APPENDICES

Appendix A

Carbon Canyon Channel Pipeline Avenue to Peyton Drive Alternatives Analysis

Interoffice Memo

SAN BERNARDINO COUNTY

DATE October 31, 2018

FROM **ERWIN FOGERSON**, P.E., Division Chief
Flood Control Engineering Division

TO **DARREN MEEKA,** P.E., Division Chief
Environmental Management Division

PHONE 387-7962

MAIL CODE 0835

File: 1-114-1B/F02651

SUBJECT **REQUEST FOR CEQA COMPLIANCE REVIEW – CARBON CANYON CHANNEL – W.O. F02651**

The Flood Control Engineering Division hereby requests a CEQA compliance review of the above subject project. The Environmental Data/Description Form and required documents as noted on that form are attached for your use. Alternative Analysis dated August 2018 for Carbon Canyon Channel between Pipeline Avenue and Peyton Drive in the City of Chino Hills.

If you need further information or have any questions, please contact Erwin Fogerson at 387-7962.

ER/af

Attachments

SAN BERNARDINO COUNTY
FLOOD CONTROL DISTRICT

CARBON CANYON CHANNEL PIPELINE AVENUE TO PEYTON DRIVE ALTERNATIVE ANALYSIS

AUGUST 2018

Prepared under the supervision of:

REGISTERED PROFESSIONAL ENGINEER
Erwin R. Fogerson
49060
CIVIL
STATE OF CALIFORNIA

SBCFCD Work Order F02651

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Project Description / Purpose

San Bernardino County Flood Control District (District) is proposing to improve Carbon Canyon Channel from an interim to an ultimate condition channel. The project goal is to decrease the chances of flooding during a 100 year storm event by improving the capacity and conveyance of the District maintained facility. The channel lies between Peyton Drive to the west, Pipeline Avenue to the east, Eucalyptus Avenue to the north, and Chino Hills Parkway to the south in the City of Chino Hills as shown on the Project Location Map. The project area will cover approximately 4,850 linear feet in length and 120 feet in width where the existing interim channel already exists.

Carbon Canyon Channel has been determined by Federal Emergency Management Agency (FEMA) to not have the ability to convey a 100 year storm event to their standards without allowing flooding to occur in the area. The District investigated multiple concepts and applied its standards to design a channel to convey a Q100 year storm event. The newly designed channel will meet both agencies standards and will reduce the chances of flooding in future storm events.

This analysis is to provide support for the project needs of potential and practical improvements that were identified and studied to determine a design that would meet the requirements of the agencies. A total of 3 alternatives were developed and a comparison matrix of the alternatives studied is included in Section B of this report. The alternative of a trapezoidal channel consisting of a combination of hardened side walls and open cell articulating block on the invert was deemed to be the preferred alternative to meet the project needs and have the most practicability solution to improve Carbon Canyon Channel. The proposed project should be completed within 12 months of the initial construction start.

As required by the United States Army Corps of Engineers Alternative Analysis Guidance, alternatives which only meet the project goals were analyzed in detail. Concepts that did not meet the project purpose are mentioned in next section. Due to the urbanization of the area, the District's available right of way cannot be increased; therefore no practical alternatives outside of the current District right-of-way were identified and therefore are not included in this analysis.

Project Approach

The District examined the existing channel which is generally described as a trapezoidal earthen channel with grouted rock side slope protection and a rocky invert. The channel shape varies but in general is 10 feet deep, 25 feet wide at the invert, and 1.5:1 (1.5 feet horizontal to 1 foot vertical) side slopes. The existing Channel has an estimated capacity of 3,468 cfs assuming clean and no debris west of Pipeline Drive. The capacity was computed using a cross section of the channel and generating a normal depth analysis at the top banks of the existing channel with FlowMaster V8i. The existing channel conveys flow from west to east and generally remains constant in size as flows are intercepted from the tributary watershed of the channel.

Design flows for the ultimate channel configuration are based upon the City of Chino Hills Storm Drain Master Plan (SDMP) dated December 2008 by LAN "Lim & Nascimento Engineering Corp". Flow rates for English Channel Q100 are 2,924 cfs which joins Carbon Canyon Channel and increases Carbon Canyon Q100 from 3,653 cfs to 6,577 cfs after the junction. The District has developed various design concepts in order to develop a practicable replacement for the interim channel.

- The first design concept was a trapezoidal shaped earthen channel, 32 feet wide at the invert, 12 feet deep, side slopes of 2:1(2 feet horizontal to 1 foot vertical), and a channel slope of 0.5%. The District found that this concept would produce velocities of greater than 14 feet per second. These velocities are greater than the District's standards for an earthen lined channel.

- The second concept was a trapezoidal channel with an earthen invert and riprap side slopes. The channel dimensions are generally 35 feet wide at the invert, 15 feet deep, and side slopes of 1.5:1 (1.5 feet horizontal to 1 foot vertical). The design of the channel needed to operate within two different flow regimes which are a clean channel with minimal vegetation and one with a large amount of vegetation. The two options were tested and found to produce high velocities for a channel with very little vegetation or flooding once the vegetation was allowed to build up which slowed the conveyance of the water and would not meet the goals of the project.
- The final concept is a trapezoidal channel with riprap lining and dimensions of 32 feet wide at the invert, 12 feet deep, and side slopes of 2:1(2 feet horizontal to 1 foot vertical). This concept also needed to operate under a two flow regime condition. As like the second concept the conveyance of the water in the channel had to high of a velocity or flooding would occur.

The three concepts that were developed from the existing channel would not meet the standards set by the two agencies to allow for the channel to have the capacity and or the conveyance of storm water flows within the channel.

Description of Alternatives

Alternative 1: NATURAL BOTTOM WITH VERTICAL WALL SYSTEM "RECTAGULAR CHANNEL"

Alternative 1 considered redesigning the channel from an existing trapezoidal shaped channel to a rectangle shaped channel. The width of the channel would increase from 25 feet to 72 feet. The invert will be divided into three sections. Two sections that are located along the walls will be concrete and extend into the channel for 16 feet. The middle section will remain natural earthen bottom and be 40 feet wide. The depth of the channel will also increase from 10 feet to a minimum of 14 feet. A cross-section of this Alternative is included as Exhibit "A". Do to the design having an earthen section, the District investigate the hydraulics within two flow regimes. The first iteration used a Manning's value of 0.075 for heavy vegetation; the average channel depth of flow was 12 feet with an average velocity of 8 feet per second in the channel. The second iteration was for a clean channel used a Manning's value of 0.023. The average depth became 6 feet with velocities increasing to 17 feet per second. Due to the velocities increasing the channel would need some form of bottom controls put in place to allow the District to determine when maintenance would be required until vegetation had a chance to grow and protect the earthen invert from erosion.

The cost of this alternative is approximately $ 18,000,000. Maintenance will consist of seasonal clearing (tree and heavy brush removal) and repair to the channel invert. The alternative would allow for natural growth to occur on the invert over time but due to the large amount of excavation and increased need to monitor the earthen invert for erosion this option would be less practical.

Alternative 2: TRAPEZOIDAL CONCRETE CHANNEL

A concrete trapezoidal channel was modeled as an alternative to determine the minimum size channel for the given capacity and conveyance. A cross-section of this Alternative is included as Exhibit "B". The analysis indicated that a concrete lined channel 30 feet wide at the invert, 15 feet deep, and with side walls of slope 1.5:1 will convey the flow to meet the different standards safely, from Peyton Drive to Pipeline Avenue. The calculated design velocity averaged 25 feet per second in the channel. The concrete channel was designed to determine the best hydraulic section in which provides the minimum wetted perimeter and maximum flow rate.

This alternative has the highest level of certainty of performance as it does not include any vegetation which would decrease the conveyance and has ability to with stand the high velocities that will exist in the channel without erosion being able to occur. The cost of this alternative is approximately $ 13,000,000 which is reasonable compared to the other alternatives. The alternative is the least practicability due to the loss of the earthen invert and changing of the channel environment. The concrete lining of the channel would lead to a high cost of environmental mitigation due to the loss of earthen channel that exists. The channel once concreted will require minimal maintenance except for seasonal spraying for weeds and intermittent trash and debris removal.

Alternative 3: TRAPEZOIDAL ARTICULATING BLOCK INVERT WITH HARDEN SIDE WALLS

Alternative 3 was developed to mimic a concrete channel as closely as possible. The channel will have an invert 40 feet wide, 15 feet deep, and side slopes 1.5:1. The side slopes will be concreted to prevent erosion and decrease the friction for high flows. The channel invert will consist of a 30 foot wide open cell articulating block surface running the middle while along each edge will have a strip of concrete 5 feet wide running parallel to the walls. This is shown in exhibit "C". These strips will allow larger flows to move faster to help reduce the friction created by vegetation growth which provides for the redevelopment of natural habitat within the channel as it occurs now.

This alternative will allow low flows to move through vegetation to increase the water quality, while the two outside edges of concrete reduce the amount of friction, which will allow higher flows to be conveyed along the channel. The cost of this alternative is approximately $9,200,000. With the use of articulating block on the invert which is wider, the channel may actually increase in the amount of permeability verse the existing rocky invert. Maintenance will consist of intermittent trash and debris removal along with possible mowing if the need arises. Form a practicability standard the articulating block and hardened side walls of the channel will allow the environment to continue to grow and allow the channel to convey storm water and reduce the chances of flooding.

Conclusion

The District developed three concepts of trapezoidal shaped channels for the proposed project. The first being an earthen lined system developed velocities greater than what Districts standards would allow for a natural channel. The District's next two concepts involved some form of riprap lining of the channel but issues with velocity or overtopping occurred depending on the amount of vegetation in the channel and in turn would not meet the District and or FEMA standards. The District started developing different alternatives for the channel to determine the best practice to increase conveyance and capacity and meet the standards of the given agencies. The District's three alternatives were a rectangular channel with hardened side walls and a natural earthen bottom, a trapezoidal concrete lined channel, and a trapezoid with hardened sides with articulating block invert. Each alternative was developed to produce a preliminary design. This design allowed the District to also perform Hydraulic calculations using WSPGP (Water Surface Pressure Gradient Package) software to determine how the channel would react under the different conditions for each alternative. The District used the developed channel conditions to determine the hydraulic conditions that would occur for the improved channel. These results were then used in support of develop a matrix to be built to investigate the practicability of each design. A comparison matrix analyzed the three alternatives against one and other in twelve specific criteria equally. The alternative of a trapezoid channel with hardened side slopes and articulating block invert was determined to be the most practicable replacement.

Carbon Canyon Channel Alternative Comparison Matrix

Item	Comments	Weighting Factor	**Alternative 1** Retaining Walls with Earthen Bottom	**Alternative 2 Trapezoidal Concrete Channel**	**Alternative 3 Trapezoidal Articalating block invert**	Comments- Given Reason For Rating
Flood Mitigation	Lower rating indicates potential of decrease in design capacity of Q100 with no bulking due to vegetation or higher level of required maintenance	20%	2	3	2	Alt 1 & 2 Given Lower Rating Due To Required Level of Maintenance
Public Safety	Ranking is based upon the ability to secure the facilities from trespassing and potential of public in the facility	20%	1	2	2	Alt 1 Lower Rating Due To Vertical Walls And Difficuitly To Reach The Bottom
Biology / Water Quality Enhancement	Ranking is based upon potential new pollutants and the potential to treat current pollutants	10%	3	1	2	Alt 2 Has No Vegatation Theirfore Given A 1 Rating
Water Retention / Infiltration	Ranking based upon potential pervious area	10%	3	1	2	
Operations and Maintenance	Ranking considers required vegetation control, trash removal and frequency of invert / side slope repair due to scour	5%	2	3	2	
Transportation (impact to road system)	Rated from standpoint of required operations vehicles in area and the potential of roadway flooding	5%	2	3	2	
Aesthetics	Ranking based upon potential visible native vegetation	5%	3	1	3	
Impact to Local Commerce	Ranking based upon change in current land use.	5%	2	3	2	Alt 1 & 3 Require Higher Level Of Maintenance To Function Properly
Cost	Ranking is based upon a comparison of total construction, right-of-way acquisition and anticipated maintenance costs	5%	1	3	2	
Recreation	Ranking is based upon available right-of-way and aesthetic value for future trails or public corridor	5%	2	1	2	
Permitting Requirements	Based upon anticipated 1602, 401 and 404 level of off-site permitting mitigation requirements	5%	2	1	2	
Public Acceptance	Construction impacts, consistency to current land use and use of public funds considered	5%	1	1	3	
Total		100%	1.95	2.00	2.10	
Select (Yes/No)			NO	NO	YES	

A ranking of alternatives was developed based on the criteria listed above with each evaluation criteria aspect being assigned a weighting factor and assigned a numerical value from 1 (low) to 3 (high). The assigned value is based upon a comparison to the other alternatives but may include a reduced ranking due to level of uncertainty of impact or performance.

Ranking 3 indicates the highest preference. This ranking indicates the optimal condition.

Ranking 2 indicates the next highest preference. Other alternatives are more optimal.

Ranking 1 indicates the least level pf preference. This ranking is the least preferred condition.

Flood mitigation and public safety were given the highest considerations as the channel runs adjacent to an interstate railway and the area already experiences issues with homeless encampments. The third and fourth highest considered factors are biological/water quality enhancement and water conservation in total are equal to these items as well.

Exhibit A

NATURAL BOTTOM W/ HIGH FLOW SIDE CHANNEL (RETAINING WALL)

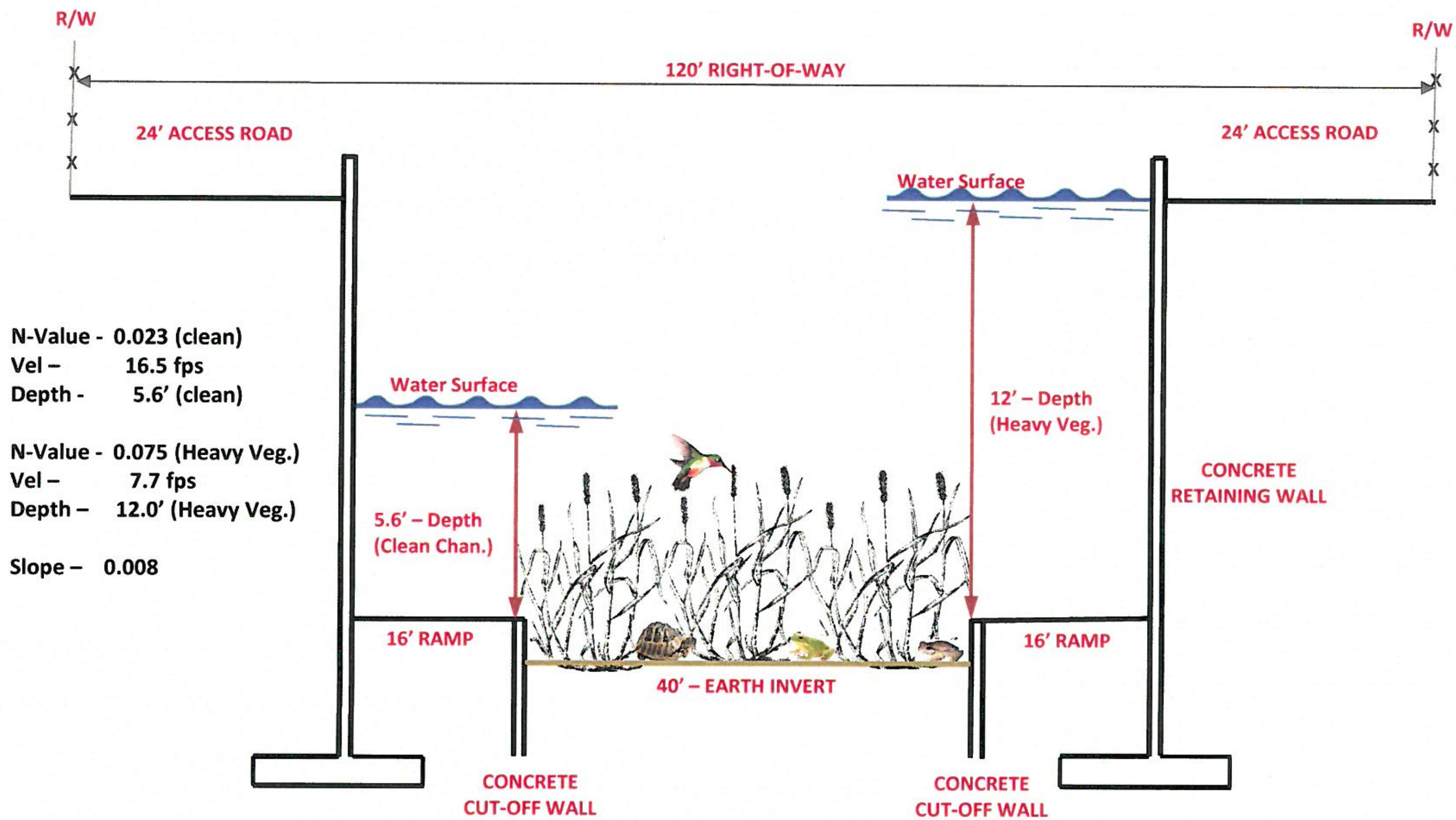


Exhibit B

CONCRETE TRAPEZOIDAL CHANNEL

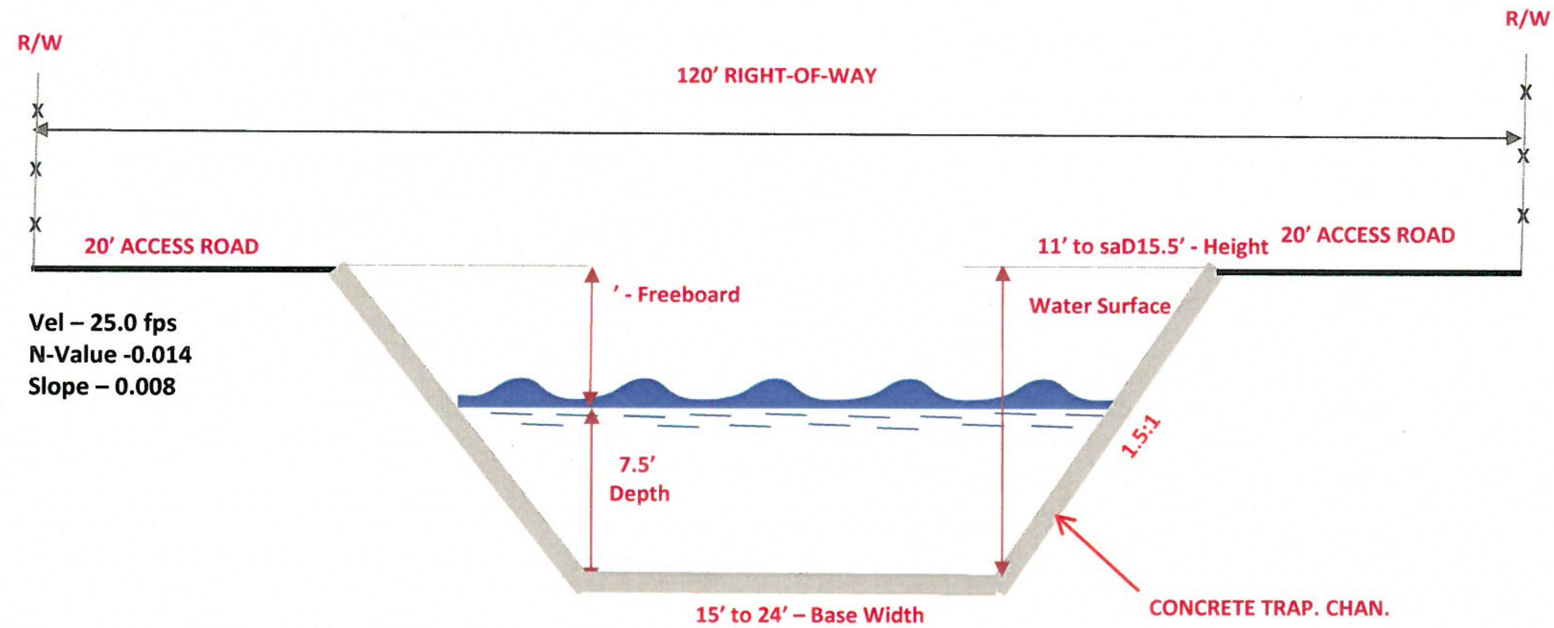
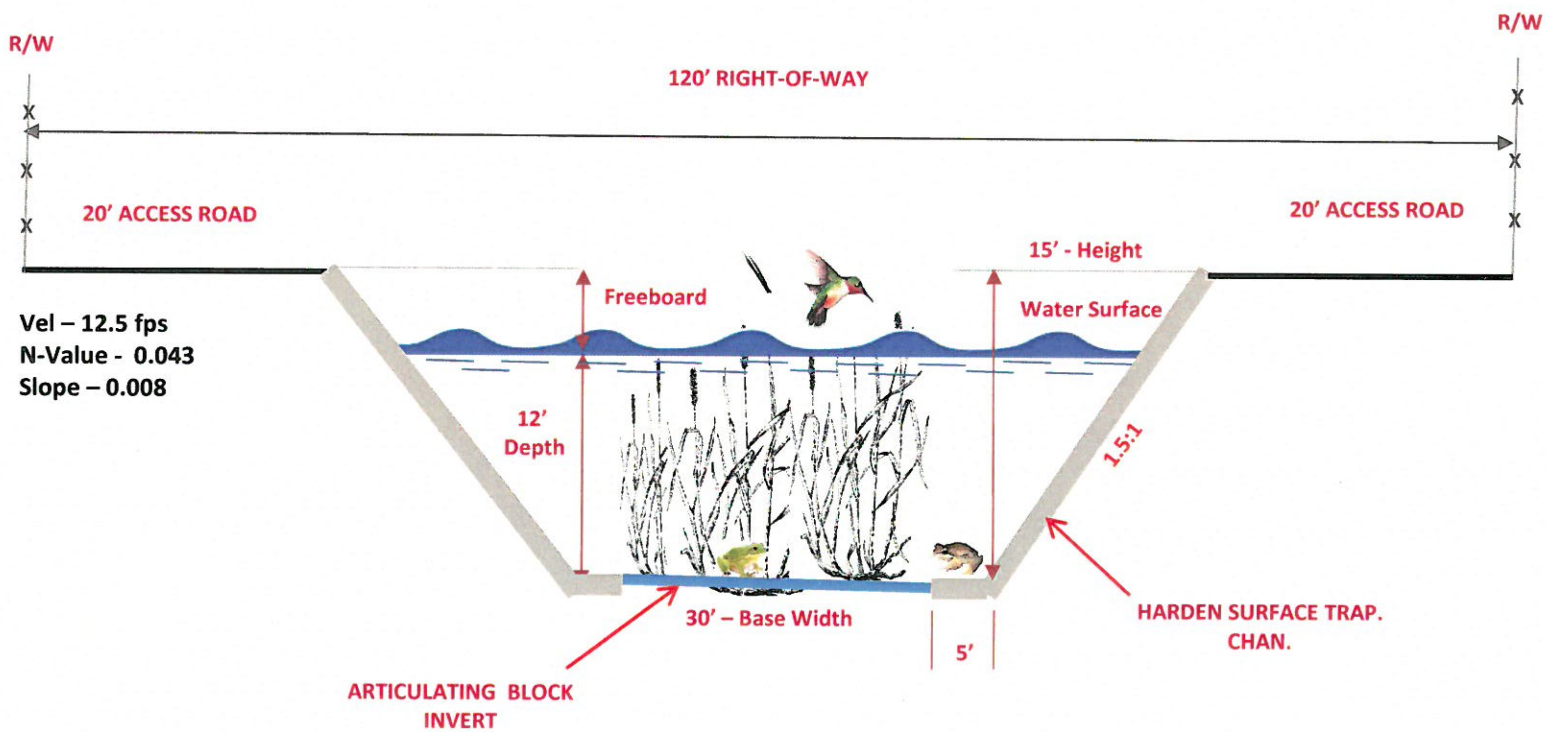


