0	0	0	0	0	0	0	13	102
8:25 AM	0	2	0	0	0	4	3	0	2	0	1	0	0	0	0	0	12	106
8:30 AM	0	1	0	0	0	2	1	0	7	0	0	0	0	0	0	0	11	105
8:35 AM	0	6	0	0	0	3	0	0	2	0	0	0	0	0	0	0	11	111
8:40 AM	0	3	0	0	0	1	0	0	1	0	0	0	0	0	0	0	5	111
8:45 AM	0	0	0	0	0	6	0	0	1	0	0	0	0	0	0	0	7	114
8:50 AM	0	2	0	0	0	1	1	0	0	0	0	0	0	0	0	0	4	110
8:55 AM	0	6	0	0	0	0	1	0	0	0	0	0	0	0	0	0	7	112

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	20	0	0	0	44	20	0	64	0	0	0	0	0	0	0	148
Heavy Trucks	0	0	0		0	0	0		0	0	0		0	0	0		0
Pedestrians		4				0				0				16			20
Bicycles	0	0	0		0	1	0		0	0	0		0	0	0		1
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/8/2015 4:27 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

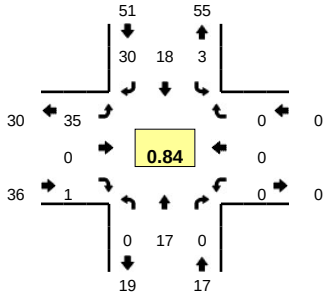
Type of peak hour being reported: Intersection Peak

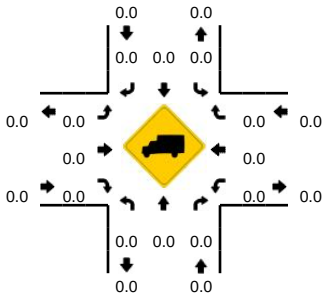
Method for determining peak hour: Total Entering Volume

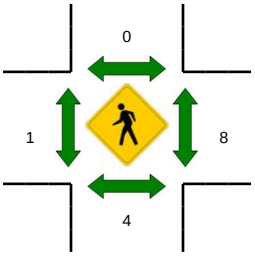
LOCATION: Camino Pablo -- Tharp Dr
CITY/STATE: Moraga, CA

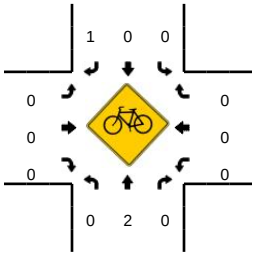
QC JOB #: 13572602
DATE: Tue, Sep 01 2015

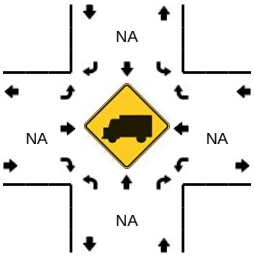
Peak-Hour: 5:00 PM -- 6:00 PM
Peak 15-Min: 5:35 PM -- 5:50 PM

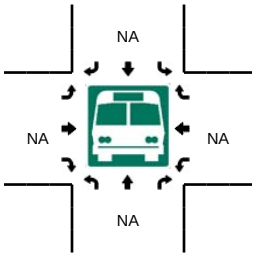












5-Min Count Period Beginning At	Camino Pablo (Northbound)				Camino Pablo (Southbound)				Tharp Dr (Eastbound)				Tharp Dr (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	0	1	0	0	0	2	0	0	1	0	0	0	0	0	0	0	4	
4:05 PM	0	0	0	0	0	1	3	0	2	0	0	0	0	0	0	0	6	
4:10 PM	0	2	0	0	0	1	0	0	1	0	0	0	0	0	0	0	4	
4:15 PM	0	1	0	0	0	2	9	0	1	0	0	0	0	0	0	0	13	
4:20 PM	0	0	0	0	0	0	3	0	2	0	1	0	0	0	0	0	6	
4:25 PM	0	0	0	0	0	3	0	0	2	0	1	0	0	0	0	0	6	
4:30 PM	0	0	0	0	0	2	1	0	0	0	0	0	0	0	0	0	3	
4:35 PM	0	1	0	0	0	0	3	0	0	0	0	0	0	0	0	0	4	
4:40 PM	0	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	
4:45 PM	1	2	0	0	0	2	1	0	0	0	0	0	0	0	0	0	6	
4:50 PM	0	1	0	0	0	1	2	0	0	0	0	0	0	0	0	0	4	
4:55 PM	0	0	0	0	0	3	1	0	1	0	0	0	0	0	0	0	5	64
5:00 PM	0	2	0	0	0	2	2	0	3	0	0	0	0	0	0	0	9	69
5:05 PM	0	2	0	0	0	0	2	0	2	0	0	0	0	0	0	0	6	69
5:10 PM	0	1	0	0	0	3	2	0	2	0	0	0	0	0	0	0	8	73
5:15 PM	0	0	0	0	0	0	2	0	1	0	0	0	0	0	0	0	3	63
5:20 PM	0	0	0	0	0	2	2	0	6	0	0	0	0	0	0	0	10	67
5:25 PM	0	1	0	0	0	1	2	0	6	0	0	0	0	0	0	0	10	71
5:30 PM	0	0	0	0	0	2	3	0	4	0	1	0	0	0	0	0	10	78
5:35 PM	0	2	0	0	0	0	1	0	5	0	0	0	0	0	0	0	8	82
5:40 PM	0	4	0	0	0	1	2	3	2	0	0	0	0	0	0	0	12	91
5:45 PM	0	1	0	0	0	4	3	0	3	0	0	0	0	0	0	0	11	96
5:50 PM	0	2	0	0	0	2	3	0	0	0	0	0	0	0	0	0	7	99
5:55 PM	0	2	0	0	0	1	6	0	1	0	0	0	0	0	0	0	10	104

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	28	0	0	0	20	24	12	40	0	0	0	0	0	0	0	124
Heavy Trucks	0	0	0		0	0	0		0	0	0		0	0	0		0
Pedestrians		8				0				0				20			28
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Railroad																	
Stopped Buses																	

Comments:

Report generated on 9/8/2015 4:27 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: NB
DATE: Sep 01 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
1:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
2:00 AM	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	31-40	1
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
4:00 AM	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	31-40	2
5:00 AM	0	0	1	5	1	1	0	0	0	0	0	0	0	0	8	21-30	6
6:00 AM	0	0	4	10	3	2	0	1	0	0	0	0	0	0	20	21-30	14
7:00 AM	0	**2**	5	27	17	4	1	0	0	0	0	0	0	0	56	26-35	44
8:00 AM	**1**	0	6	**29**	**24**	3	1	0	0	0	0	0	0	0	**64**	26-35	52
9:00 AM	0	0	4	13	21	**9**	**2**	**2**	0	0	0	0	0	0	51	26-35	34
10:00 AM	0	0	**8**	13	9	4	2	0	0	0	0	0	0	0	36	26-35	21
11:00 AM	0	0	4	10	14	2	0	0	0	0	0	0	0	0	30	26-35	23
12:00 PM	0	0	4	13	6	**5**	**3**	0	0	0	0	0	0	0	31	26-35	19
1:00 PM	**1**	0	2	19	10	0	0	0	0	0	0	0	0	0	32	26-35	29
2:00 PM	1	0	6	11	10	3	0	0	0	0	0	0	0	0	31	26-35	21
3:00 PM	0	**3**	8	19	10	3	1	0	0	0	0	0	0	0	44	26-35	29
4:00 PM	0	0	6	10	3	2	0	0	0	0	0	0	0	0	21	21-30	16
5:00 PM	1	0	**10**	**21**	14	4	3	0	0	0	0	0	0	0	**53**	26-35	34
6:00 PM	1	0	5	12	**17**	1	0	0	0	0	0	0	0	0	36	26-35	28
7:00 PM	0	0	7	19	11	2	0	0	0	0	0	0	0	0	39	26-35	30
8:00 PM	0	0	8	13	4	0	1	0	0	0	0	0	0	0	26	21-30	21
9:00 PM	0	0	1	1	1	1	0	0	0	0	0	0	0	0	4	31-40	2
10:00 PM	0	0	3	0	0	0	1	0	0	0	0	0	0	0	4	16-25	3
11:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
Day Total	5	5	92	245	176	48	15	3	0	0	0	0	0	0	589	26-35	421
Percent	0.8%	0.8%	15.6%	41.6%	29.9%	8.1%	2.5%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

ADT
589

AM Peak Volume	8:00 AM 1	7:00 AM 2	10:00 AM 8	8:00 AM 29	8:00 AM 24	9:00 AM 9	9:00 AM 2	9:00 AM 2			8:00 AM 64
PM Peak Volume	1:00 PM 1	3:00 PM 3	5:00 PM 10	5:00 PM 21	6:00 PM 17	12:00 PM 5	12:00 PM 3				5:00 PM 53

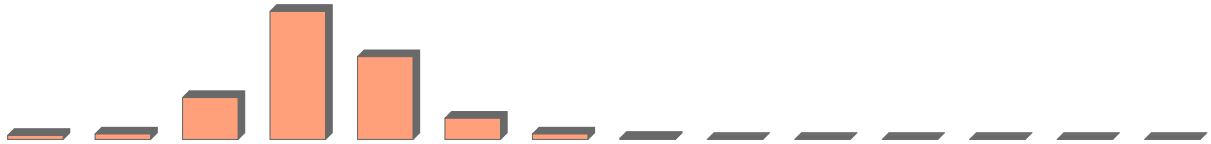
Comments:

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: NB
DATE: Sep 02 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	0	0	1	1	0	0	0	0	0	0	0	0	0	0	2	21-30	2
1:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
2:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
3:00 AM	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	26-35	2
4:00 AM	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	26-35	2
5:00 AM	0	0	0	2	1	1	0	0	0	0	0	0	0	0	4	26-35	3
6:00 AM	0	0	1	7	6	1	0	0	0	0	0	0	0	0	15	26-35	12
7:00 AM	1	1	8	**30**	**19**	**5**	0	0	0	0	0	0	0	0	**64**	26-35	48
8:00 AM	0	**2**	**14**	29	15	3	0	**1**	0	0	0	0	0	0	64	26-35	44
9:00 AM	**2**	1	5	14	9	3	0	0	0	0	0	0	0	0	34	26-35	22
10:00 AM	0	2	7	16	8	4	**2**	0	0	0	0	0	0	0	39	26-35	24
11:00 AM	0	2	5	15	9	3	1	0	0	0	0	0	0	0	35	26-35	23
12:00 PM	**1**	0	3	14	10	5	**1**	0	0	0	0	0	0	0	34	26-35	24
1:00 PM	0	0	5	19	11	0	1	0	0	0	0	0	0	0	36	26-35	30
2:00 PM	0	0	4	18	11	2	1	0	0	0	0	0	0	0	36	26-35	29
3:00 PM	1	**1**	7	16	13	1	1	**1**	0	0	0	0	0	0	41	26-35	29
4:00 PM	1	0	3	13	7	3	1	0	0	0	0	0	0	0	28	26-35	19
5:00 PM	0	0	5	14	**17**	2	1	0	0	0	0	0	0	0	39	26-35	30
6:00 PM	1	1	3	20	17	**6**	0	0	0	0	0	0	0	0	**48**	26-35	37
7:00 PM	1	1	**9**	**22**	9	2	1	0	0	0	0	0	0	0	45	26-35	30
8:00 PM	0	0	4	3	2	0	0	0	0	0	0	0	0	0	9	23-32	6
9:00 PM	0	0	1	1	1	1	1	0	0	0	0	0	0	0	5	36-45	2
10:00 PM	0	0	0	4	0	0	0	0	0	0	0	0	0	0	4	21-30	4
11:00 PM	0	0	0	0	1	1	0	0	0	0	0	0	0	0	2	31-40	2
Day Total	8	11	85	260	168	43	11	2	0	0	0	0	0	0	588	26-35	428
Percent	1.4%	1.9%	14.5%	44.2%	28.6%	7.3%	1.9%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

ADT
588



AM Peak Volume	9:00 AM 2	8:00 AM 2	8:00 AM 14	7:00 AM 30	7:00 AM 19	7:00 AM 5	10:00 AM 2	8:00 AM 1		7:00 AM 64	
PM Peak Volume	12:00 PM 1	3:00 PM 1	7:00 PM 9	7:00 PM 22	5:00 PM 17	6:00 PM 6	12:00 PM 1	3:00 PM 1		6:00 PM 48	

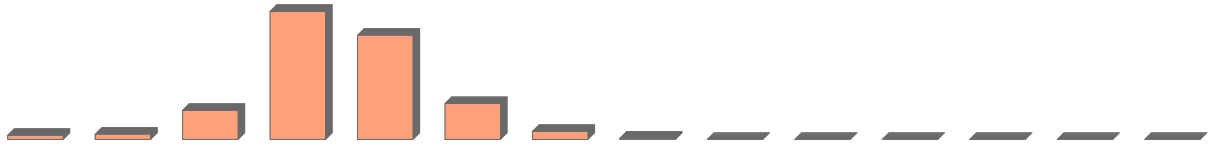
Comments:

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: NB
DATE: Sep 03 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
1:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
2:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
4:00 AM	0	0	0	1	2	0	0	0	0	0	0	0	0	0	3	26-35	3
5:00 AM	0	0	1	3	3	1	0	0	0	0	0	0	0	0	8	28-37	5
6:00 AM	**1**	0	2	5	5	2	1	0	0	0	0	0	0	0	16	26-35	10
7:00 AM	1	1	**4**	**27**	**21**	5	0	0	0	0	0	0	0	0	**59**	26-35	48
8:00 AM	0	1	4	24	20	**7**	**2**	**1**	0	0	0	0	0	0	59	26-35	44
9:00 AM	1	0	2	17	20	7	0	1	0	0	0	0	0	0	48	26-35	37
10:00 AM	1	0	3	7	8	3	1	0	0	0	0	0	0	0	23	26-35	15
11:00 AM	0	**2**	2	16	6	1	1	0	0	0	0	0	0	0	28	26-35	22
12:00 PM	0	0	2	14	9	5	0	0	0	0	0	0	0	0	30	26-35	22
1:00 PM	**1**	**1**	4	12	10	**7**	**2**	0	0	0	0	0	0	0	37	26-35	22
2:00 PM	0	0	2	13	11	4	1	0	0	0	0	0	0	0	31	26-35	24
3:00 PM	0	0	**8**	**21**	11	1	2	0	0	0	0	0	0	0	43	26-35	32
4:00 PM	0	1	6	10	11	6	0	0	0	0	0	0	0	0	34	26-35	21
5:00 PM	1	0	0	10	12	2	1	0	0	0	0	0	0	0	26	26-35	21
6:00 PM	1	1	4	20	10	6	2	0	0	0	0	0	0	0	**44**	26-35	30
7:00 PM	0	1	5	13	**13**	5	0	0	0	0	0	0	0	0	37	26-35	26
8:00 PM	0	1	2	8	5	1	0	0	0	0	0	0	0	0	17	26-35	13
9:00 PM	0	0	0	2	3	0	1	0	0	0	0	0	0	0	6	28-37	4
10:00 PM	0	0	0	1	2	0	0	0	0	0	0	0	0	0	3	26-35	3
11:00 PM	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	26-35	2
Day Total	7	9	51	225	183	63	14	2	0	0	0	0	0	0	554	26-35	408
Percent	1.3%	1.6%	9.2%	40.6%	33.0%	11.4%	2.5%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			

ADT
554



AM Peak Volume	6:00 AM 1	11:00 AM 2	7:00 AM 4	7:00 AM 27	7:00 AM 21	8:00 AM 7	8:00 AM 2	8:00 AM 1		7:00 AM 59	
PM Peak Volume	1:00 PM 1	1:00 PM 1	3:00 PM 8	3:00 PM 21	7:00 PM 13	1:00 PM 7	1:00 PM 2			6:00 PM 44	

Comments:

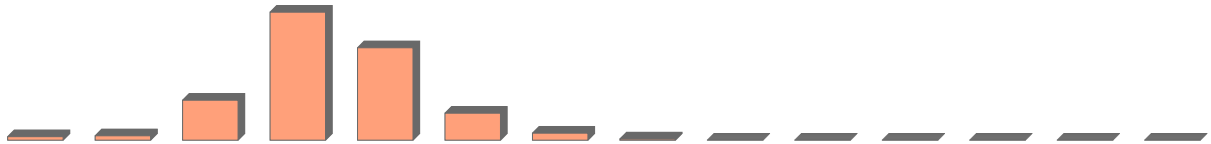
SUMMARY - Tube Count - Speed Data

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: NB
DATE: Sep 01 2015 - Sep 03 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
Grand Total	20	25	228	730	527	154	40	7	0	0	0	0	0	0	1731	26-35	1257
Percent	1.2%	1.4%	13.2%	42.2%	30.4%	8.9%	2.3%	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%			
Cumulative Percent	1.2%	2.6%	15.8%	57.9%	88.4%	97.3%	99.6%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%			

ADT
577



85th Percentile 34 MPH

Mean Speed(Average) 29 MPH

Median 29 MPH
Mode: 28 MPH

Comments:

Report generated on 9/8/2015 4:29 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: NB
DATE: Sep 01 2015 - Sep 03 2015

Start Time	Mon	Tue 01-Sep-15	Wed 02-Sep-15	Thu 03-Sep-15	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		0	2	0		1			1	
1:00 AM		0	0	0		0			0	
2:00 AM		1	0	0		0			0	
3:00 AM		0	2	0		1			1	
4:00 AM		2	2	3		2			2	
5:00 AM		8	4	8		7			7	
6:00 AM		20	15	16		17			17	
7:00 AM		56	**64**	**59**		60			60	
8:00 AM		**64**	64	59		**62**			**62**	
9:00 AM		51	34	48		44			44	
10:00 AM		36	39	23		33			33	
11:00 AM		30	35	28		31			31	
12:00 PM		31	34	30		32			32	
1:00 PM		32	36	37		35			35	
2:00 PM		31	36	31		33			33	
3:00 PM		44	41	43		**43**			**43**	
4:00 PM		21	28	34		28			28	
5:00 PM		**53**	39	26		39			39	
6:00 PM		36	**48**	**44**		43			43	
7:00 PM		39	45	37		40			40	
8:00 PM		26	9	17		17			17	
9:00 PM		4	5	6		5			5	
10:00 PM		4	4	3		4			4	
11:00 PM		0	2	2		1			1	
Day Total		589	588	554		578			578	
% Weekday Average		101.9%	101.7%	95.8%						
% Week Average		101.9%	101.7%	95.8%		100.0%				
AM Peak Volume		8:00 AM 64	7:00 AM 64	7:00 AM 59		8:00 AM 62			8:00 AM 62	
PM Peak Volume		5:00 PM 53	6:00 PM 48	6:00 PM 44		3:00 PM 43			3:00 PM 43	

Comments:

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

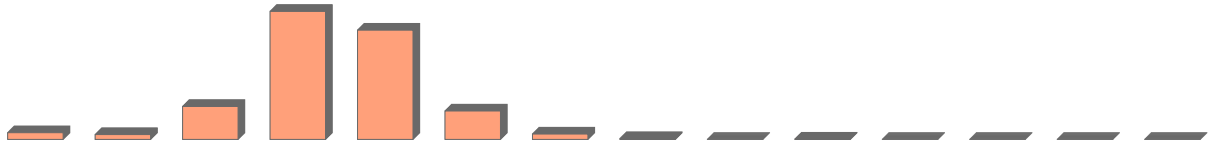
QC JOB #: 13572603
DIRECTION: NB/SB
DATE: Sep 01 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	26-35	2
1:00 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	21-30	1
2:00 AM	1	0	0	0	0	1	0	0	0	0	0	0	0	0	2	31-40	1
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
4:00 AM	0	0	0	1	1	2	0	0	0	0	0	0	0	0	4	31-40	3
5:00 AM	0	0	1	5	2	1	0	0	0	0	0	0	0	0	9	26-35	7
6:00 AM	0	0	6	14	5	3	0	1	0	0	0	0	0	0	29	21-30	20
7:00 AM	0	**3**	**8**	35	29	9	2	0	0	0	0	0	0	0	86	26-35	63
8:00 AM	1	0	7	**52**	**43**	9	1	0	0	**1**	0	0	0	0	**114**	26-35	94
9:00 AM	**2**	0	6	21	39	**12**	2	**2**	0	0	0	0	0	0	84	26-35	59
10:00 AM	0	0	8	22	20	8	**3**	0	0	0	0	0	0	0	61	26-35	42
11:00 AM	0	0	6	19	26	5	1	0	0	0	0	0	0	0	57	26-35	45
12:00 PM	2	0	5	27	13	10	3	0	0	0	0	0	0	0	60	26-35	39
1:00 PM	1	0	8	24	15	6	1	0	0	0	0	0	0	0	55	26-35	39
2:00 PM	1	0	7	21	33	**12**	1	**1**	0	0	0	0	0	0	76	26-35	53
3:00 PM	**4**	**4**	10	39	20	6	2	1	0	0	**1**	0	0	0	87	26-35	59
4:00 PM	2	1	10	25	18	7	1	0	0	0	0	0	0	0	64	26-35	42
5:00 PM	4	0	**14**	40	36	9	3	0	0	0	0	0	0	0	106	26-35	76
6:00 PM	3	2	9	**45**	**54**	10	2	0	0	0	0	0	0	0	**125**	26-35	99
7:00 PM	0	0	11	31	25	5	0	0	0	0	0	0	0	0	72	26-35	56
8:00 PM	0	0	10	19	9	4	**4**	0	0	**1**	0	0	0	0	47	25-34	28
9:00 PM	0	0	1	5	7	1	0	0	0	0	0	0	0	0	14	27-36	11
10:00 PM	0	0	3	4	2	2	1	0	0	0	0	0	0	0	12	21-30	7
11:00 PM	1	1	1	0	4	0	0	0	0	0	0	0	0	0	7	26-35	4
Day Total	22	11	131	450	403	122	27	5	0	2	1	0	0	0	1174	26-35	852
Percent	1.9%	0.9%	11.2%	38.3%	34.3%	10.4%	2.3%	0.4%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%			
ADT 1174																	
AM Peak Volume	9:00 AM 2	7:00 AM 3	7:00 AM 8	8:00 AM 52	8:00 AM 43	9:00 AM 12	10:00 AM 3	9:00 AM 2		8:00 AM 1					8:00 AM 114		
PM Peak Volume	3:00 PM 4	3:00 PM 4	5:00 PM 14	6:00 PM 45	6:00 PM 54	2:00 PM 12	8:00 PM 4	2:00 PM 1		8:00 PM 1	3:00 PM 1				6:00 PM 125		