Exhibit C

HARDEN SIDE WALLS WITH ARTICULATING BLOCK INVERT



Engineer's Estimate

Project: ***Carbon Canyon Channel Alt #1 Natrul Bottom With Vertical Wall System*** **W.O.#:** ***F02651***

Limits: ***Pipeline Ave. to Peyton Dr.*** Last Modified: Aug 8 18 0:00

Item No.	Approx. Quant.	Meas. Unit	Item Description	Unit Price	Total
1	1	L.S.	Mobilization (Includes All Offices and Need Utilities for Job)	$ 400,000.00	$ 400,000.00
2	1	L.S.	SWPPP	$ 3,000.00	$ 3,000.00
3	1	L.S.	Traffic Control System	$ 50,000.00	$ 50,000.00
4	1	L.S.	Clearing and Grubbing	$ 100,000.00	$ 100,000.00
5	1	L.S.	Diversion and Control of Water	$ 20,000.00	$ 20,000.00
6	1	L.S.	Remove Existing Concrete Rock Slope Protection And Bottom Controls	$ 200,000.00	$ 200,000.00
7	1	L.S.	Relocation of Utilities	$ 10,000.00	$ 10,000.00
8	140,000	C.Y.	Excavation	$ 10.00	$ 1,400,000.00
9	21,500	C.Y.	Backfill (90% Compaction)	$ 6.00	$ 129,000.00
10	25,800	C.Y.	Structural Backfill (95% Compaction)	$ 20.00	$ 516,000.00
11	4,000	C.Y.	Class-1 Concrete Cut-Off Walls	$ 400.00	$ 1,600,000.00
12	2,500	C.Y.	Class-1 Concrete 16' Width Driveable Ramps On Channel Side of Retaining Walls	$ 600.00	$ 1,500,000.00
13	5,400	C.Y.	Class-1 Concrete Vertical Component for Retaing Wall	$ 800.00	$ 4,320,000.00
14	5,600	C.Y.	Class-1 Concret Footing Component For Retaining Wall	$ 600.00	$ 3,360,000.00
15	470	C.Y.	Minor Concrect - Cutoff Walls, 1/4 - Ton Class Rock, Full Concrete Penetration	$ 200.00	$ 94,000.00
16	9,700	L.F.	Chain link Fence	$ 30.00	$ 291,000.00
17	7	EA.	Minor Junctions to channel (Includes Pipe and Inlet Structure)	$ 5,000.00	$ 35,000.00
18	1	0	Major Junctions (English Channel Joins Carbon Canyon Channel)	$ 20,000.00	$ 20,000.00
19	3	EA.	Transitions	$ 50,000.00	$ 150,000.00

PROJECT ESTIMATE TOTAL:	***$ 14,198,000.00***
10% Contingencies:	***$ 1,419,800.00***
~15% Constr. Eng.:	***$ 2,343,200.00***
PROJECT TOTAL:	***$ 17,961,000.00***

Engineer's Estimate

Project: ***Carbon Canyon Channel Alt #2 Concrete Trapezoidal Channel*** **W.O.#:** ***F02651***

Limits: ***Pipeline Ave. to Peyton Dr.*** Last Modified: Aug 8 18 0:00

Item No.	Approx. Quant.	Meas. Unit	Item Description	Unit Price	Total
1	1	L.S.	Mobilization (Includes All Office's and Need Utilities for Job)	$ 400,000.00	$ 400,000.00
2	1	L.S.	SWPPP	$ 3,000.00	$ 3,000.00
3	1	L.S.	Traffic Control System	$ 50,000.00	$ 50,000.00
4	1	L.S.	Clearing and Grubbing	$ 100,000.00	$ 100,000.00
5	1	L.S.	Diversion and Control of Water	$ 20,000.00	$ 20,000.00
6	1	L.S.	Remove Existing Concrete Rock Slope Protection And Bottom Controls	$ 200,000.00	$ 200,000.00
7	1	L.S.	Relocation of Utilities	$ 10,000.00	$ 10,000.00
8	13,000	C.Y.	Excavation	$ 10.00	$ 130,000.00
9	40	C.Y.	Class-1 Concrete Cut-Off Walls	$ 400.00	$ 16,000.00
10	5,200	C.Y.	Class-1 Concrete For Channel	$ 600.00	$ 3,120,000.00
11	9,700	L.F.	Chain link Fence	$ 30.00	$ 291,000.00
12	7	EA.	Minor Junctions to channel (Includes Pipe and Inlet Structure)	$ 5,000.00	$ 35,000.00
13	1	0	Major Junctions (English Channel Joins Carbon Canyon Channel)	$ 20,000.00	$ 20,000.00
14	3	EA.	Transitions	$ 50,000.00	$ 150,000.00

PROJECT ESTIMATE TOTAL:	***$ 4,545,000.00***
10% Contingencies:	***$ 454,500.00***
~15% Constr. Eng.:	***$ 750,500.00***
PROJECT TOTAL:	***$ 5,750,000.00***

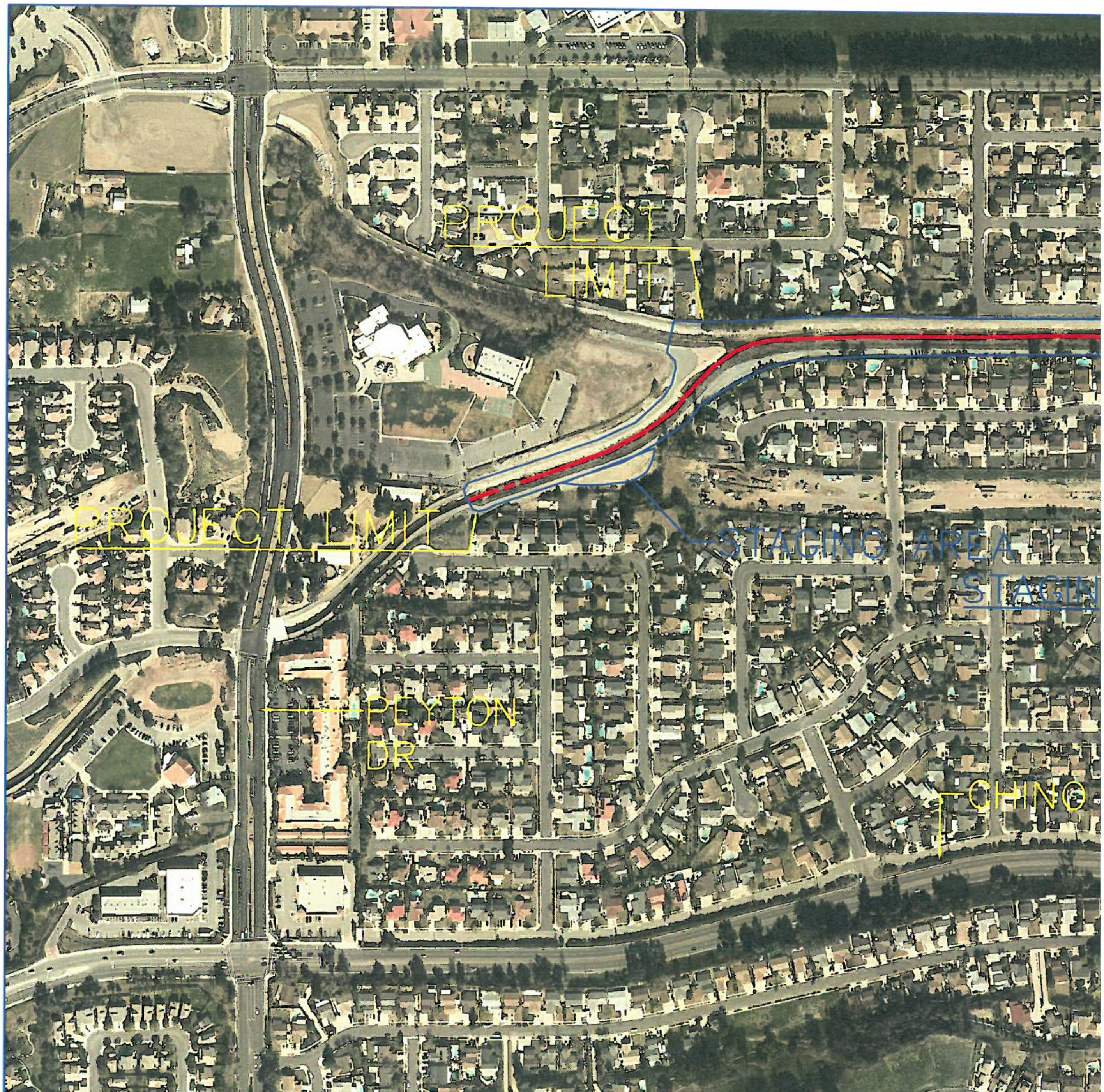
Engineer's Estimate

Project: ***Carbon Canyon Channel Alt #3 Permenble Base, Harden Side Slope Channel*** **W.O.#:** ***F02651***

Limits: ***Pipeline Ave. to Peyton Dr.*** Last Modified: Aug 8 18 0:00

Item No.	Approx. Quant.	Meas. Unit	Item Description	Unit Price	Total
1	1	L.S.	Mobilization (Includes All Offices and Need Utilities for Job)	$ 400,000.00	$ 400,000.00
2	1	L.S.	SWPPP	$ 3,000.00	$ 3,000.00
3	1	L.S.	Traffic Control System	$ 50,000.00	$ 50,000.00
4	1	L.S.	Clearing and Grubbing	$ 100,000.00	$ 100,000.00
5	1	L.S.	Diversion and Control of Water	$ 20,000.00	$ 20,000.00
6	1	L.S.	Remove Existing Concrete Rock Slope Protection And Bottom Controls	$ 200,000.00	$ 200,000.00
7	1	L.S.	Relocation of Utilities	$ 10,000.00	$ 10,000.00
8	104,000	C.Y.	Excavation	$ 10.00	$ 1,040,000.00
9	1,500	C.Y.	Class-1 Concrete Cut-Off Walls	$ 400.00	$ 600,000.00
10	10,000	C.Y.	Class-1 Concrete For Harden Walls and 5 ft Strip Along Wall In Channel	$ 600.00	$ 6,000,000.00
11	3,720	EA.	Articulating Block, Gravel, and Filter Fabric	$ 100.00	$ 372,000.00
12	9,700	L.F.	Chain link Fence	$ 30.00	$ 291,000.00
13	7	EA.	Minor Junctions to channel (Includes Pipe and Inlet Structure)	$ 5,000.00	$ 35,000.00
14	1	0	Major Junctions (English Channel Joins Carbon Canyon Channel)	$ 20,000.00	$ 20,000.00
15	3	EA.	Transitions	$ 50,000.00	$ 150,000.00

PROJECT ESTIMATE TOTAL:	***$ 9,291,000.00***
10% Contingencies:	***$ 929,100.00***
~15% Constr. Eng.:	***$ 1,533,900.00***
PROJECT TOTAL:	***$ 11,754,000.00***



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Appendix B

CalEEMod Calculations of Project-Related Air Quality and Greenhouse Gas Emissions

Carbon Canyon Channel

South Coast AQMD Air District, Summer

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	179.65	1000sqft	4.12	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	31
Climate Zone	10			**Operational Year**	2022
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Construction Phase - Project duration as stated

Off-road Equipment - Equipment as estimated

Trips and VMT - Water truck and cement truck trips in vendor trips

Construction Off-road Equipment Mitigation - Tier 4 engines estimated

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tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
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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					
2021	4.9428	74.6629	29.0590	0.1433	20.7448	2.1515	22.8963	10.6483	1.9832	12.6315	0.0000	15,063.6027	15,063.6027	1.9428	0.0000	15,112.1730
Maximum	**4.9428**	**74.6629**	**29.0590**	**0.1433**	**20.7448**	**2.1515**	**22.8963**	**10.6483**	**1.9832**	**12.6315**	**0.0000**	**15,063.6027**	**15,063.6027**	**1.9428**	**0.0000**	**15,112.1730**

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					
2021	1.5201	36.1833	28.7738	0.1433	10.7417	0.1691	10.9108	5.1763	0.1644	5.3407	0.0000	15,063.6027	15,063.6027	1.9428	0.0000	15,112.1730
Maximum	**1.5201**	**36.1833**	**28.7738**	**0.1433**	**10.7417**	**0.1691**	**10.9108**	**5.1763**	**0.1644**	**5.3407**	**0.0000**	**15,063.6027**	**15,063.6027**	**1.9428**	**0.0000**	**15,112.1730**

	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	**69.25**	**51.54**	**0.98**	**0.00**	**48.22**	**92.14**	**52.35**	**51.39**	**91.71**	**57.72**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/1/2021	5/6/2021	5	90	
2	Grading	Grading	5/7/2021	6/3/2021	5	20	
3	Paving	Paving	6/4/2021	12/30/2021	5	150	

Acres of Grading (Grading Phase): 4

Acres of Paving: 4.12

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Paving	Cement and Mortar Mixers	2	6.00	9	0.56
Paving	Pavers	1	8.00	130	0.42
Paving	Paving Equipment	2	6.00	132	0.36
Paving	Rollers	2	6.00	80	0.38
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37

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
Site Preparation	7	18.00	2.00	12,069.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	15.00	2.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving	8	20.00	8.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

3.2 Site Preparation - 2021

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					18.1876	0.0000	18.1876	9.9491	0.0000	9.9491			0.0000			0.0000
Off-Road	3.8882	40.4971	21.1543	0.0380		2.0445	2.0445		1.8809	1.8809		3,685.6569	3,685.6569	1.1920		3,715.4573
Total	**3.8882**	**40.4971**	**21.1543**	**0.0380**	**18.1876**	**2.0445**	**20.2320**	**9.9491**	**1.8809**	**11.8300**		**3,685.6569**	**3,685.6569**	**1.1920**		**3,715.4573**

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	0.9730	33.9258	7.1814	0.1028	2.3433	0.1052	2.4484	0.6422	0.1006	0.7428		11,124.1256	11,124.1256	0.7421		11,142.6791
Vendor	5.5700e-003	0.1908	0.0453	5.1000e-004	0.0128	3.8000e-004	0.0132	3.6900e-003	3.7000e-004	4.0500e-003		54.4877	54.4877	3.3000e-003		54.5701
Worker	0.0760	0.0493	0.6781	2.0000e-003	0.2012	1.4800e-003	0.2027	0.0534	1.3600e-003	0.0547		199.3326	199.3326	5.3600e-003		199.4666
Total	**1.0546**	**34.1658**	**7.9048**	**0.1053**	**2.5573**	**0.1070**	**2.6643**	**0.6992**	**0.1023**	**0.8015**		**11,377.9459**	**11,377.9459**	**0.7508**		**11,396.7158**

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					8.1844	0.0000	8.1844	4.4771	0.0000	4.4771			0.0000			0.0000
Off-Road	0.4656	2.0175	20.8690	0.0380		0.0621	0.0621		0.0621	0.0621	0.0000	3,685.6569	3,685.6569	1.1920		3,715.4573
Total	**0.4656**	**2.0175**	**20.8690**	**0.0380**	**8.1844**	**0.0621**	**8.2465**	**4.4771**	**0.0621**	**4.5392**	**0.0000**	**3,685.6569**	**3,685.6569**	**1.1920**		**3,715.4573**

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	0.9730	33.9258	7.1814	0.1028	2.3433	0.1052	2.4484	0.6422	0.1006	0.7428		11,124.1256	11,124.1256	0.7421		11,142.6791
Vendor	5.5700e-003	0.1908	0.0453	5.1000e-004	0.0128	3.8000e-004	0.0132	3.6900e-003	3.7000e-004	4.0500e-003		54.4877	54.4877	3.3000e-003		54.5701
Worker	0.0760	0.0493	0.6781	2.0000e-003	0.2012	1.4800e-003	0.2027	0.0534	1.3600e-003	0.0547		199.3326	199.3326	5.3600e-003		199.4666
Total	**1.0546**	**34.1658**	**7.9048**	**0.1053**	**2.5573**	**0.1070**	**2.6643**	**0.6992**	**0.1023**	**0.8015**		**11,377.9459**	**11,377.9459**	**0.7508**		**11,396.7158**

3.3 Grading - 2021

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					6.2342	0.0000	6.2342	3.3331	0.0000	3.3331			0.0000			0.0000
Off-Road	2.2903	24.7367	15.8575	0.0296		1.1599	1.1599		1.0671	1.0671		2,871.9285	2,871.9285	0.9288		2,895.1495

Total	**2.2903**	**24.7367**	**15.8575**	**0.0296**	**6.2342**	**1.1599**	**7.3941**	**3.3331**	**1.0671**	**4.4003**		**2,871.9285**	**2,871.9285**	**0.9288**		**2,895.1495**

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	5.5700e-003	0.1908	0.0453	5.1000e-004	0.0128	3.8000e-004	0.0132	3.6900e-003	3.7000e-004	4.0500e-003		54.4877	54.4877	3.3000e-003		54.5701
Worker	0.0633	0.0411	0.5651	1.6700e-003	0.1677	1.2300e-003	0.1689	0.0445	1.1400e-003	0.0456		166.1105	166.1105	4.4700e-003		166.2222
Total	**0.0689**	**0.2318**	**0.6104**	**2.1800e-003**	**0.1805**	**1.6100e-003**	**0.1821**	**0.0482**	**1.5100e-003**	**0.0497**		**220.5982**	**220.5982**	**7.7700e-003**		**220.7923**

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					2.8054	0.0000	2.8054	1.4999	0.0000	1.4999			0.0000			0.0000
Off-Road	0.3632	1.5737	17.7527	0.0296		0.0484	0.0484		0.0484	0.0484	0.0000	2,871.9285	2,871.9285	0.9288		2,895.1495
Total	**0.3632**	**1.5737**	**17.7527**	**0.0296**	**2.8054**	**0.0484**	**2.8538**	**1.4999**	**0.0484**	**1.5483**	**0.0000**	**2,871.9285**	**2,871.9285**	**0.9288**		**2,895.1495**

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	5.5700e-003	0.1908	0.0453	5.1000e-004	0.0128	3.8000e-004	0.0132	3.6900e-003	3.7000e-004	4.0500e-003		54.4877	54.4877	3.3000e-003		54.5701
Worker	0.0633	0.0411	0.5651	1.6700e-003	0.1677	1.2300e-003	0.1689	0.0445	1.1400e-003	0.0456		166.1105	166.1105	4.4700e-003		166.2222
Total	**0.0689**	**0.2318**	**0.6104**	**2.1800e-003**	**0.1805**	**1.6100e-003**	**0.1821**	**0.0482**	**1.5100e-003**	**0.0497**		**220.5982**	**220.5982**	**7.7700e-003**		**220.7923**

3.4 Paving - 2021

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	1.0940	10.8399	12.2603	0.0189		0.5788	0.5788		0.5342	0.5342		1,804.5523	1,804.5523	0.5670		1,818.7270
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**1.0940**	**10.8399**	**12.2603**	**0.0189**		**0.5788**	**0.5788**		**0.5342**	**0.5342**		**1,804.5523**	**1,804.5523**	**0.5670**		**1,818.7270**

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	0.0223	0.7630	0.1811	2.0400e-003	0.0512	1.5400e-003	0.0527	0.0147	1.4700e-003	0.0162		217.9508	217.9508	0.0132		218.2804
Worker	0.0844	0.0548	0.7535	2.2200e-003	0.2236	1.6500e-003	0.2252	0.0593	1.5200e-003	0.0608		221.4807	221.4807	5.9600e-003		221.6296
Total	**0.1067**	**0.8178**	**0.9345**	**4.2600e-003**	**0.2748**	**3.1900e-003**	**0.2779**	**0.0740**	**2.9900e-003**	**0.0770**		**439.4314**	**439.4314**	**0.0191**		**439.9099**

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	0.2194	0.9509	13.5323	0.0189		0.0293	0.0293		0.0293	0.0293	0.0000	1,804.5523	1,804.5523	0.5670		1,818.7270
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.2194**	**0.9509**	**13.5323**	**0.0189**		**0.0293**	**0.0293**		**0.0293**	**0.0293**	**0.0000**	**1,804.5523**	**1,804.5523**	**0.5670**		**1,818.7270**

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	0.0223	0.7630	0.1811	2.0400e-003	0.0512	1.5400e-003	0.0527	0.0147	1.4700e-003	0.0162		217.9508	217.9508	0.0132		218.2804
Worker	0.0844	0.0548	0.7535	2.2200e-003	0.2236	1.6500e-003	0.2252	0.0593	1.5200e-003	0.0608		221.4807	221.4807	5.9600e-003		221.6296
Total	**0.1067**	**0.8178**	**0.9345**	**4.2600e-003**	**0.2748**	**3.1900e-003**	**0.2779**	**0.0740**	**2.9900e-003**	**0.0770**		**439.4314**	**439.4314**	**0.0191**		**439.9099**

Carbon Canyon Channel

South Coast AQMD Air District, Winter

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	179.65	1000sqft	4.12	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	31
Climate Zone	10			**Operational Year**	2022
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Construction Phase - Project duration as stated

Off-road Equipment - Equipment as estimated

Trips and VMT - Water truck and cement truck trips in vendor trips

Construction Off-road Equipment Mitigation - Tier 4 engines estimated

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00
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	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	8.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	8.00	20.00
tblConstructionPhase	NumDays	18.00	150.00
tblConstructionPhase	NumDays	5.00	90.00
tblGrading	AcresOfGrading	10.00	4.00
tblGrading	MaterialExported	0.00	96,551.00
tblLandUse	LandUseSquareFeet	179,650.00	0.00
tblTripsAndVMT	VendorTripNumber	0.00	2.00
tblTripsAndVMT	VendorTripNumber	0.00	2.00
tblTripsAndVMT	VendorTripNumber	0.00	8.00

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					
2021	4.9778	75.0704	29.5236	0.1413	20.7448	2.1531	22.8979	10.6483	1.9848	12.6330	0.0000	14,843.3464	14,843.3464	1.9741	0.0000	14,892.6973
Maximum	**4.9778**	**75.0704**	**29.5236**	**0.1413**	**20.7448**	**2.1531**	**22.8979**	**10.6483**	**1.9848**	**12.6330**	**0.0000**	**14,843.3464**	**14,843.3464**	**1.9741**	**0.0000**	**14,892.6973**

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					
2021	1.5552	36.5908	29.2383	0.1413	10.7417	0.1707	10.9124	5.1763	0.1660	5.3422	0.0000	14,843.3464	14,843.3464	1.9741	0.0000	14,892.6973
Maximum	**1.5552**	**36.5908**	**29.2383**	**0.1413**	**10.7417**	**0.1707**	**10.9124**	**5.1763**	**0.1660**	**5.3422**	**0.0000**	**14,843.3464**	**14,843.3464**	**1.9741**	**0.0000**	**14,892.6973**

	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	**68.76**	**51.26**	**0.97**	**0.00**	**48.22**	**92.07**	**52.34**	**51.39**	**91.64**	**57.71**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/1/2021	5/6/2021	5	90	
2	Grading	Grading	5/7/2021	6/3/2021	5	20	
3	Paving	Paving	6/4/2021	12/30/2021	5	150	

Acres of Grading (Grading Phase): 4

Acres of Paving: 4.12

<u>OffRoad Equipment</u>

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Paving	Cement and Mortar Mixers	2	6.00	9	0.56
Paving	Pavers	1	8.00	130	0.42
Paving	Paving Equipment	2	6.00	132	0.36
Paving	Rollers	2	6.00	80	0.38
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37

<u>Trips and VMT</u>

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
Site Preparation	7	18.00	2.00	12,069.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Grading	6	15.00	2.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving	8	20.00	8.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

3.2 Site Preparation - 2021

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					18.1876	0.0000	18.1876	9.9491	0.0000	9.9491			0.0000			0.0000
Off-Road	3.8882	40.4971	21.1543	0.0380		2.0445	2.0445		1.8809	1.8809		3,685.6569	3,685.6569	1.1920		3,715.4573
Total	**3.8882**	**40.4971**	**21.1543**	**0.0380**	**18.1876**	**2.0445**	**20.2320**	**9.9491**	**1.8809**	**11.8300**		**3,685.6569**	**3,685.6569**	**1.1920**		**3,715.4573**

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	1.0008	34.3292	7.7093	0.1009	2.3433	0.1068	2.4500	0.6422	0.1021	0.7443		10,918.3593	10,918.3593	0.7735		10,937.6964
Vendor	5.8600e-003	0.1902	0.0507	5.0000e-004	0.0128	4.0000e-004	0.0132	3.6900e-003	3.8000e-004	4.0600e-003		52.9100	52.9100	3.5400e-003		52.9985
Worker	0.0830	0.0539	0.6094	1.8700e-003	0.2012	1.4800e-003	0.2027	0.0534	1.3600e-003	0.0547		186.4202	186.4202	5.0000e-003		186.5451
Total	**1.0896**	**34.5733**	**8.3693**	**0.1032**	**2.5573**	**0.1086**	**2.6659**	**0.6992**	**0.1039**	**0.8031**		**11,157.6895**	**11,157.6895**	**0.7820**		**11,177.2400**

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					8.1844	0.0000	8.1844	4.4771	0.0000	4.4771			0.0000			0.0000
Off-Road	0.4656	2.0175	20.8690	0.0380		0.0621	0.0621		0.0621	0.0621	0.0000	3,685.6569	3,685.6569	1.1920		3,715.4573
Total	**0.4656**	**2.0175**	**20.8690**	**0.0380**	**8.1844**	**0.0621**	**8.2465**	**4.4771**	**0.0621**	**4.5392**	**0.0000**	**3,685.6569**	**3,685.6569**	**1.1920**		**3,715.4573**

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	1.0008	34.3292	7.7093	0.1009	2.3433	0.1068	2.4500	0.6422	0.1021	0.7443		10,918.3593	10,918.3593	0.7735		10,937.6964
Vendor	5.8600e-003	0.1902	0.0507	5.0000e-004	0.0128	4.0000e-004	0.0132	3.6900e-003	3.8000e-004	4.0600e-003		52.9100	52.9100	3.5400e-003		52.9985
Worker	0.0830	0.0539	0.6094	1.8700e-003	0.2012	1.4800e-003	0.2027	0.0534	1.3600e-003	0.0547		186.4202	186.4202	5.0000e-003		186.5451
Total	**1.0896**	**34.5733**	**8.3693**	**0.1032**	**2.5573**	**0.1086**	**2.6659**	**0.6992**	**0.1039**	**0.8031**		**11,157.6895**	**11,157.6895**	**0.7820**		**11,177.2400**

3.3 Grading - 2021

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					6.2342	0.0000	6.2342	3.3331	0.0000	3.3331			0.0000			0.0000
Off-Road	2.2903	24.7367	15.8575	0.0296		1.1599	1.1599		1.0671	1.0671		2,871.9285	2,871.9285	0.9288		2,895.1495

Total	**2.2903**	**24.7367**	**15.8575**	**0.0296**	**6.2342**	**1.1599**	**7.3941**	**3.3331**	**1.0671**	**4.4003**		**2,871.9285**	**2,871.9285**	**0.9288**		**2,895.1495**

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	5.8600e-003	0.1902	0.0507	5.0000e-004	0.0128	4.0000e-004	0.0132	3.6900e-003	3.8000e-004	4.0600e-003		52.9100	52.9100	3.5400e-003		52.9985
Worker	0.0692	0.0450	0.5078	1.5600e-003	0.1677	1.2300e-003	0.1689	0.0445	1.1400e-003	0.0456		155.3502	155.3502	4.1600e-003		155.4543
Total	**0.0750**	**0.2351**	**0.5585**	**2.0600e-003**	**0.1805**	**1.6300e-003**	**0.1821**	**0.0482**	**1.5200e-003**	**0.0497**		**208.2602**	**208.2602**	**7.7000e-003**		**208.4528**

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					2.8054	0.0000	2.8054	1.4999	0.0000	1.4999			0.0000			0.0000
Off-Road	0.3632	1.5737	17.7527	0.0296		0.0484	0.0484		0.0484	0.0484	0.0000	2,871.9285	2,871.9285	0.9288		2,895.1495
Total	**0.3632**	**1.5737**	**17.7527**	**0.0296**	**2.8054**	**0.0484**	**2.8538**	**1.4999**	**0.0484**	**1.5483**	**0.0000**	**2,871.9285**	**2,871.9285**	**0.9288**		**2,895.1495**

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	5.8600e-003	0.1902	0.0507	5.0000e-004	0.0128	4.0000e-004	0.0132	3.6900e-003	3.8000e-004	4.0600e-003		52.9100	52.9100	3.5400e-003		52.9985
Worker	0.0692	0.0450	0.5078	1.5600e-003	0.1677	1.2300e-003	0.1689	0.0445	1.1400e-003	0.0456		155.3502	155.3502	4.1600e-003		155.4543
Total	**0.0750**	**0.2351**	**0.5585**	**2.0600e-003**	**0.1805**	**1.6300e-003**	**0.1821**	**0.0482**	**1.5200e-003**	**0.0497**		**208.2602**	**208.2602**	**7.7000e-003**		**208.4528**

3.4 Paving - 2021

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	1.0940	10.8399	12.2603	0.0189		0.5788	0.5788		0.5342	0.5342		1,804.5523	1,804.5523	0.5670		1,818.7270
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**1.0940**	**10.8399**	**12.2603**	**0.0189**		**0.5788**	**0.5788**		**0.5342**	**0.5342**		**1,804.5523**	**1,804.5523**	**0.5670**		**1,818.7270**

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	0.0234	0.7606	0.2026	1.9800e-003	0.0512	1.5900e-003	0.0528	0.0147	1.5200e-003	0.0163		211.6402	211.6402	0.0142		211.9942
Worker	0.0922	0.0599	0.6771	2.0800e-003	0.2236	1.6500e-003	0.2252	0.0593	1.5200e-003	0.0608		207.1336	207.1336	5.5500e-003		207.2724
Total	**0.1157**	**0.8205**	**0.8797**	**4.0600e-003**	**0.2748**	**3.2400e-003**	**0.2780**	**0.0740**	**3.0400e-003**	**0.0771**		**418.7737**	**418.7737**	**0.0197**		**419.2665**

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	0.2194	0.9509	13.5323	0.0189		0.0293	0.0293		0.0293	0.0293	0.0000	1,804.5523	1,804.5523	0.5670		1,818.7270
Paving	0.0000					0.0000	0.0000		0.0000	0.0000			0.0000			0.0000
Total	**0.2194**	**0.9509**	**13.5323**	**0.0189**		**0.0293**	**0.0293**		**0.0293**	**0.0293**	**0.0000**	**1,804.5523**	**1,804.5523**	**0.5670**		**1,818.7270**

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	0.0234	0.7606	0.2026	1.9800e-003	0.0512	1.5900e-003	0.0528	0.0147	1.5200e-003	0.0163		211.6402	211.6402	0.0142		211.9942
Worker	0.0922	0.0599	0.6771	2.0800e-003	0.2236	1.6500e-003	0.2252	0.0593	1.5200e-003	0.0608		207.1336	207.1336	5.5500e-003		207.2724
Total	**0.1157**	**0.8205**	**0.8797**	**4.0600e-003**	**0.2748**	**3.2400e-003**	**0.2780**	**0.0740**	**3.0400e-003**	**0.0771**		**418.7737**	**418.7737**	**0.0197**		**419.2665**

Carbon Canyon Channel

South Coast AQMD Air District, Annual

1.0 Project Characteristics

1.1 Land Usage

Land Uses	Size	Metric	Lot Acreage	Floor Surface Area	Population
Other Non-Asphalt Surfaces	179.65	1000sqft	4.12	0.00	0

1.2 Other Project Characteristics

Urbanization	Urban	**Wind Speed (m/s)**	2.2	**Precipitation Freq (Days)**	31
Climate Zone	10			**Operational Year**	2022
Utility Company	Southern California Edison				
CO2 Intensity (lb/MWhr)	702.44	**CH4 Intensity (lb/MWhr)**	0.029	**N2O Intensity (lb/MWhr)**	0.006

1.3 User Entered Comments & Non-Default Data

Project Characteristics -

Construction Phase - Project duration as stated

Off-road Equipment - Equipment as estimated

Trips and VMT - Water truck and cement truck trips in vendor trips

Construction Off-road Equipment Mitigation - Tier 4 engines estimated

Table Name	Column Name	Default Value	New Value
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	2.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	1.00

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	4.00
tblConstEquipMitigation	NumberOfEquipmentMitigated	0.00	8.00
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstEquipMitigation	Tier	No Change	Tier 4 Final
tblConstructionPhase	NumDays	8.00	20.00
tblConstructionPhase	NumDays	18.00	150.00
tblConstructionPhase	NumDays	5.00	90.00
tblGrading	AcresOfGrading	10.00	4.00
tblGrading	MaterialExported	0.00	96,551.00
tblLandUse	LandUseSquareFeet	179,650.00	0.00
tblTripsAndVMT	VendorTripNumber	0.00	2.00
tblTripsAndVMT	VendorTripNumber	0.00	2.00
tblTripsAndVMT	VendorTripNumber	0.00	8.00

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					
2021	0.3365	4.5317	2.4663	8.4500e-003	1.0160	0.1521	1.1681	0.5180	0.1403	0.6582	0.0000	790.7334	790.7334	0.1282	0.0000	793.9395
Maximum	**0.3365**	**4.5317**	**2.4663**	**8.4500e-003**	**1.0160**	**0.1521**	**1.1681**	**0.5180**	**0.1403**	**0.6582**	**0.0000**	**790.7334**	**790.7334**	**0.1282**	**0.0000**	**793.9395**

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					
2021	0.0976	1.8268	2.5679	8.4500e-003	0.5316	0.0106	0.5421	0.2534	0.0104	0.2638	0.0000	790.7330	790.7330	0.1282	0.0000	793.9391
Maximum	**0.0976**	**1.8268**	**2.5679**	**8.4500e-003**	**0.5316**	**0.0106**	**0.5421**	**0.2534**	**0.0104**	**0.2638**	**0.0000**	**790.7330**	**790.7330**	**0.1282**	**0.0000**	**793.9391**

	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	**70.99**	**59.69**	**-4.12**	**0.00**	**47.68**	**93.05**	**53.59**	**51.08**	**92.62**	**59.93**	**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)**
6	**12-3-2020**	**3-2-2021**	1.7439	0.8310
7	**3-3-2021**	**6-2-2021**	2.1161	0.9014
8	**6-3-2021**	**9-2-2021**	0.4277	0.0689
9	**9-3-2021**	**9-30-2021**	0.1286	0.0209
		Highest	2.1161	0.9014

3.0 Construction Detail

Construction Phase

Phase Number	Phase Name	Phase Type	Start Date	End Date	Num Days Week	Num Days	Phase Description
1	Site Preparation	Site Preparation	1/1/2021	5/6/2021	5	90	
2	Grading	Grading	5/7/2021	6/3/2021	5	20	
3	Paving	Paving	6/4/2021	12/30/2021	5	150	

Acres of Grading (Grading Phase): 4

Acres of Paving: 4.12

OffRoad Equipment

Phase Name	Offroad Equipment Type	Amount	Usage Hours	Horse Power	Load Factor
Site Preparation	Rubber Tired Dozers	3	8.00	247	0.40
Site Preparation	Tractors/Loaders/Backhoes	4	8.00	97	0.37
Grading	Excavators	1	8.00	158	0.38
Grading	Graders	1	8.00	187	0.41
Grading	Rubber Tired Dozers	1	8.00	247	0.40
Grading	Tractors/Loaders/Backhoes	3	8.00	97	0.37
Paving	Cement and Mortar Mixers	2	6.00	9	0.56
Paving	Pavers	1	8.00	130	0.42
Paving	Paving Equipment	2	6.00	132	0.36
Paving	Rollers	2	6.00	80	0.38
Paving	Tractors/Loaders/Backhoes	1	8.00	97	0.37

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
Site Preparation	7	18.00	2.00	12,069.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

Grading		6	15.00	2.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT
Paving		8	20.00	8.00	0.00	14.70	6.90	20.00	LD_Mix	HDT_Mix	HHDT

3.1 Mitigation Measures Construction

Use Cleaner Engines for Construction Equipment

Water Exposed Area

3.2 Site Preparation - 2021

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					0.8184	0.0000	0.8184	0.4477	0.0000	0.4477	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.1750	1.8224	0.9519	1.7100e-003		0.0920	0.0920		0.0846	0.0846	0.0000	150.4607	150.4607	0.0487	0.0000	151.6773
Total	**0.1750**	**1.8224**	**0.9519**	**1.7100e-003**	**0.8184**	**0.0920**	**0.9104**	**0.4477**	**0.0846**	**0.5324**	**0.0000**	**150.4607**	**150.4607**	**0.0487**	**0.0000**	**151.6773**

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	0.0443	1.5727	0.3335	4.5900e-003	0.1038	4.7600e-003	0.1085	0.0285	4.5600e-003	0.0330	0.0000	450.5956	450.5956	0.0309	0.0000	451.3670
Vendor	2.6000e-004	8.7100e-003	2.1600e-003	2.0000e-005	5.7000e-004	2.0000e-005	5.8000e-004	1.6000e-004	2.0000e-005	1.8000e-004	0.0000	2.1973	2.1973	1.4000e-004	0.0000	2.2008
Worker	3.3800e-003	2.5000e-003	0.0282	9.0000e-005	8.8900e-003	7.0000e-005	8.9500e-003	2.3600e-003	6.0000e-005	2.4200e-003	0.0000	7.7409	7.7409	2.1000e-004	0.0000	7.7460

Total	0.0480	1.5839	0.3639	4.7000e-003	0.1132	4.8500e-003	0.1180	0.0310	4.6400e-003	0.0356	0.0000	460.5338	460.5338	0.0312	0.0000	461.3138