Comments:

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: NB/SB
DATE: Sep 02 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	0	0	1	2	1	0	0	0	0	0	0	0	0	0	4	26-35	3
1:00 AM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	26-35	1
2:00 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	21-30	1
3:00 AM	0	0	0	1	2	0	0	0	0	0	0	0	0	0	3	26-35	3
4:00 AM	0	0	0	1	2	0	0	0	0	0	0	0	0	0	3	26-35	3
5:00 AM	0	0	0	2	1	1	0	0	0	0	0	0	0	0	4	26-35	3
6:00 AM	0	0	3	8	9	3	0	0	0	0	0	0	0	0	23	26-35	17
7:00 AM	1	1	11	38	33	6	0	0	0	0	0	0	0	0	90	26-35	70
8:00 AM	2	3	**21**	**59**	**34**	4	0	**1**	0	0	0	0	0	0	**124**	26-35	93
9:00 AM	**3**	**4**	6	21	23	4	1	0	0	0	0	0	0	0	62	26-35	43
10:00 AM	0	2	12	27	15	5	**2**	0	0	0	0	0	0	0	63	26-35	42
11:00 AM	0	2	8	22	19	**7**	1	0	0	0	0	0	0	0	59	26-35	40
12:00 PM	**5**	0	5	26	24	7	1	0	0	0	0	0	0	0	68	26-35	49
1:00 PM	2	1	6	38	23	4	1	0	0	0	0	0	0	0	75	26-35	60
2:00 PM	0	1	4	33	35	9	2	**1**	0	**1**	0	0	0	0	86	26-35	68
3:00 PM	2	1	9	27	29	6	1	1	0	0	0	0	0	0	76	26-35	55
4:00 PM	1	0	3	33	17	9	2	0	0	0	0	0	0	0	65	26-35	50
5:00 PM	1	0	5	31	39	10	**3**	0	0	0	0	0	0	0	89	26-35	70
6:00 PM	4	**2**	7	**39**	**56**	**17**	1	0	0	0	0	0	0	0	**126**	26-35	94
7:00 PM	3	1	**12**	36	22	4	2	0	0	0	0	0	0	0	80	26-35	58
8:00 PM	1	0	5	18	11	6	1	0	0	0	0	0	0	0	42	26-35	29
9:00 PM	0	0	4	8	8	3	1	0	0	0	0	0	0	0	24	26-35	16
10:00 PM	0	0	1	6	2	0	0	0	0	0	0	0	0	0	9	26-35	8
11:00 PM	0	0	0	1	2	1	1	0	0	0	0	0	0	0	5	31-40	3
Day Total	25	18	123	478	408	106	20	3	0	1	0	0	0	0	1182	26-35	885
Percent	2.1%	1.5%	10.4%	40.4%	34.5%	9.0%	1.7%	0.3%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%			
ADT 1182																	
AM Peak Volume	9:00 AM 3	9:00 AM 4	8:00 AM 21	8:00 AM 59	8:00 AM 34	11:00 AM 7	10:00 AM 2	8:00 AM 1							8:00 AM 124		
PM Peak Volume	12:00 PM 5	6:00 PM 2	7:00 PM 12	6:00 PM 39	6:00 PM 56	6:00 PM 17	5:00 PM 3	2:00 PM 1		2:00 PM 1					6:00 PM 126		

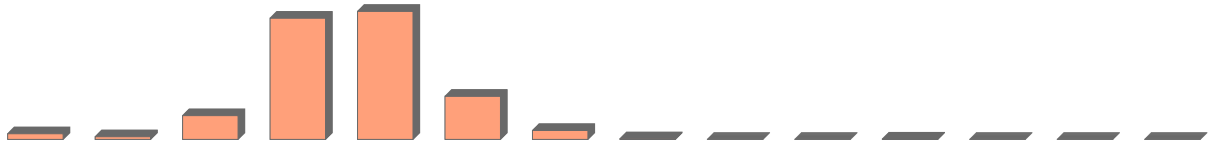
Comments:

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: NB/SB
DATE: Sep 03 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	1	0	0	1	1	0	0	0	0	0	0	0	0	0	3	26-35	2
1:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
2:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
4:00 AM	0	0	0	2	2	1	0	0	0	0	0	0	0	0	5	26-35	4
5:00 AM	0	0	1	3	3	1	0	0	0	0	0	0	0	0	8	28-37	5
6:00 AM	1	0	3	8	9	5	2	0	0	0	0	0	0	0	28	26-35	17
7:00 AM	1	1	5	36	36	8	0	0	0	0	0	0	0	0	87	26-35	72
8:00 AM	0	1	**6**	**43**	**43**	**13**	3	**1**	0	0	0	0	0	0	**110**	26-35	85
9:00 AM	1	0	3	21	29	13	1	1	0	0	0	0	0	0	69	26-35	49
10:00 AM	**2**	0	3	14	19	3	1	0	0	0	0	0	0	0	42	26-35	32
11:00 AM	0	**2**	4	23	16	3	**4**	0	0	0	0	0	0	0	52	26-35	39
12:00 PM	1	0	3	31	22	13	0	0	0	0	0	0	0	0	70	26-35	53
1:00 PM	**3**	**1**	5	23	16	10	3	0	0	0	0	0	0	0	61	26-35	39
2:00 PM	1	0	4	21	28	10	**5**	0	0	0	0	0	0	0	69	26-35	48
3:00 PM	1	0	**10**	**38**	35	8	2	0	0	0	0	0	0	0	94	26-35	73
4:00 PM	1	1	10	23	27	**16**	1	0	0	0	0	0	0	0	79	26-35	50
5:00 PM	1	0	1	24	36	12	1	0	0	0	0	0	0	0	75	26-35	60
6:00 PM	3	1	7	38	**46**	13	4	0	0	0	**1**	0	0	0	**113**	26-35	83
7:00 PM	1	1	6	26	21	10	1	0	0	0	0	0	0	0	66	26-35	47
8:00 PM	0	1	8	21	18	3	1	0	0	0	0	0	0	0	52	26-35	39
9:00 PM	1	0	0	6	14	3	1	0	0	0	0	0	0	0	25	26-35	20
10:00 PM	0	0	1	4	4	0	0	0	0	0	0	0	0	0	9	26-35	8
11:00 PM	0	0	0	2	6	0	0	0	0	0	0	0	0	0	8	26-35	8
Day Total	19	9	80	408	431	145	30	2	0	0	1	0	0	0	1125	26-35	839
Percent	1.7%	0.8%	7.1%	36.3%	38.3%	12.9%	2.7%	0.2%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%			