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					0.3683	0.0000	0.3683	0.2015	0.0000	0.2015	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0210	0.0908	0.9391	1.7100e-003		2.7900e-003	2.7900e-003		2.7900e-003	2.7900e-003	0.0000	150.4606	150.4606	0.0487	0.0000	151.6771
Total	**0.0210**	**0.0908**	**0.9391**	**1.7100e-003**	**0.3683**	**2.7900e-003**	**0.3711**	**0.2015**	**2.7900e-003**	**0.2043**	**0.0000**	**150.4606**	**150.4606**	**0.0487**	**0.0000**	**151.6771**

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	0.0443	1.5727	0.3335	4.5900e-003	0.1038	4.7600e-003	0.1085	0.0285	4.5600e-003	0.0330	0.0000	450.5956	450.5956	0.0309	0.0000	451.3670
Vendor	2.6000e-004	8.7100e-003	2.1600e-003	2.0000e-005	5.7000e-004	2.0000e-005	5.8000e-004	1.6000e-004	2.0000e-005	1.8000e-004	0.0000	2.1973	2.1973	1.4000e-004	0.0000	2.2008
Worker	3.3800e-003	2.5000e-003	0.0282	9.0000e-005	8.8900e-003	7.0000e-005	8.9500e-003	2.3600e-003	6.0000e-005	2.4200e-003	0.0000	7.7409	7.7409	2.1000e-004	0.0000	7.7460
Total	**0.0480**	**1.5839**	**0.3639**	**4.7000e-003**	**0.1132**	**4.8500e-003**	**0.1180**	**0.0310**	**4.6400e-003**	**0.0356**	**0.0000**	**460.5338**	**460.5338**	**0.0312**	**0.0000**	**461.3138**

3.3 Grading - 2021

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					0.0623	0.0000	0.0623	0.0333	0.0000	0.0333	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	0.0229	0.2474	0.1586	3.0000e-004		0.0116	0.0116		0.0107	0.0107	0.0000	26.0537	26.0537	8.4300e-003	0.0000	26.2644
Total	**0.0229**	**0.2474**	**0.1586**	**3.0000e-004**	**0.0623**	**0.0116**	**0.0739**	**0.0333**	**0.0107**	**0.0440**	**0.0000**	**26.0537**	**26.0537**	**8.4300e-003**	**0.0000**	**26.2644**

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	6.0000e-005	1.9400e-003	4.8000e-004	1.0000e-005	1.3000e-004	0.0000	1.3000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.4883	0.4883	3.0000e-005	0.0000	0.4891
Worker	6.3000e-004	4.6000e-004	5.2300e-003	2.0000e-005	1.6500e-003	1.0000e-005	1.6600e-003	4.4000e-004	1.0000e-005	4.5000e-004	0.0000	1.4335	1.4335	4.0000e-005	0.0000	1.4345
Total	**6.9000e-004**	**2.4000e-003**	**5.7100e-003**	**3.0000e-005**	**1.7800e-003**	**1.0000e-005**	**1.7900e-003**	**4.8000e-004**	**1.0000e-005**	**4.9000e-004**	**0.0000**	**1.9218**	**1.9218**	**7.0000e-005**	**0.0000**	**1.9235**

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					

Category	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
Fugitive Dust					0.0281	0.0000	0.0281	0.0150	0.0000	0.0150	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Off-Road	3.6300e-003	0.0157	0.1775	3.0000e-004		4.8000e-004	4.8000e-004		4.8000e-004	4.8000e-004	0.0000	26.0537	26.0537	8.4300e-003	0.0000	26.2643
Total	**3.6300e-003**	**0.0157**	**0.1775**	**3.0000e-004**	**0.0281**	**4.8000e-004**	**0.0285**	**0.0150**	**4.8000e-004**	**0.0155**	**0.0000**	**26.0537**	**26.0537**	**8.4300e-003**	**0.0000**	**26.2643**

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	6.0000e-005	1.9400e-003	4.8000e-004	1.0000e-005	1.3000e-004	0.0000	1.3000e-004	4.0000e-005	0.0000	4.0000e-005	0.0000	0.4883	0.4883	3.0000e-005	0.0000	0.4891
Worker	6.3000e-004	4.6000e-004	5.2300e-003	2.0000e-005	1.6500e-003	1.0000e-005	1.6600e-003	4.4000e-004	1.0000e-005	4.5000e-004	0.0000	1.4335	1.4335	4.0000e-005	0.0000	1.4345
Total	**6.9000e-004**	**2.4000e-003**	**5.7100e-003**	**3.0000e-005**	**1.7800e-003**	**1.0000e-005**	**1.7900e-003**	**4.8000e-004**	**1.0000e-005**	**4.9000e-004**	**0.0000**	**1.9218**	**1.9218**	**7.0000e-005**	**0.0000**	**1.9235**

3.4 Paving - 2021

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	0.0821	0.8130	0.9195	1.4200e-003		0.0434	0.0434		0.0401	0.0401	0.0000	122.7797	122.7797	0.0386	0.0000	123.7441
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0821**	**0.8130**	**0.9195**	**1.4200e-003**		**0.0434**	**0.0434**		**0.0401**	**0.0401**	**0.0000**	**122.7797**	**122.7797**	**0.0386**	**0.0000**	**123.7441**

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	1.7100e-003	0.0581	0.0144	1.5000e-004	3.7800e-003	1.2000e-004	3.9000e-003	1.0900e-003	1.1000e-004	1.2000e-003	0.0000	14.6488	14.6488	9.3000e-004	0.0000	14.6720
Worker	6.2500e-003	4.6200e-003	0.0523	1.6000e-004	0.0165	1.2000e-004	0.0166	4.3700e-003	1.1000e-004	4.4800e-003	0.0000	14.3349	14.3349	3.8000e-004	0.0000	14.3445
Total	**7.9600e-003**	**0.0627**	**0.0667**	**3.1000e-004**	**0.0202**	**2.4000e-004**	**0.0205**	**5.4600e-003**	**2.2000e-004**	**5.6800e-003**	**0.0000**	**28.9837**	**28.9837**	**1.3100e-003**	**0.0000**	**29.0165**

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	0.0165	0.0713	1.0149	1.4200e-003		2.1900e-003	2.1900e-003		2.1900e-003	2.1900e-003	0.0000	122.7795	122.7795	0.0386	0.0000	123.7440
Paving	0.0000					0.0000	0.0000		0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Total	**0.0165**	**0.0713**	**1.0149**	**1.4200e-003**		**2.1900e-003**	**2.1900e-003**		**2.1900e-003**	**2.1900e-003**	**0.0000**	**122.7795**	**122.7795**	**0.0386**	**0.0000**	**123.7440**

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	1.7100e-003	0.0581	0.0144	1.5000e-004	3.7800e-003	1.2000e-004	3.9000e-003	1.0900e-003	1.1000e-004	1.2000e-003	0.0000	14.6488	14.6488	9.3000e-004	0.0000	14.6720
Worker	6.2500e-003	4.6200e-003	0.0523	1.6000e-004	0.0165	1.2000e-004	0.0166	4.3700e-003	1.1000e-004	4.4800e-003	0.0000	14.3349	14.3349	3.8000e-004	0.0000	14.3445
Total	**7.9600e-003**	**0.0627**	**0.0667**	**3.1000e-004**	**0.0202**	**2.4000e-004**	**0.0205**	**5.4600e-003**	**2.2000e-004**	**5.6800e-003**	**0.0000**	**28.9837**	**28.9837**	**1.3100e-003**	**0.0000**	**29.0165**

Appendix C

Carbon Canyon Channel Habitat Assessment

Carbon Canyon Channel
Habitat Assessment
Chino Hills, San Bernardino County, California

Prepared for:

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December 2019

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1.0 INTRODUCTION

This report represents findings from a habitat assessment and vegetation mapping conducted for the proposed Carbon Canyon Channel Flood Control Improvement Project (Project) in Chino Hills, California in San Bernardino County (Figure 1). The report has been prepared for San Bernardino County Department of Public Works and Tetra Tech to assess the potential for sensitive species of plant and wildlife to occur on the Project site and the effect of project-related activities on sensitive species.

1.1 Project Location

The proposed Project is for the improvement to the existing Carbon Canyon Channel, located within Section 36, Township 2 South, and Range 8 West of the Prado Dam USGS 7.5-minute topographic quadrangle map. The total Project site encompasses 0.61 miles of the channel (approximately 14.39 acres). The Project is situated within the Santa Ana River watershed. Carbon Canyon Channel (and English Channel which joins from the northwest) is part of Little Chino Creek which flows into Chino Creek which, in turn, flows into the Santa Ana River.

The Project area is located west of the intersection of Highway 71 and Pipeline Avenue, north of Chino Hills Parkway, and south of Eucalyptus Avenue (Figure 2). The Project site also has two construction staging areas: one adjacent to the channel area just north of Maywood Drive, and a smaller adjacent staging area north of Velvet Street.

The Project site is surrounded primarily by suburban/urban development. Private residences are located along the northern and southern boundaries with a few business centers near the western and eastern boundaries.

Chino Hills State Park is approximately three miles south of the Project. Critical habitat for least Bell's vireo, a federal and state listed as endangered bird, is just west and south of the Project. California gnatcatcher critical habitat is approximately 3 miles south of the Project and southwestern willow flycatcher critical habitat is approximately 2 miles southeast of the Project (Figure 1).

1.2 Project Description

San Bernardino County Flood Control District is proposing to improve Carbon Canyon Channel from an interim to an ultimate condition channel to decrease the chances of flooding during a 100-year storm event by improving the capacity and conveyance of the County-maintained facility. Currently, Carbon Canyon Channel is a trapezoidal shaped earthen channel with grouted rock side slopes and a rocky invert. The Project will consist of the construction of a trapezoidal channel with articulating block invert with hardened side walls. The improved channel will replace an undersized earthen channel. The new channel will include transitional structures to join it with existing concrete structures at both ends of the new channel, and with the existing earthen channel that is English Channel, which joins from the northwest.

1.3 Study Area

The study area for the habitat assessment includes the entirety of the proposed Project site including the laydown (staging) areas and a 150-meter buffer where access was permissible due to private properties surrounding the Project site.

2.0 METHODS

2.1 Desktop Review

Prior to conducting the habitat assessment, a desktop review of data sources and literature review was conducted to determine the potential occurrence of special-status wildlife, plant species, and ecological communities in the vicinity of the Project site. The desktop review included the following sources:

- Natural Resource Conservation Service (NRCS) Soil Survey Geographic (SSURGO) Database (NRCS 2019);
- US Geological Survey (USGS) National Hydrography Dataset (NHD) (USGS 2019);
- National Wetlands Inventory Wetlands Mapper (USFWS 2019);
- California Natural Diversity Data Base (CNDDB) California Department of Fish and Wildlife (CDFW 2019);
- California Native Plant Society's (CNPS) Online Inventory of Rare and Endangered Plants (CNPS 2019a);
- Manual of California Vegetation Online (CNPS 2019b, Sawyer et al. 2009);
- National Center for Environmental Information at the National Oceanic and Atmospheric Administration (NCEI-NOAA 2019);
- 7.5' USGS topographic quadrangles; and
- Previous survey report conducted on the project site (AMEC 2016).

2.2 Survey Method

On May 24, 2019, Ironwood biologists Kelsi Black and Lehong Chow conducted a habitat assessment of the Carbon Canyon Channel. Meandering pedestrian transects were conducted throughout the Project boundary and a 150-meter buffer, where possible, documenting vegetation and species encountered and mapping vegetation communities on aerial images.

3.0 ENVIRONMENTAL SETTING

3.1 Precipitation

Precipitation data was obtained from the NCEI-NOAA (2019) for the most proximate station to the study area, which is located at the Chino Airport, approximately 4 miles east.

Historical rainfall data from 2009 to 2019 were totaled and averaged for the winter (October through March) and summer (April through September) periods (Table 1) (rainfall seasons run from October through September of the following year). In the last decade, the 2019 season up through May of 2019 has already been the wettest precipitation year, with May 2019 being the wettest summer month on record in the last decade.

Table 1. Regional Rainfall Totals Since 2009

	Precipitation (inches)	
Year	**Winter (October to March)**	**Summer (April to September)**
2009	5.72	0
2010	11.47	0.51
2011	9.35	0.36
2012	4.2	0.63
2013	2.46	0.42
2014	2.02	0.44
2015	7.21	2.87
2016	4.59	0.25
2017	14.55	0.82
2018	2.27	0.12
2019	15.63	1.13 (April-May)

Source: NCEI-NOAA 2019, Chino Airport Weather Station.

3.2 Hydrology

The proposed Project is located within the South Coast hydrologic region, in the Santa Ana River watershed, which covers approximately 1.8 million acres (2,800 square miles) in southwestern California (Figure 3). The study area is along Carbon Canyon Channel of Little Chino Creek, approximately 0.4 miles west of Chino Creek (Figure 3). Chino Creek drains into the Santa Ana River approximately 7.1 miles to the south of the study area. The Santa Ana River then drains into the Pacific Ocean approximately 28 miles southwest of the study area. Flowing water was present in Little Chino Creek within the study area during the survey.

The National Wetland Inventory (USFWS 2019) indicates that there is potential for freshwater emergent (PEM1C) wetlands along the extent of the study area, and riverine wetlands (R5UBF) near the western boundary of the study area (Figure 4).

The entirety of Carbon Canyon Channel of Little Chino Creek within the study area has been manipulated and channelized. It is described as a trapezoidal-shaped earthen channel with grouted rock side slopes and a rocky invert.

3.3 Soils

The soil within the Project area is primarily Sorrento clay loam, 2 to 9 percent (Figure 5). The Sorrento soil series consists of very deep, well drained soils that formed in alluvium mostly from sedimentary rock. They are typically on alluvial fans and stabilized floodplains and have slopes that range from 0 to 15 percent (NRCS 2019). Within the study area, the slope ranges from 0 to 9 percent and within the buffer area, the slope ranges from 0 to 2 percent.

Soils that have been mapped within the Project buffer area includes Sorrento clay loam and Chualar clay. The Chualar soil series consists of well drained soils that formed from granitic and schistose rocks on alluvial fans and terraces. (NRCS 2019). Slopes within the Project area range from 0 to 9 percent, but within the buffer of the project ranges from 0 to 2 percent.

4.0 RESULTS

4.1 Weather Conditions

Weather conditions during the habitat assessment were 74 to 77 degrees Fahrenheit with 15 percent cloud cover and mild winds of 2 to 4 miles per hour. Visibility was good for the entirety of the habitat assessment.

4.2 General Habitat Description

Just northwest of the Project area is a recreational field with irrigated grass and ornamentals plants that border Little Chino Creek (including the English Channel portion of the Creek). This portion of Little Chino Creek consists of native freshwater marsh with willows and bulrush, which becomes less dense as it approaches the Project boundary. At the western end of the Project boundary, only a few branches of a willow fall within the Project boundary where maintenance activities in the channel have precluded the establishment of habitat. At the western confluence of the Project area (Carbon Canyon Channel) with English Channel, there is a small patch of still green bulrush and cattails.

Southwest of the confluence, there are sparse patches of disturbed non-native grassland and even sparser freshwater marsh that that has been unable to fully establish due to existing conditions. The water here is slightly more brackish and there are more rocky breaks in the channel.

East of the confluence, heading into the main part of the channel, the patches of freshwater marsh and grassland become a little more evident although still disturbed and sparse. Water becomes clearer to the east and crayfish, green sunfish, tadpoles, and a red-eared slider were observed. One staging area is at the western end of the Project and consists of non-native grassland with a few mustards and thistles interspersed. The second staging area is closer to the east end of the Project and is fully disturbed with no discernable vegetation. At the end of the eastern project boundary, there is a concrete drop-off where Chino Creek continues to the east. Vegetation communities are depicted in Figures 6a through 6c.

4.3 Wildlife

No special status wildlife species were observed within the Project boundaries. In the buffer area, approximately 150 feet west of the project boundary in the English Channel where vegetation is slightly dense, a male least bell's vireo was observed singing (Figure 7).

Other wildlife species observed within the Project area and its environs are summarized in Table 2.

Table 2. Wildlife Species Observations

Common Name	Scientific Name
Fish	
green sunfish	*Lepomis cyanellus*
Amphibians and Reptiles	
red-eared slider	*Trachemys scripta elegans*
western toad	*Anaxyrus boreas*
Birds	
Allen's hummingbird	*Selasphorus sasin*
American crow	*Corvus brachyrhynchos*
American goldfinch	*Spinus tristis*
Anna's hummingbird	*Calypte anna*
barn swallow	*Hirundo rustica*
black phoebe	*Sayornis nigricans*
brewer's blackbird	*Euphagus cyanocephalus*
brown-headed cowbird	*Molothrus ater*
bushtit	*Psaltriparus minimus*
cliff swallow	*Petrochelidon pyrrhonota*
common raven	*Corvus corax*
common yellowthroat	*Geothlypis trichas*
Cooper's hawk	*Accipiter cooperii*
eurasian starling	*Sturnus vulgaris*
great blue heron	*Area herodias*
hooded oriole	*Icterus cucullatus*
house finch	*Haemorhous mexicanus*
house sparrow	*Passer domesticus*
killdeer	*Charadrius vociferus*
least Bell's vireo	***Vireo bellii pusillus***
lesser goldfinch	*Spinus psaltria*
mallard	*Anas platyrhynchos*
mourning dove	*Zenaida macroura*
northern mockingbird	*Mimus polyglottos*
northern rough-winged swallow	*Stelgidopteryx serripennis*
nutmeg manakin	*Lonchura punctulata*
Nuttall's woodpecker	*Picoides nuttallii*
pin-tailed whydah	*Vidua macroura*
red-tailed hawk	*Buteo jamaicensis*
Say's phoebe	*Sayornis saya*
song sparrow	*Melospiza melodia*
western bluebird	*Sialia mexicana*
white-crowned sparrow	*Zonotrichia leucophrys*
yellow warbler	*Setophaga petechia*

***BOLD** = sensitive species*

4.4 Plants

No special status plants were observed within the Study Area. Very few annuals were recorded during this survey and all were identifiable as common species. However, a 100 percent coverage survey was not completed, and timing may not have been ideal for detecting some annual plants. The list of all observed plants throughout the study area is found in Table 3.

Table 3. Plants Species Observations

Scientific Name	Common Name	Family
**Bromus rubens*	red brome	Poaceae
Brassica sp.	mustard	Brassicaceae
Ceratophyllum demersum	coon's tail mats	Ceratophyllaceae
Cirsium sp.	common thistle	Asteraceae
Juncus xiphioides	Irish leaved rush	Juncaceae
Leptochloa fusca ssp uninervia	Mexican sprangletop	Poaceae
Nasturtium officinale	watercress	Brassicaceae
**Polypogon maritimus*	mediterranean beardgrass	Poaceae
Schoenoplectus californicus	California bulrush	Cyperaceae
Typha angustifolia	narrow leaf cattail	Typhaceae
Urtica dioica	stinging nettle	Urticaceae
Veronica americana	American brooklime	Plantaginaceae
Veronica anagallis-aquatica	water speedwell	Plantaginaceae

**=non native*

4.5 Vegetation Communities

There are two vegetation communities that occur within the Project area: disturbed freshwater marsh and disturbed non-native grassland. The remainder of the Project area is not considered a vegetation community and is classified as developed/disturbed with no plant cover in the concrete or grouted rock areas or as open water. Vegetation communities are depicted in Figures 6a through 6c.

4.5.1 Disturbed Freshwater Marsh

Freshwater marsh has a state rarity rank of S5 and is secure, which is synonymous with narrow leaf cat tail (*Typha angustifolia*) herbaceous alliance (NVCS) and coast and valley freshwater marsh (Holland). It is characterized with clayey or silty soils. Other plants that occur within this community include cattail (*Schoenoplectus californicus*), Irish-leaved rush (*Juncus xiphoides*), and coon’s tail mats (*Ceratophyllum demersum*) and is associated with the freshwater emergent wetland areas of the project area.

This vegetation community has been highly disturbed by anthropogenic effects from previous channel maintenance activities, trash, and occasional recreation from nearby residents resulting in less density and shorter plants.

4.5.2 Disturbed Non-Native Grassland

This vegetation community does not have a state rarity rank. It is synonymous to red brome (*Bromus rubens*) herbaceous semi-natural alliance (NVCS) and non-native grassland (Holland). This vegetation community occurs in all topography settings and soil textures.

This vegetation community is associated with the upland habitat of the Project where primarily grasses and ruderal plants were observed and is also disturbed from maintenance activities.

4.6 Special Status Species

Within a 5-mile radius of the Project a total of 28 special status species had records of occurrences (Figure 8).

4.6.1 Wildlife

There were 20 special status wildlife species that have occurrence records within 5 miles of the Project. The potential for these wildlife species to occur is summarized in Table 4 below.