ADT
1125



AM Peak Volume	10:00 AM 2	11:00 AM 2	8:00 AM 6	8:00 AM 43	8:00 AM 43	8:00 AM 13	11:00 AM 4	8:00 AM 1							8:00 AM 110		
PM Peak Volume	1:00 PM 3	1:00 PM 1	3:00 PM 10	3:00 PM 38	6:00 PM 46	4:00 PM 16	2:00 PM 5				6:00 PM 1				6:00 PM 113		

Comments:

SUMMARY - Tube Count - Speed Data

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: NB/SB
DATE: Sep 01 2015 - Sep 03 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
Grand Total	66	38	334	1336	1242	373	77	10	0	3	2	0	0	0	3481	26-35	2577
Percent	1.9%	1.1%	9.6%	38.4%	35.7%	10.7%	2.2%	0.3%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%			
Cumulative Percent	1.9%	3.0%	12.6%	51.0%	86.6%	97.4%	99.6%	99.9%	99.9%	99.9%	100.0%	100.0%	100.0%	100.0%			

ADT
1160

85th Percentile 34 MPH

Mean Speed(Average) 29 MPH

Median 29 MPH
Mode: 28 MPH

Comments:

Report generated on 9/8/2015 4:29 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: NB/SB
DATE: Sep 01 2015 - Sep 03 2015

Start Time	Mon	Tue 01-Sep-15	Wed 02-Sep-15	Thu 03-Sep-15	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		2	4	3		3			3	
1:00 AM		1	1	0		1			1	
2:00 AM		2	1	0		1			1	
3:00 AM		0	3	0		1			1	
4:00 AM		4	3	5		4			4	
5:00 AM		9	4	8		7			7	
6:00 AM		29	23	28		27			27	
7:00 AM		86	90	87		88			88	
8:00 AM		**114**	**124**	**110**		**116**			**116**	
9:00 AM		84	62	69		72			72	
10:00 AM		61	63	42		55			55	
11:00 AM		57	59	52		56			56	
12:00 PM		60	68	70		66			66	
1:00 PM		55	75	61		64			64	
2:00 PM		76	86	69		77			77	
3:00 PM		87	76	94		86			86	
4:00 PM		64	65	79		69			69	
5:00 PM		106	89	75		90			90	
6:00 PM		**125**	**126**	**113**		**121**			**121**	
7:00 PM		72	80	66		73			73	
8:00 PM		47	42	52		47			47	
9:00 PM		14	24	25		21			21	
10:00 PM		12	9	9		10			10	
11:00 PM		7	5	8		7			7	
Day Total		1174	1182	1125		1162			1162	
% Weekday Average		101.0%	101.7%	96.8%						
% Week Average		101.0%	101.7%	96.8%		100.0%				
AM Peak Volume		8:00 AM 114	8:00 AM 124	8:00 AM 110		8:00 AM 116			8:00 AM 116	
PM Peak Volume		6:00 PM 125	6:00 PM 126	6:00 PM 113		6:00 PM 121			6:00 PM 121	

Comments:

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: SB
DATE: Sep 01 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	0	0	0	0	2	0	0	0	0	0	0	0	0	0	2	26-35	2
1:00 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	21-30	1
2:00 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	15-24	0
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
4:00 AM	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2	21-30	1
5:00 AM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	26-35	1
6:00 AM	0	0	2	4	2	1	0	0	0	0	0	0	0	0	9	26-35	6
7:00 AM	0	**1**	**3**	8	12	5	**1**	0	0	0	0	0	0	0	30	27-36	19
8:00 AM	0	0	1	**23**	**19**	**6**	0	0	0	**1**	0	0	0	0	**50**	26-35	41
9:00 AM	**2**	0	2	8	18	3	0	0	0	0	0	0	0	0	33	26-35	26
10:00 AM	0	0	0	9	11	4	1	0	0	0	0	0	0	0	25	26-35	20
11:00 AM	0	0	2	9	12	3	1	0	0	0	0	0	0	0	27	26-35	20
12:00 PM	2	0	1	14	7	5	0	0	0	0	0	0	0	0	29	26-35	20
1:00 PM	0	0	**6**	5	5	6	1	0	0	0	0	0	0	0	23	21-30	11
2:00 PM	0	0	1	10	23	**9**	1	**1**	0	0	0	0	0	0	45	26-35	33
3:00 PM	**4**	1	2	20	10	3	1	1	0	0	**1**	0	0	0	43	26-35	30
4:00 PM	2	1	4	15	15	5	1	0	0	0	0	0	0	0	43	26-35	30
5:00 PM	3	0	4	19	22	5	0	0	0	0	0	0	0	0	53	26-35	41
6:00 PM	2	**2**	4	**33**	**37**	9	2	0	0	0	0	0	0	0	**89**	26-35	70
7:00 PM	0	0	4	12	14	3	0	0	0	0	0	0	0	0	33	26-35	25
8:00 PM	0	0	2	6	5	4	**3**	0	0	**1**	0	0	0	0	21	26-35	11
9:00 PM	0	0	0	4	6	0	0	0	0	0	0	0	0	0	10	27-36	9
10:00 PM	0	0	0	4	2	2	0	0	0	0	0	0	0	0	8	26-35	6
11:00 PM	1	1	1	0	4	0	0	0	0	0	0	0	0	0	7	26-35	4
Day Total	17	6	39	205	227	74	12	2	0	2	1	0	0	0	585	26-35	431
Percent	2.9%	1.0%	6.7%	35.0%	38.8%	12.6%	2.1%	0.3%	0.0%	0.3%	0.2%	0.0%	0.0%	0.0%			
ADT 585																	
AM Peak Volume	9:00 AM 2	7:00 AM 1	7:00 AM 3	8:00 AM 23	8:00 AM 19	8:00 AM 6	7:00 AM 1			8:00 AM 1					8:00 AM 50		
PM Peak Volume	3:00 PM 4	6:00 PM 2	1:00 PM 6	6:00 PM 33	6:00 PM 37	2:00 PM 9	8:00 PM 3	2:00 PM 1		8:00 PM 1	3:00 PM 1				6:00 PM 89		

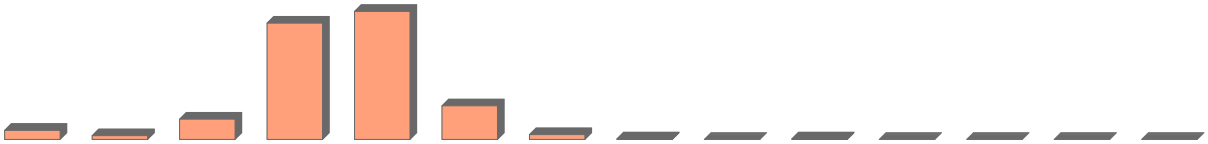
Comments:

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: SB
DATE: Sep 02 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	0	0	0	1	1	0	0	0	0	0	0	0	0	0	2	26-35	2
1:00 AM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	26-35	1
2:00 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	21-30	1
3:00 AM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	26-35	1
4:00 AM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	26-35	1
5:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
6:00 AM	0	0	2	1	3	2	0	0	0	0	0	0	0	0	8	31-40	5
7:00 AM	0	0	3	8	14	1	0	0	0	0	0	0	0	0	26	26-35	21
8:00 AM	**2**	1	**7**	**30**	**19**	1	0	0	0	0	0	0	0	0	**60**	26-35	48
9:00 AM	1	**3**	1	7	14	1	**1**	0	0	0	0	0	0	0	28	26-35	21
10:00 AM	0	0	5	11	7	1	0	0	0	0	0	0	0	0	24	26-35	17
11:00 AM	0	0	3	7	10	**4**	0	0	0	0	0	0	0	0	24	26-35	17
12:00 PM	**4**	0	2	12	14	2	0	0	0	0	0	0	0	0	34	26-35	25
1:00 PM	2	**1**	1	19	12	4	0	0	0	0	0	0	0	0	39	26-35	30
2:00 PM	0	1	0	15	24	7	1	**1**	0	**1**	0	0	0	0	50	26-35	38
3:00 PM	1	0	2	11	16	5	0	0	0	0	0	0	0	0	35	26-35	27
4:00 PM	0	0	0	**20**	10	6	1	0	0	0	0	0	0	0	37	26-35	30
5:00 PM	1	0	0	17	22	8	**2**	0	0	0	0	0	0	0	50	26-35	39
6:00 PM	3	1	**4**	19	**39**	**11**	1	0	0	0	0	0	0	0	**78**	26-35	57
7:00 PM	2	0	3	14	13	2	1	0	0	0	0	0	0	0	35	26-35	27
8:00 PM	1	0	1	15	9	6	1	0	0	0	0	0	0	0	33	26-35	23
9:00 PM	0	0	3	7	7	2	0	0	0	0	0	0	0	0	19	26-35	13
10:00 PM	0	0	1	2	2	0	0	0	0	0	0	0	0	0	5	26-35	4
11:00 PM	0	0	0	1	1	0	1	0	0	0	0	0	0	0	3	26-35	2
Day Total	17	7	38	218	240	63	9	1	0	1	0	0	0	0	594	26-35	458
Percent	2.9%	1.2%	6.4%	36.7%	40.4%	10.6%	1.5%	0.2%	0.0%	0.2%	0.0%	0.0%	0.0%	0.0%			

ADT
594



AM Peak Volume	8:00 AM 2	9:00 AM 3	8:00 AM 7	8:00 AM 30	8:00 AM 19	11:00 AM 4	9:00 AM 1								8:00 AM 60		
PM Peak Volume	12:00 PM 4	1:00 PM 1	6:00 PM 4	4:00 PM 20	6:00 PM 39	6:00 PM 11	5:00 PM 2	2:00 PM 1		2:00 PM 1					6:00 PM 78		

Comments:

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: SB
DATE: Sep 03 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	**1**	0	0	1	1	0	0	0	0	0	0	0	0	0	3	26-35	2
1:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
2:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
3:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
4:00 AM	0	0	0	1	0	1	0	0	0	0	0	0	0	0	2	21-30	1
5:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1-10	0
6:00 AM	0	0	1	3	4	3	1	0	0	0	0	0	0	0	12	28-37	7
7:00 AM	0	0	1	9	15	3	0	0	0	0	0	0	0	0	28	26-35	24
8:00 AM	0	0	**2**	**19**	**23**	**6**	1	0	0	0	0	0	0	0	**51**	26-35	41
9:00 AM	0	0	1	4	9	6	1	0	0	0	0	0	0	0	21	31-40	14
10:00 AM	1	0	0	7	11	0	0	0	0	0	0	0	0	0	19	26-35	18
11:00 AM	0	0	2	7	10	2	**3**	0	0	0	0	0	0	0	24	26-35	17
12:00 PM	1	0	1	17	13	8	0	0	0	0	0	0	0	0	40	26-35	30
1:00 PM	**2**	0	1	11	6	3	1	0	0	0	0	0	0	0	24	26-35	17
2:00 PM	1	0	2	8	17	6	**4**	0	0	0	0	0	0	0	38	28-37	24
3:00 PM	1	0	2	17	24	7	0	0	0	0	0	0	0	0	51	26-35	40
4:00 PM	1	0	4	13	16	**10**	1	0	0	0	0	0	0	0	45	26-35	29
5:00 PM	0	0	1	14	24	10	0	0	0	0	0	0	0	0	49	27-36	37
6:00 PM	2	0	3	**18**	**36**	7	2	0	0	0	**1**	0	0	0	**69**	26-35	54
7:00 PM	1	0	1	13	8	5	1	0	0	0	0	0	0	0	29	26-35	21
8:00 PM	0	0	**6**	13	13	2	1	0	0	0	0	0	0	0	35	26-35	26
9:00 PM	1	0	0	4	11	3	0	0	0	0	0	0	0	0	19	31-40	14
10:00 PM	0	0	1	3	2	0	0	0	0	0	0	0	0	0	6	26-35	5
11:00 PM	0	0	0	1	5	0	0	0	0	0	0	0	0	0	6	26-35	6
Day Total	12	0	29	183	248	82	16	0	0	0	1	0	0	0	571	26-35	431
Percent	2.1%	0.0%	5.1%	32.0%	43.4%	14.4%	2.8%	0.0%	0.0%	0.0%	0.2%	0.0%	0.0%	0.0%			

ADT
571

AM Peak Volume	12:00 AM 1			8:00 AM 2	8:00 AM 19	8:00 AM 23	8:00 AM 6	11:00 AM 3																					8:00 AM 51	
PM Peak Volume	1:00 PM 2			8:00 PM 6	6:00 PM 18	6:00 PM 36	4:00 PM 10	2:00 PM 4																					6:00 PM 69	

Comments:

SUMMARY - Tube Count - Speed Data

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: SB
DATE: Sep 01 2015 - Sep 03 2015

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
Grand Total	46	13	106	606	715	219	37	3	0	3	2	0	0	0	1750	26-35	1321
Percent	2.6%	0.7%	6.1%	34.6%	40.9%	12.5%	2.1%	0.2%	0.0%	0.2%	0.1%	0.0%	0.0%	0.0%			
Cumulative Percent	2.6%	3.4%	9.4%	44.1%	84.9%	97.4%	99.5%	99.7%	99.7%	99.9%	100.0%	100.0%	100.0%	100.0%			

ADT
583

85th Percentile 35 MPH

Mean Speed(Average): 30 MPH

Median 30 MPH
Mode: 33 MPH

Comments:

Report generated on 9/8/2015 4:29 PM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Quality Counts
TRANSPORTATION DATA COLLECTION