Table 4. Potential for Special Status Wildlife Species to Occur

SPECIES	HABITAT REQUIREMENTS	CONSERVATION STATUS	POTENTIAL TO OCCUR
Fish			
Arroyo Chub ***Gila orcutti***	Found in habitats with low-moving water, mud or substrate and depths greater than 40 cm, but also in areas with cobble, boulders. Most abundant in low gradient pools and flat-water habitats with aquatic/emergent vegetation.	SSC	Not observed; low potential due to habitat and almost 4 miles upstream from nearest occurrence
Santa Ana Sucker ***Catostomus santaanae***	Occurs within all historic drainages within their range including Santa Ana River. Habitat generalists but prefer areas that have sand-rubble-boulder bottoms and cool, clear water, and algae.	FT	Not observed; low potential due to habitat and almost 4 miles upstream from nearest occurrence
Reptiles			
coast horned lizard *Phrynosoma blainvillii*	Frequents a wide variety of habitats, most common in lowlands along sandy washes with scattered low bushes. Open areas for sunning, bushes for cover, patches of loose soil for burial, and abundant supply of ants and other insects.	SSC	Not observed; low potential due to habitat
glossy snake *Arizona elegans occidentalis*	Patchily distributed from the eastern portion of San Francisco Bay, southern San Joaquin Valley, and the Coast, Transverse, and Peninsular ranges, south to Baja California. Generalist reported from a range of scrub and grassland habitats, often with loose or sandy soils.	SSC	Not observed; low potential due to habitat
red diamond rattlesnake *Crotolus ruber*	Chaparral, woodland, grassland, & desert areas from coastal San Diego County to the eastern slopes of the mountains. Occurs in rocky areas and dense vegetation. Needs rodent burrows, cracks in rocks or surface cover objects.	SSC	Not observed; low potential due to habitat

SPECIES	HABITAT REQUIREMENTS	CONSERVATION STATUS	POTENTIAL TO OCCUR
Southern California legless lizard *Aniella stebinisi*	Occurs in sandy or loose loamy soils under sparse vegetation. Variety of habitats; generally in moist, loose soil. They prefer soils with a high moisture content.	SSC	Not observed; low potential due to habitat
western pond turtle (*Emys marmorata)*	A thoroughly aquatic turtle of ponds, marshes, rivers, streams and irrigation ditches, usually with aquatic vegetation, below 6000 ft. elevation. Needs basking sites and suitable (sandy banks or grassy open fields) upland habitat up to 0.5 km from water for egg-laying.	SSC	Not observed; low potential due to habitat
Birds			
burrowing owl *Athene cunicularia*	A yearlong resident of open, dry grassland and desert habitats. Uses rodent or other burrows for roosting and nesting cover. In the Colorado Desert, generally occur at low densities in scattered populations	SSC	Not observed; low potential due to habitat
California black rail *Laterallus jamaicensis coturniculus*	Inhabits freshwater marshes, wet meadows and shallow margins of saltwater marshes bordering larger bays. Needs water depths of about 1 inch that do not fluctuate during the year and dense vegetation for nesting habitat.	ST, FP	Not observed; low potential due to habitat
coastal California gnatcatcher *Polioptila californica*	Obligate, permanent resident of coastal sage scrub below 2500 ft. in Southern California. Low, coastal sage scrub in arid washes, on mesas and slopes. Not all areas classified as coastal sage scrub are occupied.	FT, SSC	Not observed; low potential - foraging habitat in buffer
Cooper's hawk *Accipiter cooperii*	Woodland, chiefly of open, interrupted or marginal type. Nest sites mainly in riparian growths of deciduous trees, as in canyon bottoms on river flood-plains; also, live oaks.	WL	Not observed; low potential due to habitat
golden eagle (nesting/wintering) *Aquila chrysaetos*	Typically rolling foothills, mountain areas, sage- juniper flats, desert. Nests on cliffs of all heights and in large trees in open areas. Rugged, open habitats with canyons and escarpments used most frequently for nesting.	FP	Not observed; low potential due to habitat

SPECIES	HABITAT REQUIREMENTS	CONSERVATION STATUS	POTENTIAL TO OCCUR
Least bell's vireo *bellii pusillus*	Endemic to California and Baja California - Bell's vireo is a rare, local, summer resident below about 600 m (2000 ft.) in willows and other low, dense valley foothill riparian habitat and lower portions of canyons mostly in San Benito and Monterey Co.; in coastal southern California from Santa Barbara Co. south; and along the western edge of the deserts in desert riparian habitat.	FE, SE	Not observed; low potential - foraging habitat in buffer
Long eared owl *Asio otus*	Roost in dense vegetation and forage in open grasslands or shrublands; also open coniferous or deciduous woodlands.	SSC	Not observed; low potential due to habitat
Swainson's hawk *Buteo swainsoni*	Require large areas of open landscape for foraging, including grasslands and agricultural lands that provide low-growing vegetation for hunting and high rodent prey populations. Typically nest in large native trees such as valley oak, cottonwood, walnut, willow, and occasionally in nonnative trees within riparian woodlands, roadside trees, trees along field borders, isolated trees, small groves, and on the edges of remnant oak woodlands	ST	Not observed; low potential due to habitat
tricolored blackbird *Agelaius tricolor*	Highly colonial species, most numerous in Central Valley & vicinity. Largely endemic to California. Requires open water, protected nesting substrate, and foraging area with insect prey within a few km of the colony.	ST, SSC	Not observed; low potential - foraging habitat in buffer
western yellow-billed cuckoo *Coccyzus americanus occidentalis*	Breeds along the major river valleys in southern and western New Mexico, and central and southern Arizona. In California, the western yellow-billed cuckoo's breeding distribution is now thought to be restricted to isolated sites in the Sacramento, Amargosa, Kern, Santa Ana, and Colorado River valleys.	FT/SE	Not observed; low potential due to habitat
white-tailed kite *Elanus leucurus*	Rolling foothills and valley margins with scattered oaks & river bottomlands or marshes next to deciduous woodland. Open grasslands, meadows, or marshes for foraging close to isolated, dense-topped trees for nesting and perching.	FP	Not observed; low potential - foraging habitat in buffer

SPECIES	HABITAT REQUIREMENTS	CONSERVATION STATUS	POTENTIAL TO OCCUR
yellow warbler *Setophaga petechia*	Riparian plant associations in close proximity to water. Also nests in montane shrubbery in open conifer forests in Cascades and Sierra Nevada. Frequently found nesting and foraging in willow shrubs and thickets, and in other riparian plants including cottonwoods, sycamores, ash, and alders.	SSC	Not observed; low potential - foraging habitat in buffer
Mammals			
big free tailed bat *Nyctinomops macrotis*	Found generally sea level to 8,000 feet in elevation. This species occurs in desert shrub. It roosts mostly in the crevices of rocks although may roost in buildings, caves, and tree cavities	SSC	Not observed; low potential due to habitat
western mastiff bat *Eumops perotis californicus*	Variety of habitats, from desert scrub to chaparral to oak woodland and into the ponderosa pine belt and high elevation meadows of mixed conifer forests	BLMS SSC	Not observed; low potential due to habitat
western yellow bat *Lasiurus xanthinus*	Recorded below 600 m (2000 ft) in valley foothill riparian, desert riparian, desert wash. This species occurs year-round in California.	SSC	Not observed; low potential due to habitat

Conservation Status

Federal FE = Federally listed endangered: species in danger of extinction throughout a significant portion of its range
FT = Federally listed, threatened: species likely to become endangered within the foreseeable future
FCT = Proposed for federal listing as a threatened species
BCC = Fish and Wildlife Service: Birds of Conservation Concern:

State SSC = State Species of Special Concern
FP = California Fully Protected
SE = State listed as endangered
ST = State listed as threatened
WL = State watch list
CPF = California Protected Furbearing Mammal
CPGS = California Protected Game Species

Bureau of Land Management
BLMS = BLM Sensitive

4.6.2 Plants

There were 8 special status plant species that have occurrences within 5 miles of the Project. The potential for these plants to occur is summarized in Table 5 below.

Table 5. Potential for Special Status Plant to Occur

SPECIES	FORM; HABITAT; DISTRIBUTION	CONSERVATION STATUS	ELEVATION (meters)	BLOOM PERIOD	POTENTIAL TO OCCUR
coulter's saltbush *Atriplex coulteri*	perennial herb; Alkaline or clay soils, open sites, scrub, coastal bluff scrub; records near Chino Creek, South of Ontario	1B.2	<500	Mar-Oct	None – lacks suitable habitat
intermediate mariposa lily *Calochortus weedii var. intermedius*	perennial herb (bulb); dry rocky open slopes; nearest records within Chino State Park	1B.2	<680	May-Jul	None – lacks suitable habitat
Jokerst's monardella *australis ssp jokerstii*	perennial herb; Steep scree or talus, stony benches on canyon bottoms in montane forest (or chaparral); nearest records	1B.1	1350-1750	Jul-Sep	None – lacks suitable habitat
lucky morning glory *Calystegia felix*	annual herb; historically found on somewhat poorly drained alkali silt loam on a floodplain with an average slope of just over 1%; currently found on well-watered landscaping on recently completed industrial, commercial, and residential developments. Records in the city of Chino	1B.1	90-210	Mar-Aug	None – lacks suitable habitat
Robinson's pepper grass *Lepidium virginicum var robinsonii*	annual herb; usually occurs in non-wetlands, but occasionally in wetlands, chaparral, coastal sage scrub; records in Chino, Santa Ana Canyon, Avery Canyon	4.3	50-1200	Jan-Jun	Moderate – suitable habitat in wetland area
salt spring checkerbloom *Sidalcea neomexicana*	perennial herb; alkaline springs, marshes, playas; Creosote Bush Scrub, Chaparral, Yellow Pine Forest, Coastal Sage Scrub, Alkali Sink, wetland-riparian; records near Chino Creek south of Ontario and in Chino	2B.2	<1500	Mar-Jun	Moderate – suitable habitat; not observed
San Bernardino aster *Symphyotrichum defoliatum*	perennial herb (rhizomatous); grassland, disturbed places, wetlands; nearest records southeast of Chino and near Chino	1B.2	<2050	Jul-Nov	Moderate – suitable habitat in staging area; not observed
smooth tarplant *Centromadia pungens ssp. Laevis*	annual herb; Open, poorly drained flats, depressions, waterway banks and beds, grassland, disturbed sites; shadscale scrub, alkali sink, valley grassland; nearest records south of Ontario	1B.1	90-500	Apr-Sep	Moderate – suitable habitat in staging area; not observed

California Rare Plant Rank (CRPR)

CRPR 1A = Presumed extirpated in California and either rare or extinct elsewhere
CRPR 1B = Rare, threatened, or endangered in California and elsewhere
CRPR 2A = Presumed extirpated in California but more common elsewhere
CRPR 2B = Rare, threatened, or endangered in California but more common elsewhere
CRPR 3 = Plants which need more information

CRPR 4 = Limited distribution – a watch list
CBR = Considered, But Rejected
.1 = Seriously endangered in California (high degree/immediacy of threat; over 80% of occurrences threatened)
.2 = Fairly endangered in California (moderate degree/immediacy of threat; 20%-80% of occurrences threatened)
.3 = Not very endangered in California (low degree/immediacy of threats or no current threats known; <20% of occurrences threatened, or no current threats known)

4.7 Jurisdictional Waters

The Project is within a channel that contains jurisdictional waters. A separate jurisdictional delineation and California Rapid Assessment Method (CRAM) analysis for wetlands were completed and are summarized in a separate report.

5.0 DISCUSSION

The habitat assessment determined that protocol surveys for burrowing owl and least bell's vireo were not necessary, due to the lack of appropriate habitat for the species within the Project area.

A pre-construction survey is recommended prior to construction activities beginning and nesting bird surveys may be necessary if activities occur during nesting bird season (February to August) since there is appropriate foraging habitat and potential nesting habitat within the Project buffer for multiple bird species.

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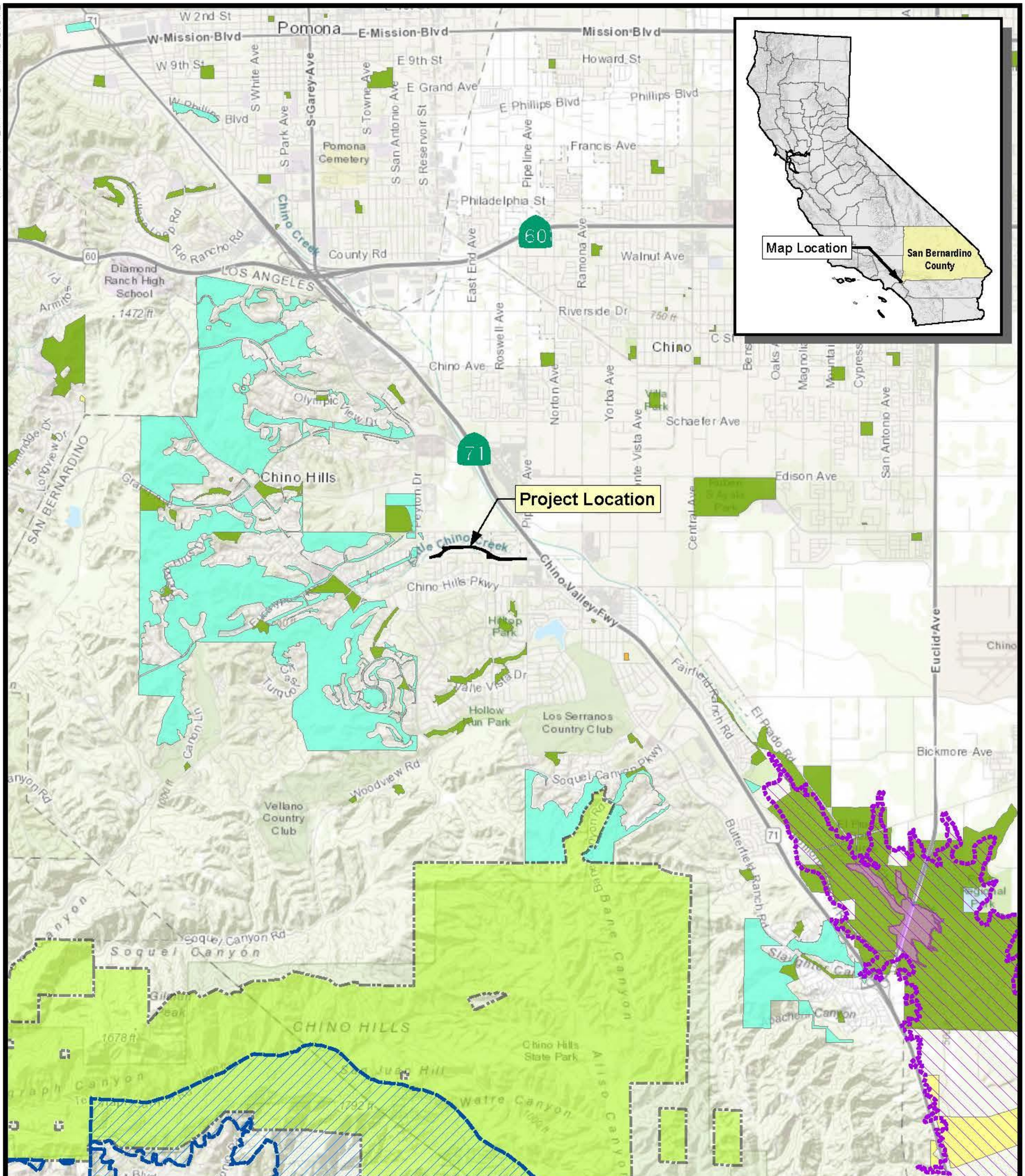


Ironwood Consulting

0 1 Miles

Least Bell's Vireo *(Vireo bellii pusillus)* Critical Habitat Area

California Gnatcatcher *(Polioptiila californica)* Critical Habitat Area

Chino Hills State Park

Southwestern Willow Flycatcher *(Empidonax traillii extimus)* Critical Habitat

Prado Flood Control Basin

Local Park

Local Recreation Area

State Resource Management Area

FIGURE 1

Regional Location

Carbon Canyon Channel

P:\GIS\Carbon_Canyon\Site.mxd

Ironwood
Consulting

0 250 500
Feet

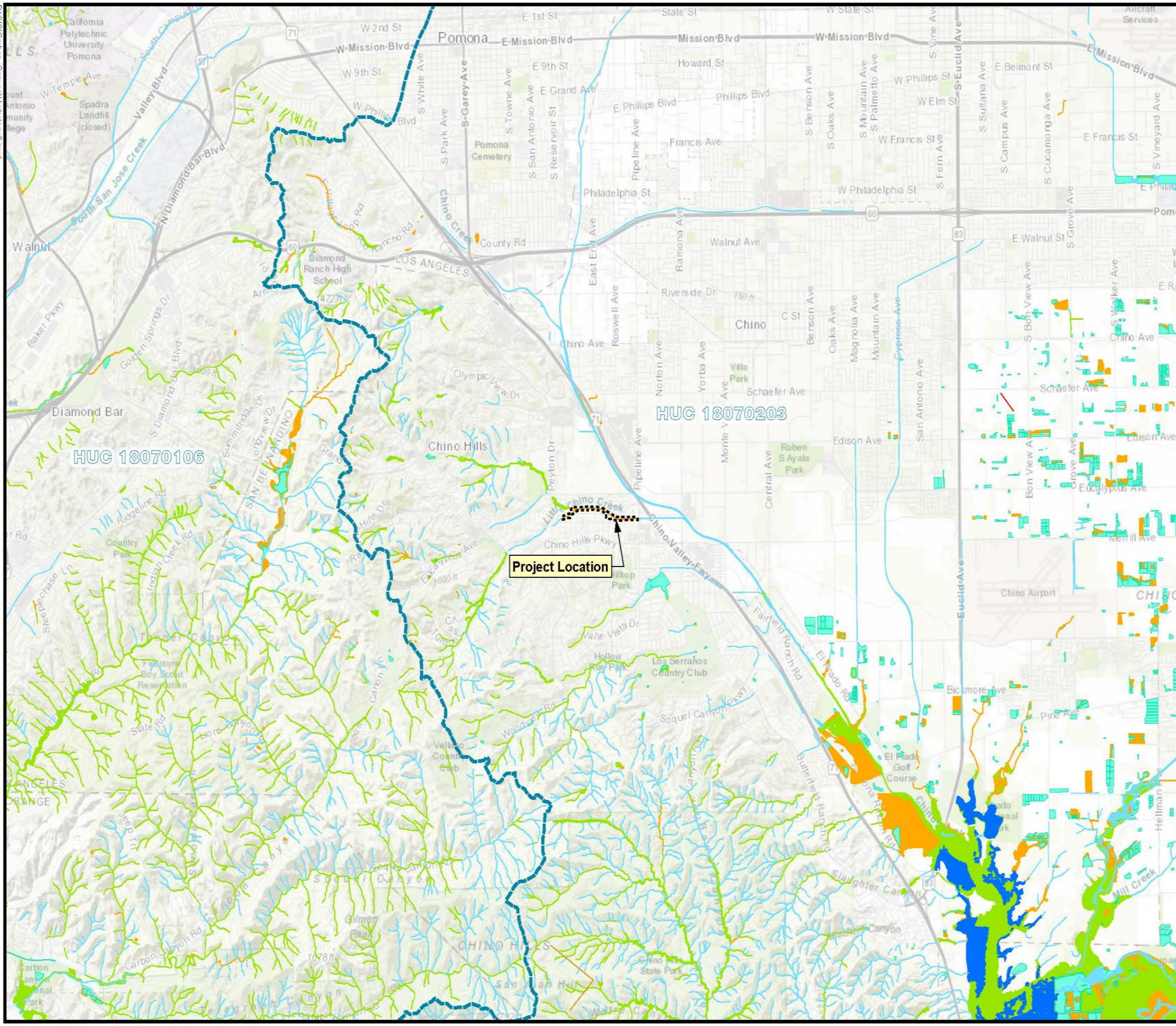
Project Boundary

Note:
Project site located within the Prado Dam 7.5' topographic quadrangle, in Township 2 South, Range 8 West, Section 21. (33.98771 latitude, -117.72339 longitude).

FIGURE 2

Project Site

Carbon Canyon Channel



CARBON CANYON CHANNEL

Figure 3

Hydrology

TETRA TECH

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P

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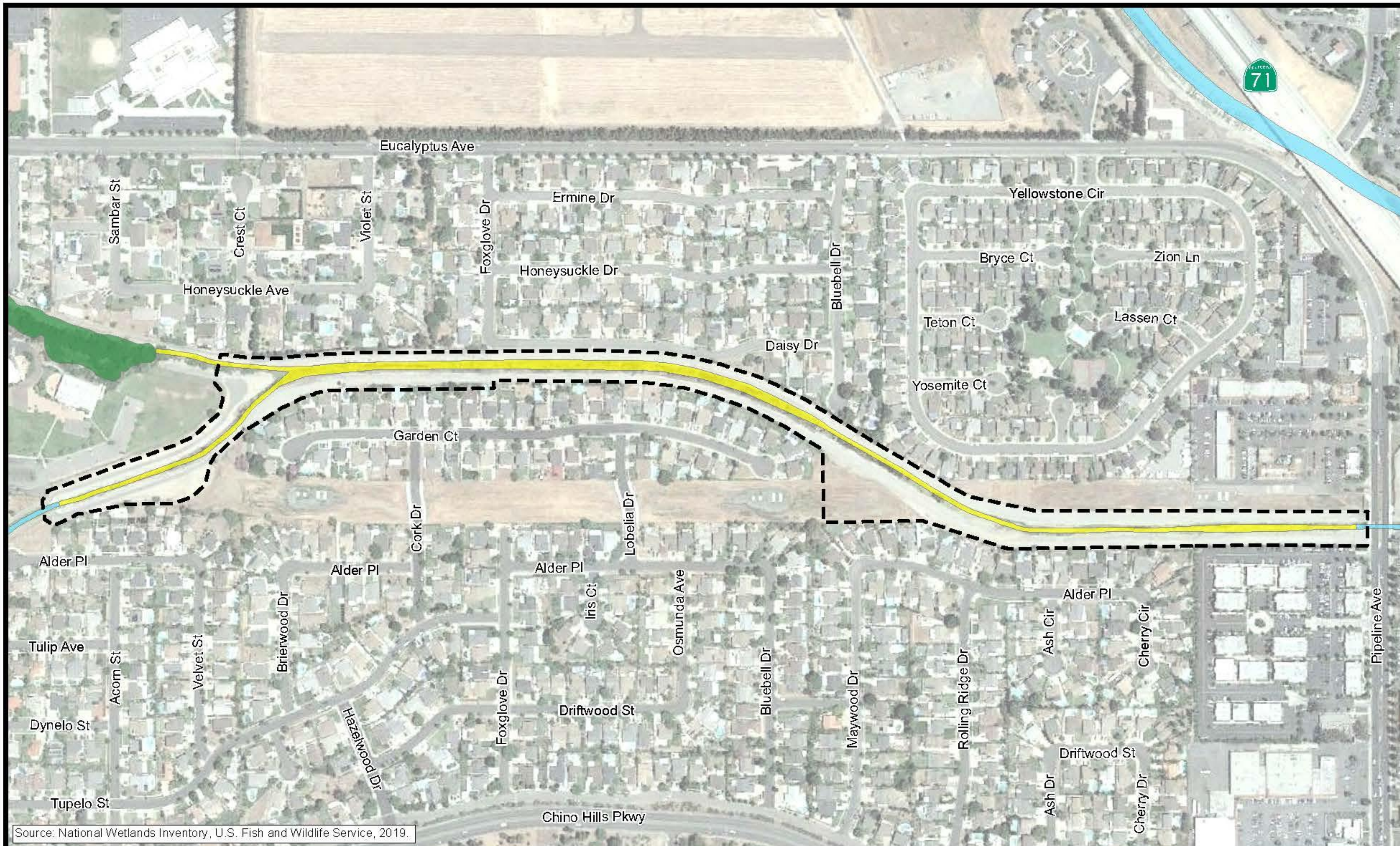


Ironwood Consulting

0 250 500
Feet

Project Boundary

Freshwater Emergent Wetland

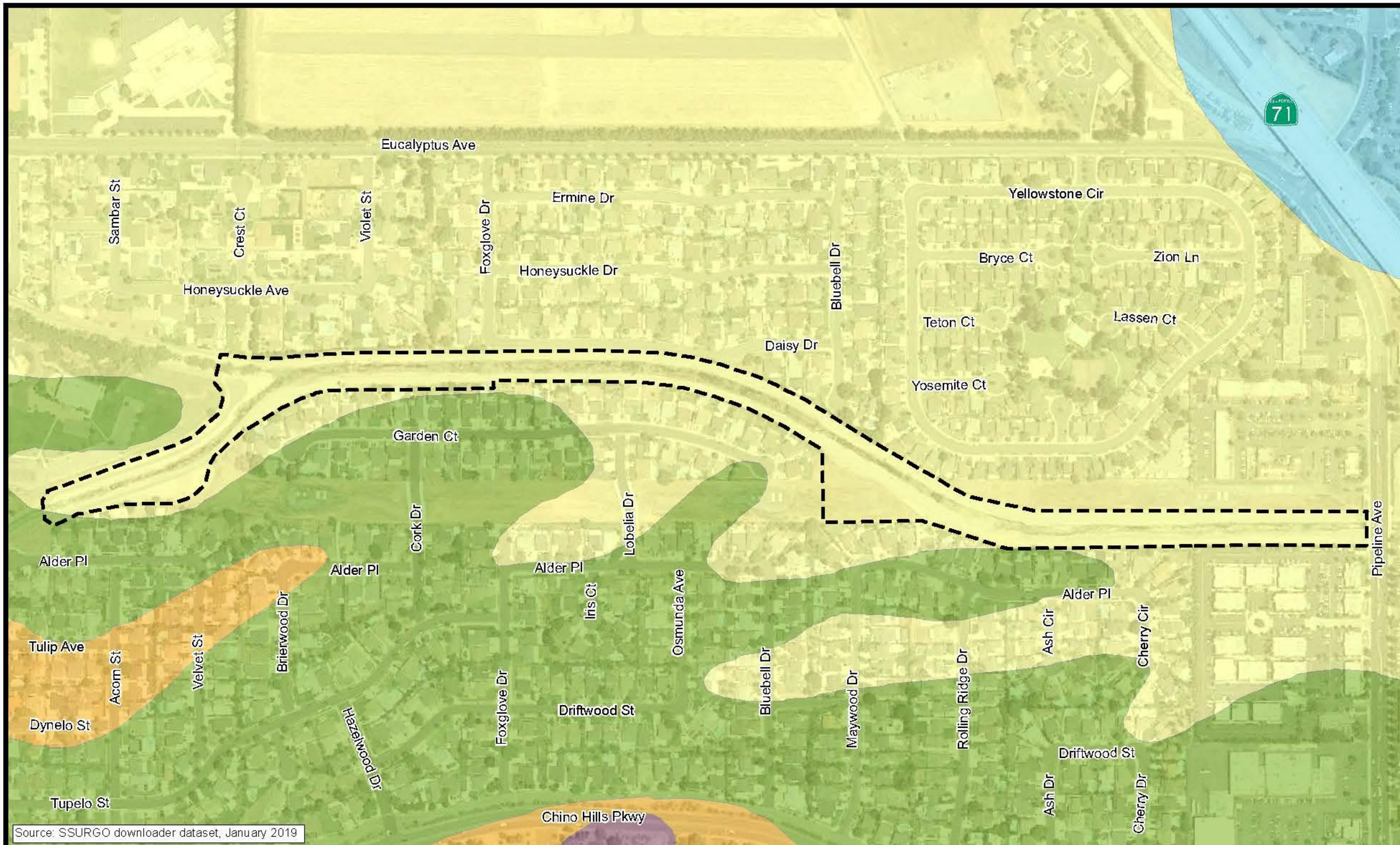
Freshwater Forested/Shrub Wetland

Riverine

FIGURE 4

National Wetland Inventory (NWI)

Carbon Canyon Channel



Ironwood Consulting

0 250 500
Feet

Project Boundary

Chualar clay loam, 2 to 9 percent slopes

Fontana clay loam, 15 to 30 percent slopes

Fontana clay loam, 30 to 50 percent slopes

Grangeville fine sandy loam, warm MAAT, MLRA 19

Sorrento clay loam, 0 to 2 percent slopes, warm MAAT, MLRA 19

FIGURE 5

Soils

Carbon Canyon Channel

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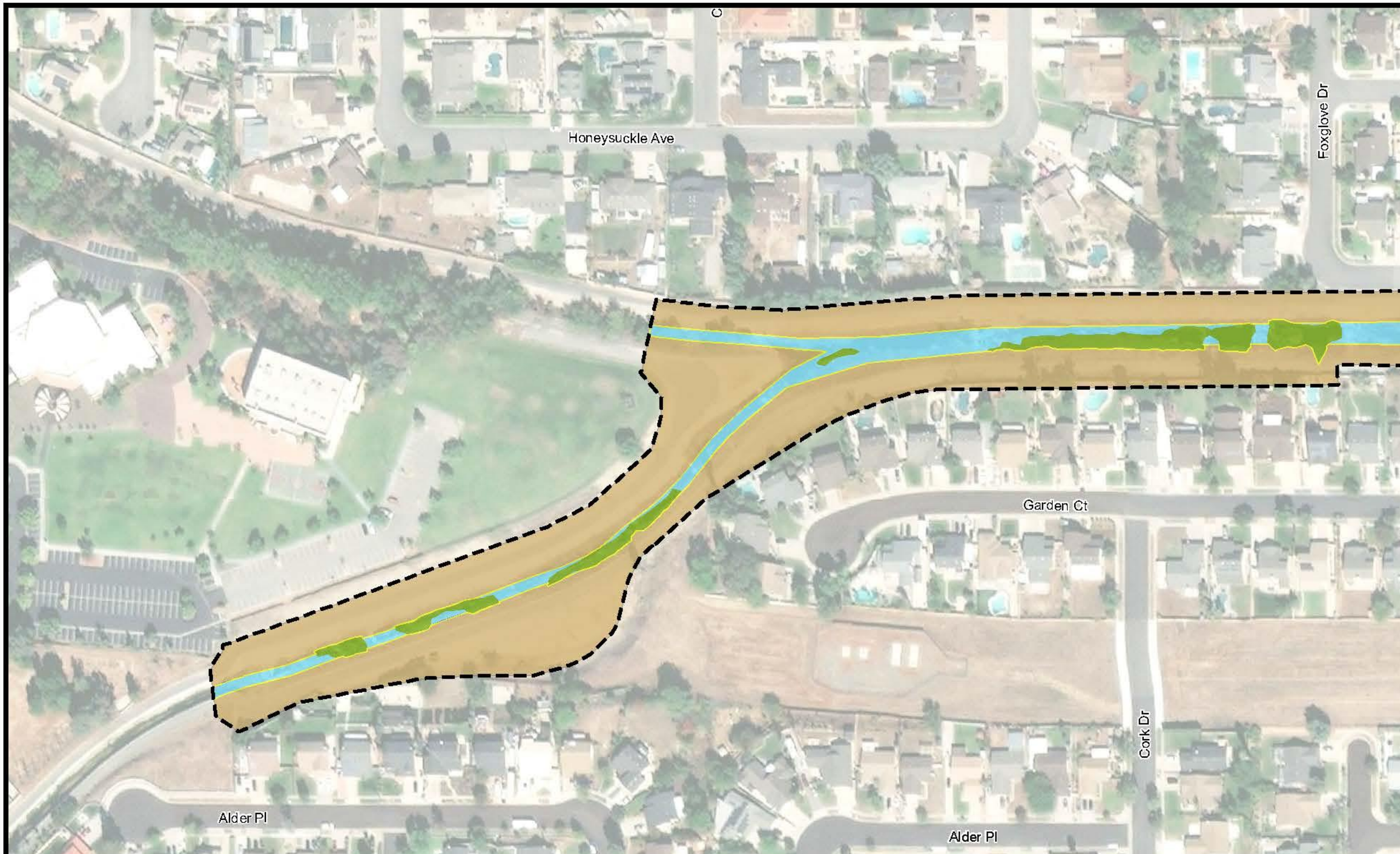

Ironwood Consulting

0 100 200
Feet

Project Boundary

Disturbed Freshwater Marsh

Disturbed Non-native Grassland

Open Water

Developed Area

FIGURE 6a

Vegetation

Carbon Canyon Channel

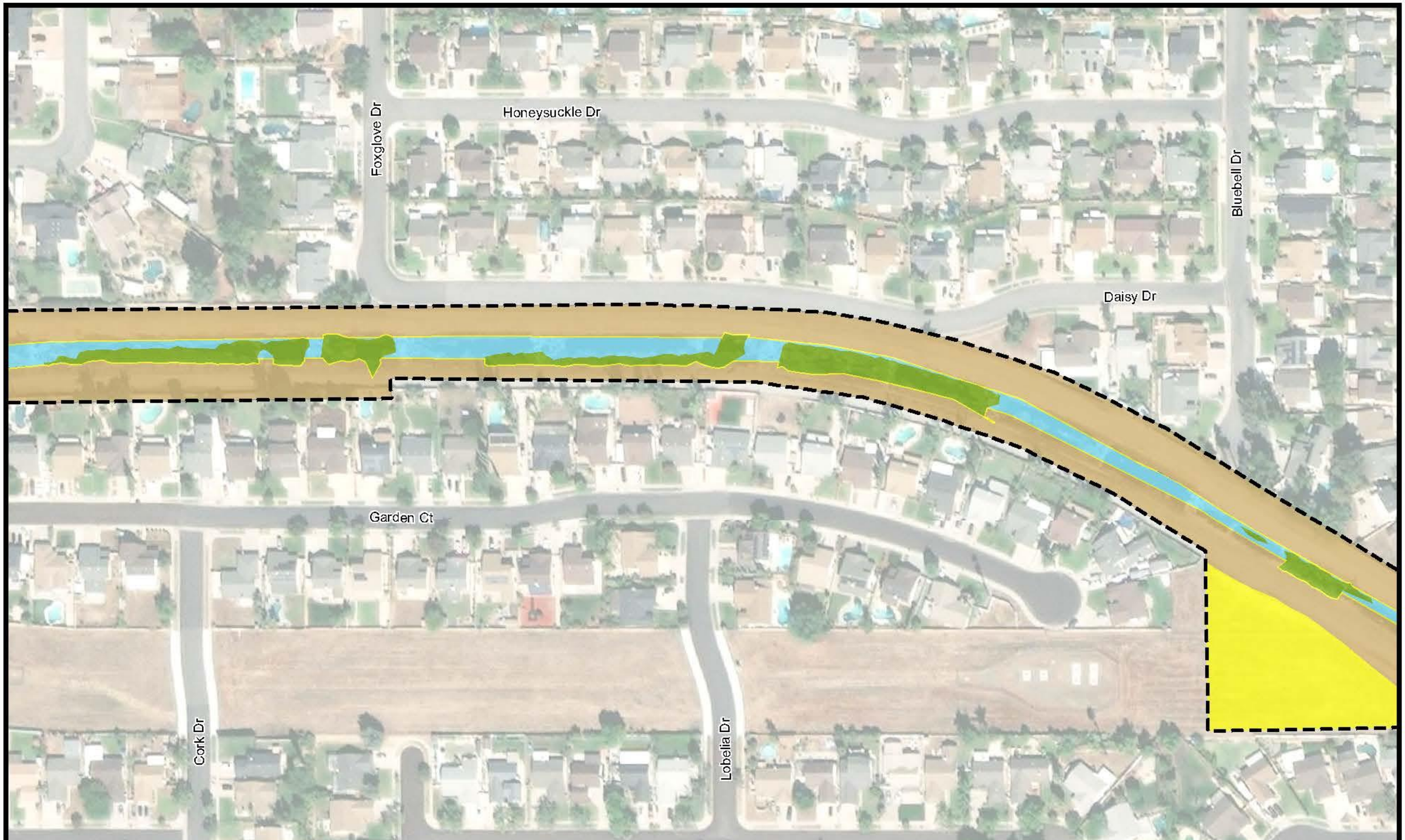

FIGURE 6b

Vegetation

Carbon Canyon Channel

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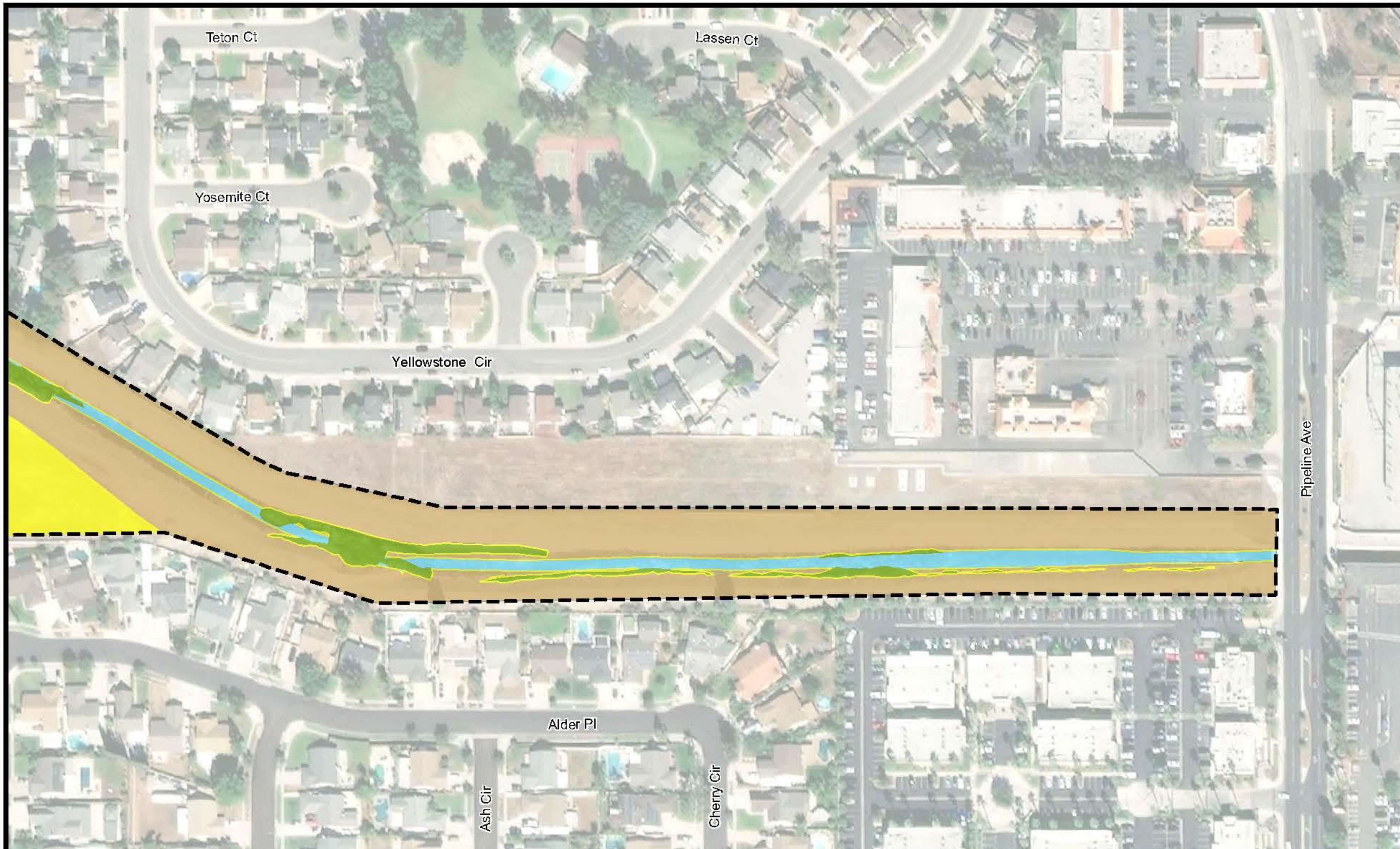