LOCATION: Camino Pablo
SPECIFIC LOCATION: Camino Pablo
CITY/STATE: Moraga, CA

QC JOB #: 13572603
DIRECTION: SB
DATE: Sep 01 2015 - Sep 03 2015

Start Time	Mon	Tue 01-Sep-15	Wed 02-Sep-15	Thu 03-Sep-15	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM		2	2	3		2			2	
1:00 AM		1	1	0		1			1	
2:00 AM		1	1	0		1			1	
3:00 AM		0	1	0		0			0	
4:00 AM		2	1	2		2			2	
5:00 AM		1	0	0		0			0	
6:00 AM		9	8	12		10			10	
7:00 AM		30	26	28		28			28	
8:00 AM		**50**	**60**	**51**		**54**			**54**	
9:00 AM		33	28	21		27			27	
10:00 AM		25	24	19		23			23	
11:00 AM		27	24	24		25			25	
12:00 PM		29	34	40		34			34	
1:00 PM		23	39	24		29			29	
2:00 PM		45	50	38		44			44	
3:00 PM		43	35	51		43			43	
4:00 PM		43	37	45		42			42	
5:00 PM		53	50	49		51			51	
6:00 PM		**89**	**78**	**69**		**79**			**79**	
7:00 PM		33	35	29		32			32	
8:00 PM		21	33	35		30			30	
9:00 PM		10	19	19		16			16	
10:00 PM		8	5	6		6			6	
11:00 PM		7	3	6		5			5	
Day Total		585	594	571		584			584	
% Weekday Average		100.2%	101.7%	97.8%						
% Week Average		100.2%	101.7%	97.8%		100.0%				
AM Peak Volume		8:00 AM 50	8:00 AM 60	8:00 AM 51		8:00 AM 54			8:00 AM 54	
PM Peak Volume		6:00 PM 89	6:00 PM 78	6:00 PM 69		6:00 PM 79			6:00 PM 79	

Comments:

ATTACHMENT C – LEVEL OF SERVICE WORKSHEETS

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	35	1	0	28	38	12
Future Vol, veh/h	35	1	0	28	38	12
Conflicting Peds, #/hr	3	6	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	77	77	77	77	77	77
Heavy Vehicles, %	0	0	0	4	5	0
Mvmt Flow	45	1	0	36	49	16

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	97	64	66	0	-	0
Stage 1	58	-	-	-	-	-
Stage 2	39	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	907	1006	1549	-	-	-
Stage 1	970	-	-	-	-	-
Stage 2	989	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	905	1000	1548	-	-	-
Mov Cap-2 Maneuver	905	-	-	-	-	-
Stage 1	969	-	-	-	-	-
Stage 2	988	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.2	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1548	-	907	-	-
HCM Lane V/C Ratio	-	-	0.052	-	-
HCM Control Delay (s)	0	-	9.2	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	3.1

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	35	1	0	17	21	30
Future Vol, veh/h	35	1	0	17	21	30
Conflicting Peds, #/hr	0	4	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	42	1	0	20	25	36

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	64	48	62	0	-	0
Stage 1	44	-	-	-	-	-
Stage 2	20	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	947	1027	1554	-	-	-
Stage 1	984	-	-	-	-	-
Stage 2	1008	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	945	1023	1553	-	-	-
Mov Cap-2 Maneuver	945	-	-	-	-	-
Stage 1	983	-	-	-	-	-
Stage 2	1007	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1553	-	947	-	-
HCM Lane V/C Ratio	-	-	0.045	-	-
HCM Control Delay (s)	0	-	9	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	3.7

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	35	0	1	0	0	13	0	28	0	4	38	12
Future Vol, veh/h	35	0	1	0	0	13	0	28	0	4	38	12
Conflicting Peds, #/hr	3	0	6	6	0	3	1	0	17	17	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	77	77	77	77	77	77	77	77	77	77	77	77
Heavy Vehicles, %	0	0	0	0	0	0	0	4	0	0	5	0
Mvmt Flow	45	0	1	0	0	17	0	36	0	5	49	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	116	121	64	127	129	56	66	0	0	53	0	0
Stage 1	68	68	-	53	53	-	-	-	-	-	-	-
Stage 2	48	53	-	74	76	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	865	773	1006	851	765	1016	1549	-	-	1566	-	-
Stage 1	947	842	-	965	855	-	-	-	-	-	-	-
Stage 2	971	855	-	940	836	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	846	759	1000	831	751	999	1548	-	-	1544	-	-
Mov Cap-2 Maneuver	846	759	-	831	751	-	-	-	-	-	-	-
Stage 1	946	839	-	951	843	-	-	-	-	-	-	-
Stage 2	952	843	-	931	833	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.5	8.7	0	0.5
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1548	-	-	850	999	1544	-	-
HCM Lane V/C Ratio	-	-	-	0.055	0.017	0.003	-	-
HCM Control Delay (s)	0	-	-	9.5	8.7	7.3	0	-
HCM Lane LOS	A	-	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.1	0	-	-

Intersection	
Int Delay, s/veh	3.9

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	35	0	1	0	0	6	0	17	0	11	21	30
Future Vol, veh/h	35	0	1	0	0	6	0	17	0	11	21	30
Conflicting Peds, #/hr	0	0	4	4	0	0	1	0	8	8	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	84	84	84	84	84	84	84	84	84
Heavy Vehicles, %	3	3	3	3	3	3	3	3	3	3	3	3
Mvmt Flow	42	0	1	0	0	7	0	20	0	13	25	36

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	94	98	48	102	116	28	62	0	0	28	0	0
Stage 1	70	70	-	28	28	-	-	-	-	-	-	-
Stage 2	24	28	-	74	88	-	-	-	-	-	-	-
Critical Hdwy	7.13	6.53	6.23	7.13	6.53	6.23	4.13	-	-	4.13	-	-
Critical Hdwy Stg 1	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.13	5.53	-	6.13	5.53	-	-	-	-	-	-	-
Follow-up Hdwy	3.527	4.027	3.327	3.527	4.027	3.327	2.227	-	-	2.227	-	-
Pot Cap-1 Maneuver	887	790	1018	876	772	1044	1535	-	-	1579	-	-
Stage 1	937	835	-	987	870	-	-	-	-	-	-	-
Stage 2	991	870	-	933	820	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	874	777	1014	860	759	1037	1534	-	-	1568	-	-
Mov Cap-2 Maneuver	874	777	-	860	759	-	-	-	-	-	-	-
Stage 1	936	827	-	980	864	-	-	-	-	-	-	-
Stage 2	984	864	-	920	812	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.3	8.5	0	1.3
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1534	-	-	877	1037	1568	-	-
HCM Lane V/C Ratio	-	-	-	0.049	0.007	0.008	-	-
HCM Control Delay (s)	0	-	-	9.3	8.5	7.3	0	-
HCM Lane LOS	A	-	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0	0	-	-

Intersection	
Int Delay, s/veh	2.6

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	35	1	0	35	45	12
Future Vol, veh/h	35	1	0	35	45	12
Conflicting Peds, #/hr	3	6	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	77	77	77	77	77	77
Heavy Vehicles, %	0	0	0	4	5	0
Mvmt Flow	45	1	0	45	58	16