Ironwood Consulting

0 100 200
Feet

Project Boundary

Disturbed Freshwater Marsh

Disturbed Non-native Grassland

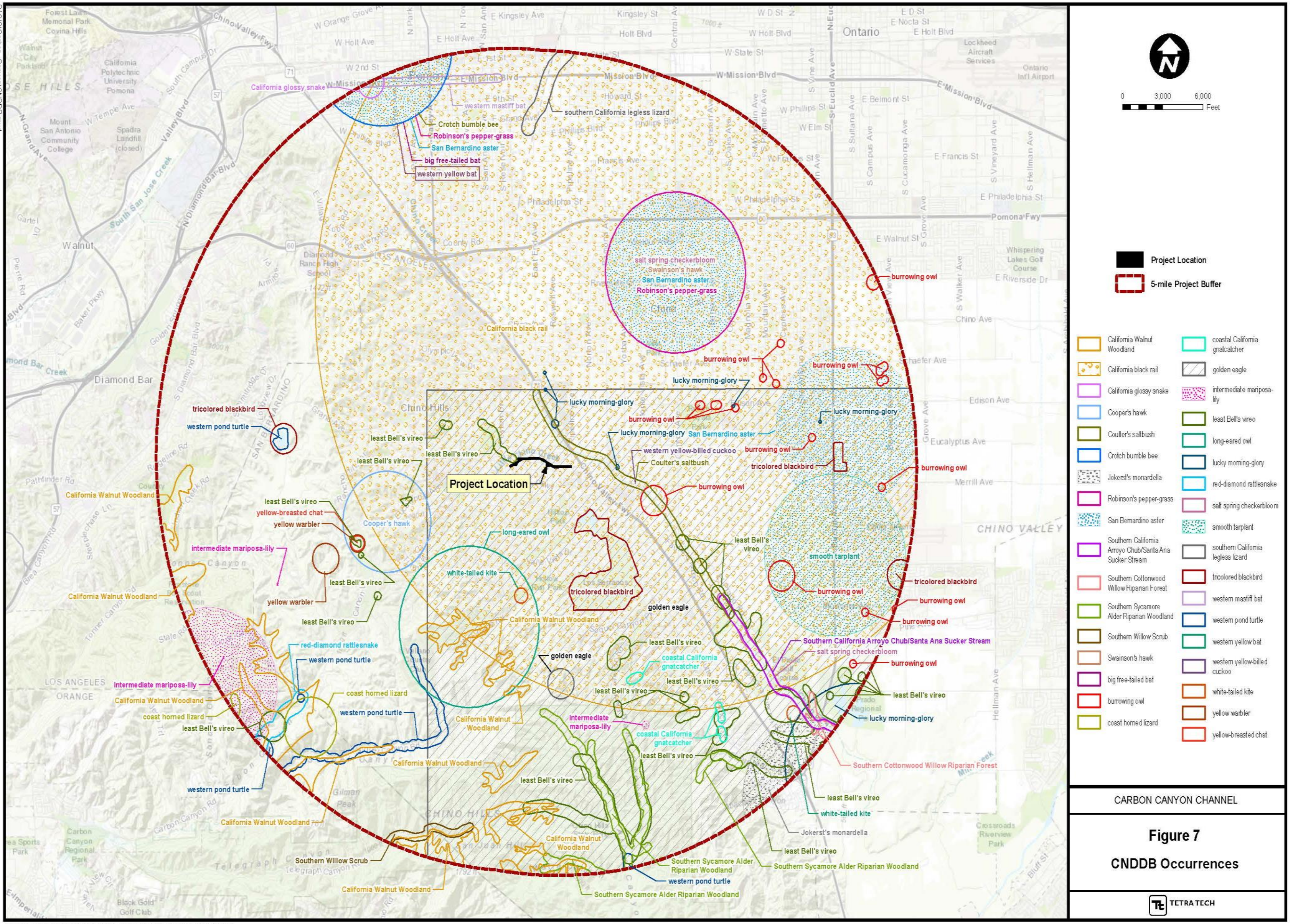
Open Water

Developed Area

FIGURE 6c

Vegetation

Carbon Canyon Channel



Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P

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Ironwood Consulting

0 250 500
Feet

Least Bell's Vireo Observation

Project Boundary

FIGURE 8

Observations

Carbon Canyon Channel

Photo 1. Western Extent of Project at Confluence, Facing East

Photo 2. Typical vegetation of Project, Eastern Extent of Project, Facing East

Photo 3. Disturbed non-native grassland in laydown area

Appendix D

Carbon Canyon Wetland Condition Analysis and Jurisdictional Waters

Carbon Canyon Channel Wetland Condition Analysis and Jurisdictional Waters

Chino Hills, San Bernardino County, California

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December 2019

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CRAM Datasheets
CRAM Field Maps
JD Datasheets

List of Abbreviations

AA	Assessment Area
CA	California
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CFGC	California Fish and Game Code
CNDDB	California Natural Diversity Data Base
CNPS	California Native Plant Society
CRAM	California Rapid Assessment Method
CWA	Clean Water Act
EPA	Environmental Protection Agency
FAC	Facultative
FACU	Facultative Upland
FACW	Facultative Wetland
GPS	Geographic Positioning System
LSAA	Lake or Streambed Alteration Agreement
NAIP	National Agriculture Imagery Program
NCEI	National Center for Environmental Information
NHD	National Hydrography Dataset
NOAA	National Oceanic and Atmospheric Administration
NRCS	Natural Resource Conservation Service
NWI	National Wetlands Inventory
OBL	Obligate
OHWM	Ordinary High-Water Mark
RPW	Relatively Permanent Water
RWQCB	Regulatory Water Quality Control Board
SWANCC	Solid Waste Agency of North Cook County
SWRCB	State Water Regional Control Board
TNW	Traditional Navigable Waters
US	United States
USACE	United States Army Corps of Engineers
USGS	United States Geological Survey
WDR	Water Discharge Requirement

1.0 INTRODUCTION

This report represents findings from a California Rapid Assessment Method (CRAM) analysis and a jurisdictional waters delineation in the proposed Carbon Canyon Channel Flood Control Improvement Project (Project) in Chino Hills, California in San Bernardino County (Figure 1). The report has been prepared for San Bernardino County Flood Control District and Tetra Tech. The purpose of the analysis is to assess the condition of wetlands and delineate the areas that may be considered jurisdictional wetland areas.

1.1 PROJECT LOCATION

The proposed Project consists of improvements to the existing Carbon Canyon Channel, is located within Section 36, Township 2 South, and Range 8 West, within the Prado Dam USGS 7.5-minute topographic quadrangle map.

The Project area is located west of the intersection of Highway 71 and Pipeline Avenue, north of Chino Hills Parkway, and south of Eucalyptus Avenue. The Project site also has two staging areas: one adjacent to the channel area that is just north of Maywood Drive and a smaller area north of Velvet Street. The Project is situated within the Santa Ana River watershed. Carbon Canyon Channel (and English Channel which joins from the northwest) is part of Little Chino Creek which flows into Chino Creek which flows into the Santa Ana River.

The Project site is surrounded primarily by suburban/urban development. Private residences are located along the northern and southern boundaries with a few commercial developments near the western and eastern boundaries. A recreational sports field is just northwest of the Project.

Chino Hills State Park is approximately 3 miles south of the Project. Critical habitat for least bell's vireo is about 2 miles west and south of the project. California gnatcatcher critical habitat is approximately 2 miles south of the Project and southwestern willow flycatcher critical habitat is approximately 2 miles southeast of the Project (Figure 1).

1.2 PROJECT DESCRIPTION

San Bernardino County Flood Control District is proposing to improve Carbon Canyon Channel from an interim to an ultimate condition channel to decrease the likelihood of flooding during a 100-year storm event by improving the capacity and conveyance of the County-maintained facility. Currently, Carbon Canyon Channel is a trapezoidal shaped earthen channel with grouted rock side slopes and a rocky invert. The Project will consist of the construction of a trapezoidal channel with an articulating block invert with hardened side walls. The improved channel will replace an undersized earthen channel. The new channel will include transitional structures to join it with existing concrete structures at both ends of the new channel, and with the existing earthen channel that is English Channel, which joins from the northwest.

1.3 STUDY AREA

The study area for the analysis includes the entirety of the proposed Project site including the laydown (staging) areas which covers approximately 14.4 acres, and approximately 4,800 feet (0.9 miles) lengthwise along the Carbon Canyon Channel (Figure 2). The topography within the concrete channel is relatively flat. The ground surface within the study area is predominantly concrete or grouted rock along the stabilized Carbon Canyon Channel. Some soil accumulation has occurred within the channel.

2.0 REGULATORY SETTING

2.1 CLEAN WATER ACT (SECTION 404)

Section 404 of the Clean Water Act (CWA) established a program to regulate the discharge of dredged or fill material into waters of the United States, including wetlands. Activities in waters of the United States regulated under this program include fill for development, water resource projects (such as dams and levees), infrastructure development (such as highways and airports) and mining projects. The U.S. Army Corps of Engineers (USACE) administers the activities required by Section 404. These include the individual permit decisions, jurisdictional determinations, developing policy and guidance, and enforcing provisions of Section 404. Waters of the U.S. are defined in 33 CFR §328.3 and clarified via several Supreme Court and supplemental guidance documents.

2.2 CLEAN WATER ACT (SECTION 401) AND CALIFORNIA PORTER-COLOGNE WATER QUALITY ACT

Dredge and fill activities in federally jurisdictional waters of the U.S. that trigger coverage under Section 404 of the CWA must also receive water quality certification under Section 401 of the CWA. The State Water Resources Control Board (SWRCB), through its Regional Water Quality Control Boards (RWQCBs), has jurisdiction over Section 401 water quality certification in California.

The Porter-Cologne Water Quality Control Act (Porter-Cologne), Division 7 of the California Water Code, establishes the responsibilities and authorities of the nine RWQCBs and the SWRCB. This act establishes that the waters of the State shall be protected for use and enjoyment by the people of the State; that the activities and factors which may affect the quality of the waters of the State shall be regulated to attain the highest water quality. Porter-Cologne also names the RWQCBs to formulate and adopt water quality control plans for all areas within the region. The project site is located within the Santa Ana (Region 8) RWQCB jurisdiction.

Under Porter-Cologne, the RWQCB may also regulate discharge of waste. All parties proposing to discharge waste that could affect waters of the State must file a report of waste discharge with the appropriate RWQCB (§ 13260 of the California Water Code). The RWQCB would then respond to the report of waste discharge by issuing waste discharge requirements (WDRs), or by waiving WDRs for the proposed discharge. Both of the terms *Discharge of Waste* and *Waters of the State* are broadly defined such that discharges of waste, including fill, any material resulting from human activity or any other discharge that may directly or indirectly affect waters of the State. While all waters of the U.S. that are within the borders of California are also waters of the State pursuant to Porter-Cologne, the converse is not true. Waters of the U.S. are federally jurisdictional and legally distinct from waters of the State. While Section 404 permits and Section 401 certifications are required when activity results in fill or discharge directly below ordinary high-water mark of waters of the U.S., any activity that results or may result in a discharge that directly or indirectly impacts waters of the State or the beneficial uses of those waters may be subject to WDRs.

2.3 CALIFORNIA FISH AND GAME CODE SECTIONS 1600-1616

Pursuant to Section 1602 of the California Department of Fish and Game (CDG) Code may require a Lake or Streambed Alteration Agreement (LSAA) prior to any activity that would substantially divert or obstruct the natural flow, or substantially change the bed, channel, or bank of a river, stream or lake, or use material from a streambed. The California Department of Fish and Wildlife (CDFW)reviews LSAA applications and issues permits after requirements to protect fish and wildlife resources are committed to or implemented. The issuance of a LSAA is subject to California Environmental Quality Act (CEQA) certification.

CDFW traditionally defines a stream (including creeks and rivers) as "a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life. This includes watercourses having surface or subsurface flow that supports or has supported riparian vegetation." CDFW's definition of lake includes natural lakes or man-made reservoirs. CDFW jurisdiction also includes riparian or wetland vegetation associated with a watercourse. CDFW takes jurisdiction over CWA Section 404 waters as well as stream banks, riparian areas, and floodplains.

Streambed morphology and presence was evaluated for the Project site based on guidance from the USACE outlined in the *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (USACE 2008a); or *A Guide to Ordinary High Water Mark (OHWM) Delineation for Non-Perennial Streams in the Western Mountains, Valleys, and Coast Region of the United States* (USACE 2014) depending on the location and the characteristics of the culvert and associated drainages. Guidance outlined in CDFW Code Sections 1600-1616 was used to determine the presence of stream bank, riparian areas, and floodplains where state jurisdiction may apply.

3.0 METHODS

3.1 DESKTOP REVIEW

Prior to conducting the CRAM analysis and jurisdictional water delineation, a desktop review of data sources and literature review was conducted which included the following sources:

- 7.5' United States Geological Survey (USGS) topographic quadrangles;
- California Natural Diversity Data Base (CNDDB) California Department of Fish and Wildlife (CDFW 2019);
- California Rapid Analysis Method for Wetlands, Riverine Wetlands Field Book (California Wetland Monitoring Workgroup 2013);
- California Native Plant Society's (CNPS) Online Inventory of Rare and Endangered Plants (CNPS 2019a);
- EcoAtlas Online (California Wetland Monitoring Workgroup 2019);
- Manual of California Vegetation Online (CNPS 2019b, Sawyer et al. 2009);
- National Agriculture Imagery Program (NAIP) 4-band imagery (2016);
- National Center for Environmental Information at the National Oceanic and Atmospheric Administration (NCEI-NOAA 2019);
- National Wetlands Inventory Wetlands Mapper (USFWS 2019);
- Natural Resource Conservation Service (NRCS) Soil Survey Geographic (SSURGO) Database (NRCS2019); and
- USGS National Hydrography Dataset (NHD) (USGS 2019).

Relevant digital data were incorporated into ESRI ArcGIS Online and made accessible during field investigations via the ESRI ArcGIS Collector© application.

3.2 SURVEY METHOD

3.2.1 CRAM

The CRAM analysis was conducted by practitioners Lehong Chow and Scott Taylor on May 28, 2019. Both practitioners have completed CRAM training as required.

Two assessment areas (AAs) were selected to more accurately represent the Project site - southwest of the confluence of Carbon Canyon Channel and English Channel (AA1) and east of the confluence (AA2). Assessment areas are shown and discussed in Section 5.1. Assessment areas were adjusted in the field to meet the criteria for AA selection as described in CRAM Riverine Wetlands Field Book (2013). AAs were drawn directly on aerial maps during the field assessment (see Appendix for datasheets and hand drawn assessment areas on aerials).

Methods for analyzing each AA used guidelines and standardized datasheets from the CRAM Riverine Wetland Field Book (2013).

Determination of CRAM scores include the four attributes below that are further divided into metrics and submetrics. Confined riverine scoring was used to determine the alphabetic score of each metric. The alphabetic score for each metric corresponds to a numeric value. These metric values were then calculated to get the raw and final attribute score that contributes to the total CRAM score out of 100.

<u>Attribute 1: Buffer and Landscape Context</u>

- *Stream Corridor Continuity*: spatial association with other areas of aquatic resources
- *Buffer*: area adjoining AA in a natural or semi-natural state not dedicated to anthropogenic uses that would protect the AA from stress and disturbance
    - Percent AA with Buffer: percent of AA that is surrounded by at least 5 meters of buffer land cover
    - Average Buffer Width: average width of buffer adjoining the AA from perimeter outward to nearest non-buffer land cover or 250 meters, whichever is encountered first
    - Buffer Condition: extent and quality of buffer vegetation cover, overall substrate condition, and amount of human visitation

<u>Attribute 2: Hydrology</u>

- *Water Source*: direct inputs of water into the AA or diversions of water from AA
- *Channel Stability*: degree of increasing or decreasing flows assessed by field indicators that show channel aggradation, degradation, or equilibrium
- *Hydrologic Connectivity*: ability of water to flow into and out of wetland and the degree to which lateral movement of floodwaters is restricted

<u>Attribute 3: Physical Structure</u>

- *Structural Patch Richness*: number of different obvious types of physical surfaces or features that may provide habitat for aquatic, wetland, or riparian species

- *Topographic Complexity*: micro and macro topographic relief and elevation variations that affect moisture gradients or influence the path of flowing water

Attribute 4: Biotic Structure

- Plant Community Composition
  - *Number of Plant Layers*: comprised of short, medium, tall, very tall, and floating layers that occupy at least 5% of AA
  - *Number of Co-Dominant Plants*: must represent at least 10% of relative cover within a plant layer
  - *Percent Invasion*: number of invasive co-dominant species for all plant layers
- Horizontal Interspersion: variety of plant zones that makeup the AA
- Vertical Biotic Structure: degree of overlap among plant layers

3.2.2 Jurisdictional Wetlands and Waters of the U.S.

The jurisdictional delineation (delineation) was conducted on May 29, 2019 by Emily Thorn and Lehong Chow, who are qualified with 40-hour jurisdictional water training and previous experience with jurisdictional resources associated with arid lands. The delineation included the boundaries of jurisdictional waters and wetlands.

Little Chino Creek (of which Carbon Canyon Channel is a part) is a tributary to Chino Creek which drains into the Santa Ana River. The Santa Ana River is a tributary to the Pacific Ocean and is therefore considered a TNW and a water of the U.S. under Section 401 of the CWA. All wetlands and waters associated with Little Chino Creek would be considered jurisdictional under the Clean Water Act.

Wetlands

Federally regulated wetlands were identified based on the *Wetlands Delineation Manual* (USACE, 1987), *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (USACE, 2008b). Three criteria must be fulfilled in order to classify an area as a wetland under the jurisdiction of the USACE:

- **Hydrophytic Vegetation:** Greater than 50 percent of all the dominant species present within the wetland sample plot are classified as wetland indicator species. Indicator species include obligate (OBL), facultative wetland (FACW), or facultative (FAC) species (USACE 2008b). An OBL indicator status refers to plants that almost always occur in wetlands. A FACW indicator status refers to plants that usually occur in wetlands but may occur in non-wetlands. A FAC indicator status refers to plants that occur in wetlands and non-wetlands. Other wetland indicator statuses include facultative upland (FACU) which refers to plants that usually occur in non-wetlands, but may occur in wetlands, upland (UPL) for species that almost never occur in wetlands, and NL for plants that are not listed on the National Wetland Plant List. The wetland indicator status used for this report follows the 2013 National Wetland Plant List (Arid West Region) (Lichvar et al. 2016).
- **Hydric soil:** Soils in the area can be inferred or observed to have a high groundwater table if there is evidence of prolonged soil saturation, or if there are any indicators suggesting a persistent hydric soil environment. The presence of hydric soils is determined using soil color, which are evaluated in the field with *Munsell Soil Color Charts* (Gretag and Macbeth, 2000). Other indicators such as texture and soil layers can also indicate hydric soils (USDA 2018).

- **Wetland hydrology:** Inferred from field observations that indicate an area has a high probability of being inundated or saturated (flooded, ponded, or tidally influenced) long enough during the growing season to develop anaerobic conditions in the surface soil environment, especially the root zone (USACE 1987 and 2008b).

The boundaries of wetlands were delineated using the three indicators with ESRI ArcGIS Collector©. A sub-meter geographic positioning system (GPS) was used in the field to map jurisdictional feature boundaries. Data forms for each wetland data point were completed in the field (USACE 2010).

Waters of the U.S.

USACE regulated waters of the U.S. and RWQCB WSC were delineated according to the methods outlined in the *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (USACE 2008a). In general, ephemeral and perennial streams are more dynamic, occur at a lower overall gradient, and are characterized by the presence of a clear natural scour line impressed on the bank, recent bank erosion, destruction of native terrestrial vegetation, and the presence of litter and debris. Vegetation in the arid west is generally less dense (USACE 2008a).

To determine jurisdictional boundaries of waters of the U.S., the length and width of the drainage within the project area was mapped using ESRI ArcGIS Collector© application. Other data recorded included bank height and morphology, substrate type, presence of floodplain, and vegetation within the streambed and riparian vegetation adjacent to the streambed. The final OHWM was determined using field collected data, aerial imagery, and NWI mapped riverine and wetland data (USFWS 2019).

California Department of Fish and Wildlife (CDFW) Jurisdictional Waters

All features regulated under the CWA are included under California Fish and Game Code (CFGC) Sections 1600 to 1616, in addition to stream banks, riparian areas and floodplains associated with a water body. CDFW jurisdiction was delineated by measuring the elevations of land that confine a stream to a definite course when its waters rise to their highest level and to the extent of associated riparian vegetation or floodplain. When observed, bed, bank, channel, floodplain, and riparian corridors were mapped in addition to the OHWM used to determine jurisdiction under the CWA. Vegetation associated with watercourses, either perennial, ephemeral, or intermittent and defined as riparian vegetation under California Fish and Game Code(CFGC) Section 1602 was mapped during delineation. The current authoritative classification system for these vegetation communities is set by the Manual of California Vegetation, 2nd Ed. (Sawyer et al. 2009). No riparian communities are present within the study area.

4.0 ENVIRONMENTAL SETTING

4.1 HYDROLOGY

The Project is located within the South Coast hydrologic region, in the Santa Ana River watershed, which covers approximately 1.8 million acres (2,800 square miles) in southwestern California. The study area is along Carbon Canyon Channel of Little Chino Creek, approximately 0.4 miles west of Chino Creek (Figure 3). Chino Creek drains into the Santa Ana River approximately 7.1 miles to the south of the study area. The Santa Ana River then drains into the Pacific Ocean approximately 28 miles southwest of the study area. Flowing water was present in Little Chino Creek within the study area during the delineation.

The entirety of Carbon Canyon Channel of Little Chino Creek within the study area has been manipulated and channelized. It is described as a trapezoidal-shaped earthen channel with grouted rock side slopes and a rocky invert.