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	115	73	75	0	-	0
Stage 1	67	-	-	-	-	-
Stage 2	48	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	886	995	1537	-	-	-
Stage 1	961	-	-	-	-	-
Stage 2	980	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	884	989	1536	-	-	-
Mov Cap-2 Maneuver	884	-	-	-	-	-
Stage 1	960	-	-	-	-	-
Stage 2	979	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9.3	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1536	-	887	-	-
HCM Lane V/C Ratio	-	-	0.053	-	-
HCM Control Delay (s)	0	-	9.3	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.2	-	-

Intersection	
Int Delay, s/veh	2.9

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Vol, veh/h	35	1	0	20	25	30
Future Vol, veh/h	35	1	0	20	25	30
Conflicting Peds, #/hr	0	4	1	0	0	1
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	84	84	84	84	84	84
Heavy Vehicles, %	0	0	0	0	0	0
Mvmt Flow	42	1	0	24	30	36

Major/Minor	Minor2		Major1		Major2	
Conflicting Flow All	73	53	67	0	-	0
Stage 1	49	-	-	-	-	-
Stage 2	24	-	-	-	-	-
Critical Hdwy	6.4	6.2	4.1	-	-	-
Critical Hdwy Stg 1	5.4	-	-	-	-	-
Critical Hdwy Stg 2	5.4	-	-	-	-	-
Follow-up Hdwy	3.5	3.3	2.2	-	-	-
Pot Cap-1 Maneuver	936	1020	1547	-	-	-
Stage 1	979	-	-	-	-	-
Stage 2	1004	-	-	-	-	-
Platoon blocked, %				-	-	-
Mov Cap-1 Maneuver	934	1016	1546	-	-	-
Mov Cap-2 Maneuver	934	-	-	-	-	-
Stage 1	978	-	-	-	-	-
Stage 2	1003	-	-	-	-	-

Approach	EB	NB	SB
HCM Control Delay, s	9	0	0
HCM LOS	A		

Minor Lane/Major Mvmt	NBL	NBT	EBLn1	SBT	SBR
Capacity (veh/h)	1546	-	936	-	-
HCM Lane V/C Ratio	-	-	0.046	-	-
HCM Control Delay (s)	0	-	9	-	-
HCM Lane LOS	A	-	A	-	-
HCM 95th %tile Q(veh)	0	-	0.1	-	-

Intersection	
Int Delay, s/veh	3.4

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	35	0	1	0	0	13	0	35	0	4	45	12
Future Vol, veh/h	35	0	1	0	0	13	0	35	0	4	45	12
Conflicting Peds, #/hr	3	0	6	6	0	3	1	0	17	17	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	77	77	77	77	77	77	77	77	77	77	77	77
Heavy Vehicles, %	0	0	0	0	0	0	0	4	0	0	5	0
Mvmt Flow	45	0	1	0	0	17	0	45	0	5	58	16

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	134	139	73	145	147	65	75	0	0	62	0	0
Stage 1	77	77	-	62	62	-	-	-	-	-	-	-
Stage 2	57	62	-	83	85	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	842	756	995	828	748	1005	1537	-	-	1554	-	-
Stage 1	937	835	-	954	847	-	-	-	-	-	-	-
Stage 2	960	847	-	930	828	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	823	742	989	809	735	988	1536	-	-	1532	-	-
Mov Cap-2 Maneuver	823	742	-	809	735	-	-	-	-	-	-	-
Stage 1	936	832	-	941	835	-	-	-	-	-	-	-
Stage 2	941	835	-	921	825	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.6	8.7	0	0.5
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1536	-	-	827	988	1532	-	-
HCM Lane V/C Ratio	-	-	-	0.057	0.017	0.003	-	-
HCM Control Delay (s)	0	-	-	9.6	8.7	7.4	0	-
HCM Lane LOS	A	-	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0.1	0	-	-

Intersection	
Int Delay, s/veh	3.6

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	35	0	1	0	0	6	0	20	0	11	25	30
Future Vol, veh/h	35	0	1	0	0	6	0	20	0	11	25	30
Conflicting Peds, #/hr	0	0	4	4	0	0	1	0	8	8	0	1
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop	Free	Free	Free	Free	Free	Free
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	-	-	-	-	-	-	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	84	84	84	84	84	84	84	84	84	84	84	84
Heavy Vehicles, %	0	0	0	0	0	0	0	0	0	0	0	0
Mvmt Flow	42	0	1	0	0	7	0	24	0	13	30	36

Major/Minor	Minor2			Minor1			Major1			Major2		
Conflicting Flow All	103	107	53	111	125	32	67	0	0	32	0	0
Stage 1	75	75	-	32	32	-	-	-	-	-	-	-
Stage 2	28	32	-	79	93	-	-	-	-	-	-	-
Critical Hdwy	7.1	6.5	6.2	7.1	6.5	6.2	4.1	-	-	4.1	-	-
Critical Hdwy Stg 1	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Critical Hdwy Stg 2	6.1	5.5	-	6.1	5.5	-	-	-	-	-	-	-
Follow-up Hdwy	3.5	4	3.3	3.5	4	3.3	2.2	-	-	2.2	-	-
Pot Cap-1 Maneuver	882	787	1020	872	769	1048	1547	-	-	1593	-	-
Stage 1	939	836	-	990	872	-	-	-	-	-	-	-
Stage 2	994	872	-	935	822	-	-	-	-	-	-	-
Platoon blocked, %								-	-		-	-
Mov Cap-1 Maneuver	869	774	1016	856	756	1041	1546	-	-	1582	-	-
Mov Cap-2 Maneuver	869	774	-	856	756	-	-	-	-	-	-	-
Stage 1	938	828	-	983	866	-	-	-	-	-	-	-
Stage 2	987	866	-	922	814	-	-	-	-	-	-	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	9.3	8.5	0	1.2
HCM LOS	A	A		

Minor Lane/Major Mvmt	NBL	NBT	NBR	EBLn1	WBLn1	SBL	SBT	SBR
Capacity (veh/h)	1546	-	-	873	1041	1582	-	-
HCM Lane V/C Ratio	-	-	-	0.049	0.007	0.008	-	-
HCM Control Delay (s)	0	-	-	9.3	8.5	7.3	0	-
HCM Lane LOS	A	-	-	A	A	A	A	-
HCM 95th %tile Q(veh)	0	-	-	0.2	0	0	-	-

ATTACHMENT D DRIVEWAY GRADE ANALYSIS

COMPLIANCE OF PROPOSED DRIVEWAYS WITH FIRE DISTRICT REQUIREMENTS
SOUTH CAMINO PABLO ANNEXATION PROJECT
SUBDIVISION 9396
April 16, 2020

In this project, the proposed residential driveways comply with the regulations of the Moraga-Orinda Fire District. All lots have driveways that do not exceed 150' in length and are, therefore, not required to have a fire department approved turnaround at the end. All driveways have slopes that do not exceed the fire department maximum of 20%. They are tabulated as foloows:

Lot Number	Max. Driveway Slope
1	10%
2	20% with transitions at top and bottom
3	8.5%
4	10%
5	10.4%
6	6.57%
7	8.00%
8	14.27% with transitions at top and bottom
9	14.43% with transitions at top and bottom
10	14.69% with transitions at top and bottom
11	14.56% with transitions at top and bottom
12	6.45%
13	8.28%