4.2 NATIONAL WETLAND INVENTORY

The NWI (USFWS 2019) indicates the potential for freshwater emergent (PEM1C) wetlands along the extent of the study area, and riverine wetlands (R5UBF) near the western boundary of the study area (Figure 4). NWI wetland descriptions are based on Cowardin Classification (Cowardin et. al. 1979). The NWI program was neither designed nor intended to produce legal or regulatory products; therefore, wetlands identified by the NWI program are not the same as wetlands defined by the USACE and require field review and confirmation.

4.3 SOILS

Soils within the Project are primarily Sorrento clay loam with slopes of 0 to 2 percent. The Sorrento soil series consists of very deep, well drained soils that formed in alluvium mostly from sedimentary rock. They are typically on alluvial fans and stabilized floodplains and have slopes that range from 0 to 15 percent (NRCS 2019). Within the project, the slope ranges from 0 to 2 percent.

Soils that have been mapped within the Project area buffer include Sorrento clay loam and Chualar clay. The Chualar soil series consists of well drained soils that formed from granitic and schistose rocks on alluvial fans and terraces (NRCS 2019). Slopes from 0 to 9 percent but within the buffer of the project ranges from 0 to 2 percent (Figure 5).

4.4 VEGETATION COMMUNITIES

There are two vegetation communities that occur within the Project area: disturbed freshwater marsh and disturbed non-native grassland. The remainder of the Project area is not considered a vegetation community and is classified as developed/disturbed with no plant cover in the concrete and grouted rock areas or as open water. Acreages for these communities are summarized in Table 1 and depicted in Figures 6a through 6c.

4.4.1 Disturbed Freshwater Marsh

Freshwater marsh has a state rarity rank of S5 and is secure, which is synonymous with narrow leaf cattail (*Typha angustifolia*) herbaceous alliance (NVCS) and coast and valley freshwater marsh (Holland). It is characterized with clayey or silty soils. Other plants that occur within this community include cattail (*Schoenoplectus californicus*), Irish-leaved rush (*Juncus xiphoides*), and coon's tail mats (*Ceratophyllum demersum*) and is associated with the freshwater emergent wetland areas of the project area.

This vegetation community has been highly disturbed by anthropogenic effects from previous channel maintenance activities, trash, and occasional recreation from nearby residents resulting in less density and shorter plants.

4.4.2 Disturbed Non-Native Grassland

This vegetation community does not have a state rarity rank. It is synonymous to red brome (*Bromus rubens*) herbaceous semi-natural alliance (NVCS) and non-native grassland (Holland). This vegetation community occurs in all topography settings and soil textures.

This vegetation community is associated with the upland habitat of the Project where primarily grasses and ruderal plants were observed and is also disturbed from maintenance activities.

Table 1. Summary of Vegetation Communities

Community Type	Acreage
Disturbed Freshwater Marsh	1.13
Disturbed Non-Native Grassland	1.3
Open Water	1.75
Developed/Disturbed	11.36

4.5 PRECIPITATION

Precipitation data was obtained from the NCEI-NOAA (2019) for the most proximate station to the study area, which is located at the Chino Airport, approximately 4 miles east.

Historical rainfall data from 2009 to 2019 were totaled and averaged for the winter (October through March) and summer (April through September) periods (**Error! Reference source not found.**) (rainfall seasons run from October through September of the following year). In the last decade, the 2019 season up through May of 2019 has already been the wettest precipitation year with May 2019 being the wettest summer month on record in the last decade.

Table 2. Regional Rainfall Totals Since 2009

	Precipitation (inches)	
Year	**Winter (October to March)**	**Summer (April to September)**
2009	5.72	0
2010	11.47	0.51
2011	9.35	0.36
2012	4.2	0.63
2013	2.46	0.42
2014	2.02	0.44
2015	7.21	2.87
2016	4.59	0.25
2017	14.55	0.82
2018	2.27	0.12
2019	15.63	1.13 (April-May)

Source: NCEI-NOAA 2019, Chino Airport Weather Station.

5.0 RESULTS

5.1 CRAM

CRAM scores for each AA were very similar – AA1 had a total CRAM score of 38 while AA2 had a total CRAM score of 39. The average CRAM score for both AAs is 38.5 out of 100.

Attribute scores for AA1 and AA2 were the same except for hydrology and biotic structure. The difference in the hydrology attribute was due to a lower average entrenchment ratio for AA2 which gave it a lower score. The difference in the biotic structure attribute was due to AA2 having one more floating plant layer that also gave it a slightly higher score. Figure 7 shows the location of both AA1 and AA2 within the Study Area. Representative photographs for AA1 and AA2 (Photos 1 through 5) are provided following the figures.

Attribute and metric scores for each AA are summarized below in Table 3. Datasheets for each AA and aerial maps used for reference in the field are included in the Appendix.

Table 3. CRAM Attribute and Metric Score Summary

ATTRIBUTES AND METRICS	AA1 SCORES	AA1 COMMENTS	AA2 SCORES	AA2 COMMENTS
Attribute 1: Buffer and Landscape Context				
Stream Corridor Continuity	3 (D)	240 m	3 (D)	270 m
%AA with Buffer	12 (A)	100% with buffer from walkway/ maintenance road	12 (A)	100% with buffer from walkway/ maintenance road
Average Buffer Width	3 (D)	19 m wide	3 (D)	15 m wide
Buffer Submetric Condition	3(D)	Buffer compacted and barren	3(D)	Buffer compacted and barren
Raw Attribute 1 Score	*6*	-	*6*	-
Final Attribute 1 Score	*25*	-	*25*	-
Attribute 2: Hydrology				
Water Source	6 (C)	urban runoff	6 (C)	urban runoff
Channel Stability	12 (A)	4 equilibrium indicators	12 (A)	4 equilibrium indicators
Hydrologic Connectivity	6 (C)	1.36 average entrenchment ratio	3(D)	1.18 average entrenchment ratio
Raw Attribute 2 Score	*24*	-	*21*	-
Final Attribute 2 Score	*66*	-	*58*	-
Attribute 3: Physical Structure				
Structural Patch Richness	6 (C)	4 patches	6 (C)	6 patches
Topographic Complexity	3(D)	no micro or macro topography	3(D)	no micro or macro topography
Raw Attribute 3 Score	*9*	-	*9*	-
Final Attribute 3 Score	*37*	-	*37*	-
Attribute 4: Biotic Structure				
Plant Community Composition Metric (Avg of submetrics)	3	short layer only, 2 co-dominants, 50% invasion	4	short and floating layers, 2 co-dominant, 50% invasion
Horizontal Interspersion	3 (D)	No interspersion	3(D)	Little interspersion
Vertical Biotic Structure	3 (D)	<25% plant overlap	6(C)	>25% plant overlap
Raw Attribute 4 Score	*9*	-	*13*	-
Final Attribute 4 Score	*25*	-	*36*	-
OVERALL AA CRAM SCORE		***38***		***39***
AVERAGE CRAM SCORE				***38.5***

5.2 JURISDICTIONAL WETLANDS AND WATERS OF THE U.S.

A total of 17 jurisdictional features were identified during the delineation. The Carbon Canyon Channel of Little Chino Creek was mapped as a jurisdictional water of the U.S. Five wetland data points were recorded (Table 4) and 16 individual wetlands were identified delineated (Table 5).

All aquatic resources identified during the delineation are associated with the Carbon Canyon Channel of Little Chino Creek and are considered to be jurisdictional under Sections 401 and 404 of the CWA and under CDFW's CFGC Sections 1600 to 1616. No riparian vegetation was observed within the study area during the delineation.

Of the five wetland data points collected, three met the wetland criteria (hydrophytic vegetation, hydric soils, and hydrology indicators) (SP-1, SP-2, and SP-3) (Table 4). All wetland data points are representative of riverine wetlands (Cowardin Type R5UBF). Table 5 summarizes all aquatic resources and data points. Wetland Determination Data Forms for the five data points are in the Appendix. Wetlands and data points are shown on Figures 8a through c. Representative photographs corresponding to each data point (Photos 5 through 11) follow the figures.

Table 4. Wetland Data Points

Data Point	Location (Lat/Long)	Dominant Vegetation	Soil	Hydrology	Cowardin Type
SP-01	33.98618056/ -117.71556	• Coon's tail mat (*Ceratophyllum demersum*) (OBL) • California bulrush (*Schoenoplectus californicus*) (OBL) • Hydrophytic vegetation cover = 65 percent	• Inundated surface (0-3") • Loamy mucky mineral soils (F1), classified as 10YR value 2 and chroma 1 (10YR 2/1) (3-9")	• Surface water (A1) • Saturation (A3)	R5UBF (Riverine)
SP-02	33.98618/ -117.71556	• None	• None- Stabilized bank	• None	NA
SP-03	33.98769/ -117.72389	• California bulrush • Narrowleaf cattail (*Typha angustifolia*) (OBL) • Mexican sprangletop (*Leptochloa fusca univervia*) (FACW) • Hydrophytic vegetation cover = 60 percent	• Open water at surface (0-10"+)	• Surface water (A1)	R5UBF (Riverine)
SP-04	33.98767/ -117.26694	• Red brome (*Bromus rubens*) (UPL) • No hydrophytic vegetation cover present	• Sandy, light uniform soils characterized as 10YR 6/2 (0-10") • Concrete-lined channel at 10"	• Water stained leaves below OHWM (B9)	NA

Data Point	Location (Lat/Long)	Dominant Vegetation	Soil	Hydrology	Cowardin Type
SP-05	33.98767/ -117.72750	• Narrowleaf cattail (OBL) • Hydrophytic vegetation cover = 66 percent	• Sandy, light uniform soils characterized as 10YR 6/2 (0-5") • Sandy mucky mineral soils (S1), gritty and greasy • Soil color classified as 10YR 3/2 (5-10") • Concrete channel lining at 10"	• Surface water (A1) • Saturation (A3)	R5UBF (Riverine)

Table 5. Aquatic Resources, Associated Data Points, Acreage, and Location

Wetland	Data Point	Size (Acres)	Location (Lat/Long)	Description
Carbon Canyon Channel	NA	2.62 (5,147 linear feet)	33.98771/ -117.72339	Approximately 20 to 30 feet wide along the project area, with flowing water present during the delineation. Carbon Canyon Channel is part of the Little Chino Creek which drains into Chino Creek approximately 0.4 miles east of the study area. Chino Creek is a tributary to the Santa Ana River, a TNW.
W-01	SP-01	0.004	33.98617/ -117.71568	Disturbed freshwater marsh wetlands dominated by coon's tail mat and California bulrush. Other aquatic species include irisleaf rush (*Juncus xiphioides*) (OBL), Mediterranean rabbitsfoot grass (*Polypogon meritimus*) (OBL), and Mexican sprangletop (FACW). Surface water and/or soil saturation is present (A1, A3). Soils are characterized as loamy mucky mineral (F1).
W-02	SP-01	0.06	33.98615/ -117.71706	
W-02a	SP-01	0.01	33.98623/ -117.71692	
W-03	SP-01	0.04	33.98615/ -117.71813	
W-04	SP-01	0.20	33.98623/ -117.71950	
W-05	SP-01	0.06	33.98986/ -117.72103	
W-06	SP-01	0.005	33.98702/ -117.72132	
W-09	SP-01	0.23	33.98765/ -117.72299	
W-10	SP-03	0.13	33.98767/ -117.72431	Disturbed freshwater marsh wetlands dominated by narrowleaf cattail (OBL) and California bulrush (OBL). Other hydrophytic species include irisleaf rush (OBL), coon's tail mat (OBL), American speedwell (*Veronica Americana*) (OBL), and Mexican sprangletop (FACW). Upland species include red brome and stinging nettle. Surface water and/or soil saturation is present (A1, A3). Soils are inundated under 10"+ of water.
W-11	SP-03	0.17	33.98768/ -117.72637	
W-11a	SP-03	0.08	33.98770/ -117.72549	

Wetland	Data Point	Size (Acres)	Location (Lat/Long)	Description
W-12	SP-05	0.01	33.98763/ -117.72762	Disturbed freshwater marsh wetland dominated by narrowleaf cattail (OBL). Other hydrophytic species coon's tail mat (OBL), American speedwell (OBL), water speedwell (*Veronica anagallis-aquatica*)(OBL), Mediterranean rabbitsfoot grass (OBL), watercress (*Nasturtuim officianale*) (OBL), and Mexican sprangletop (FACW). Upland species present include stinging nettle. Surface water and/or soil saturation was present at each wetland (A1, A3). Soils are characterized as loamy mucky mineral (F1). Surface water and/or soil saturation is present (A1, A3). Soils are characterized as sandy mucky mineral (S1).
W-14	SP-03	0.07	33.98690/ -117.72863	Disturbed freshwater marsh wetlands dominated by narrowleaf cattail (OBL) and California bulrush (OBL). Other hydrophytic species include irisleaf rush (OBL), coon's tail mat (OBL), American speedwell (OBL), and Mexican sprangletop (FACW). Upland species present include red brome and stinging nettle. Surface water and/or soil saturation is present (A1, A3). Soils are inundated under 10"+ of water.
W-14a	SP-03	0.04	33.98664/ -117.72943	
W-15	SP-03	0.03	33.98651/ -117.72988	
Total Potential USACE and CDFW Jurisdictional Acreages: **Wetland Acres: 1.099** **Waters Acres: 2.63** **Waters Linear Feet: 5,147**				

6.0 DISCUSSION

6.1 CRAM

Records of two CRAM assessments, closest to the Project that were conducted within Chino Creek had average CRAM scores of 36 and 34 (EcoAtlas 2019). The average CRAM score for the Project at 38.5 is slightly higher, but still occurs within a similar range. CRAM scores can be objective when metric scores are within borderline values resulting in some variation between individual CRAM practitioners. More than one practitioner performing a CRAM assessment forms a consensus of the CRAM score.

The current CRAM score indicates the current wetland condition of the Project prior to beginning construction activities has a lower score due to the surrounding residential development resulting in a lack of buffer and the developed condition of the study area. There were no sensitive wildlife species observed within AA1 or AA2. However, a red-eared slider, tadpoles, and green sunfish were observed within and adjacent to AA2.

6.2 JURISDICTIONAL WETLANDS AND WATERS OF THE U.S.

The following discussion represents the best effort at determining the jurisdictional boundaries using the most current regulations and guidance from the USACE and CDFW. The USACE is ultimately responsible for jurisdictional determination and approval of permits that authorize permanent and temporary impacts to wetlands. This report has been prepared to provide the necessary information to assist with that determination and permitting process.

6.2.1 Clean Water Act Jurisdiction (Section 404)

Carbon Canyon Channel is an intermittent drainage that experiences flowing water between 3 and 6 months a year. Flowing water was present during the delineation, after the wettest winter in the previous decade and a relatively high level of precipitation during the month of May compared to previous years. The wetlands and waters identified during the delineation all have a surface connection to the Santa Ana River through Chino Creek and are likely to be waters of the U.S. Permanent impacts to jurisdictional wetlands and waters of the U.S. would require review and permitting by the USACE. A nationwide permit may cover the proposed permanent and temporary impacts to the jurisdictional wetlands and water delineated within the study area.

6.2.2 California Porter-Cologne Water Quality Act and Clean Water Act Jurisdiction (Section 401)

The RWQCB regulates discharges to jurisdictional waters under the federal CWA and the California Porter-Cologne Water Quality Control Act, which is implemented through issuance of National Pollutant Discharge Elimination System permits for point source discharges and WDRs for non-point source discharges. Based on the findings outlined above, a CWA Section 401 Water Quality Certification is likely to be required. It is recommended that San Bernardino County Flood Control District confirm with the Santa Ana (Region 8) RWQCB as to whether Waste Discharge Requirements or Report of Waste Discharge would be required for the Project.

6.2.3 CDFW Jurisdiction (CFGC Sections 1600–1616)

The area estimated to meet the definition of CDFW-jurisdictional waters within the study area includes all delineated features within the study area. CFGC Section 1602 requires project proponents to notify CDFW prior to any activity that may substantially modify CDFW-jurisdictional streambeds. Based on the findings above, a Notification of Lake or Streambed Alteration form should be submitted to CDFW, along with the required supplemental material (including precise impact calculations) and fee. CEQA review will be required for the effects of CDFW-jurisdictional streambeds and associated riparian habitat.

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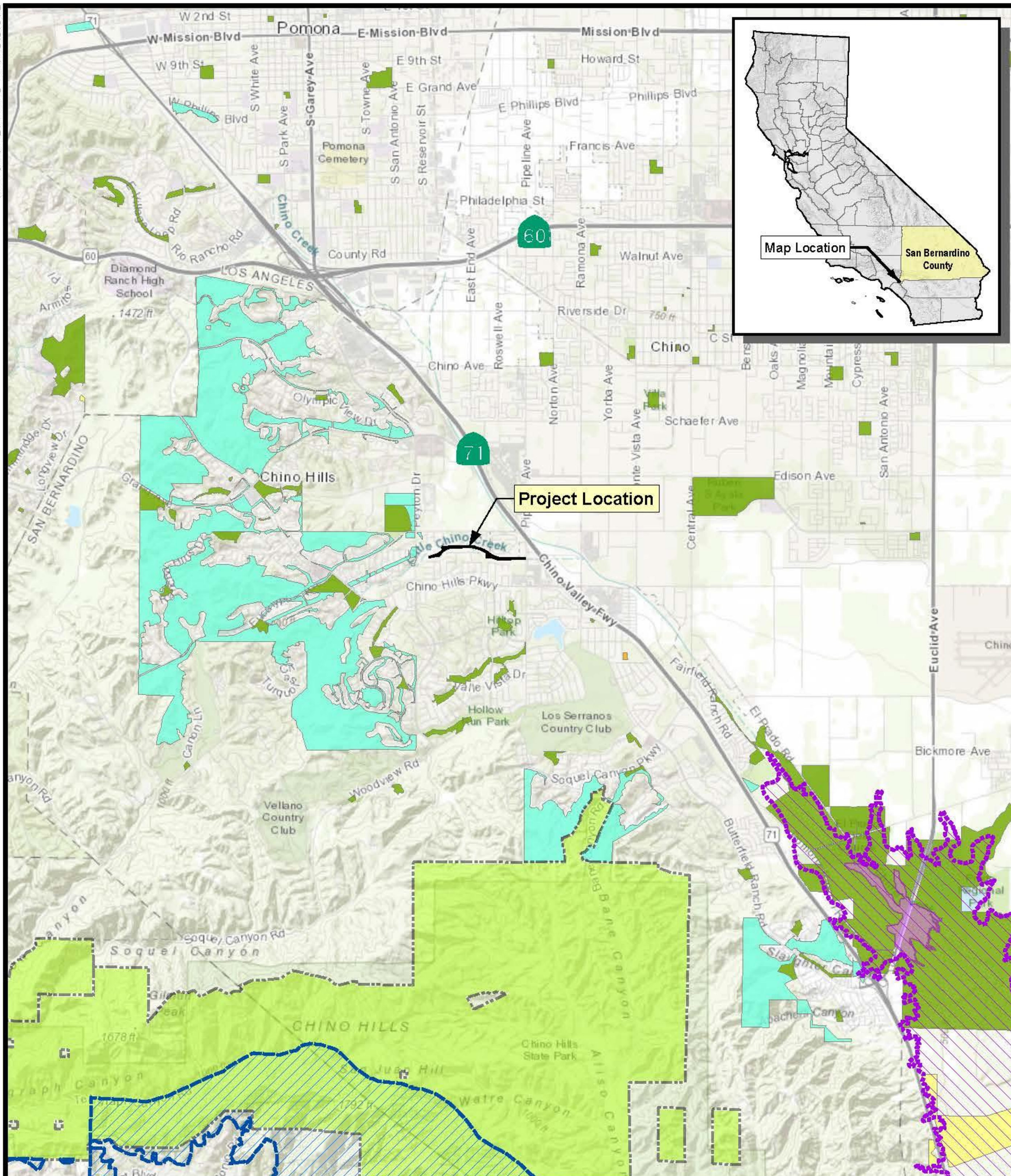


Least Bell's Vireo *(Vireo bellii pusillus)* Critical Habitat Area

California Gnatcatcher *(Polioptiila californica)* Critical Habitat Area

Chino Hills State Park

Southwestern Willow Flycatcher *(Empidonax traillii extimus)* Critical Habitat

Prado Flood Control Basin

Local Park

Local Recreation Area

State Resource Management Area

Ironwood Consulting

0 1

Miles

FIGURE 1

Regional Location

Carbon Canyon Channel

P:\GIS\Carbon_Canyon\Site.mxd

Ironwood
Consulting

0 250 500
Feet

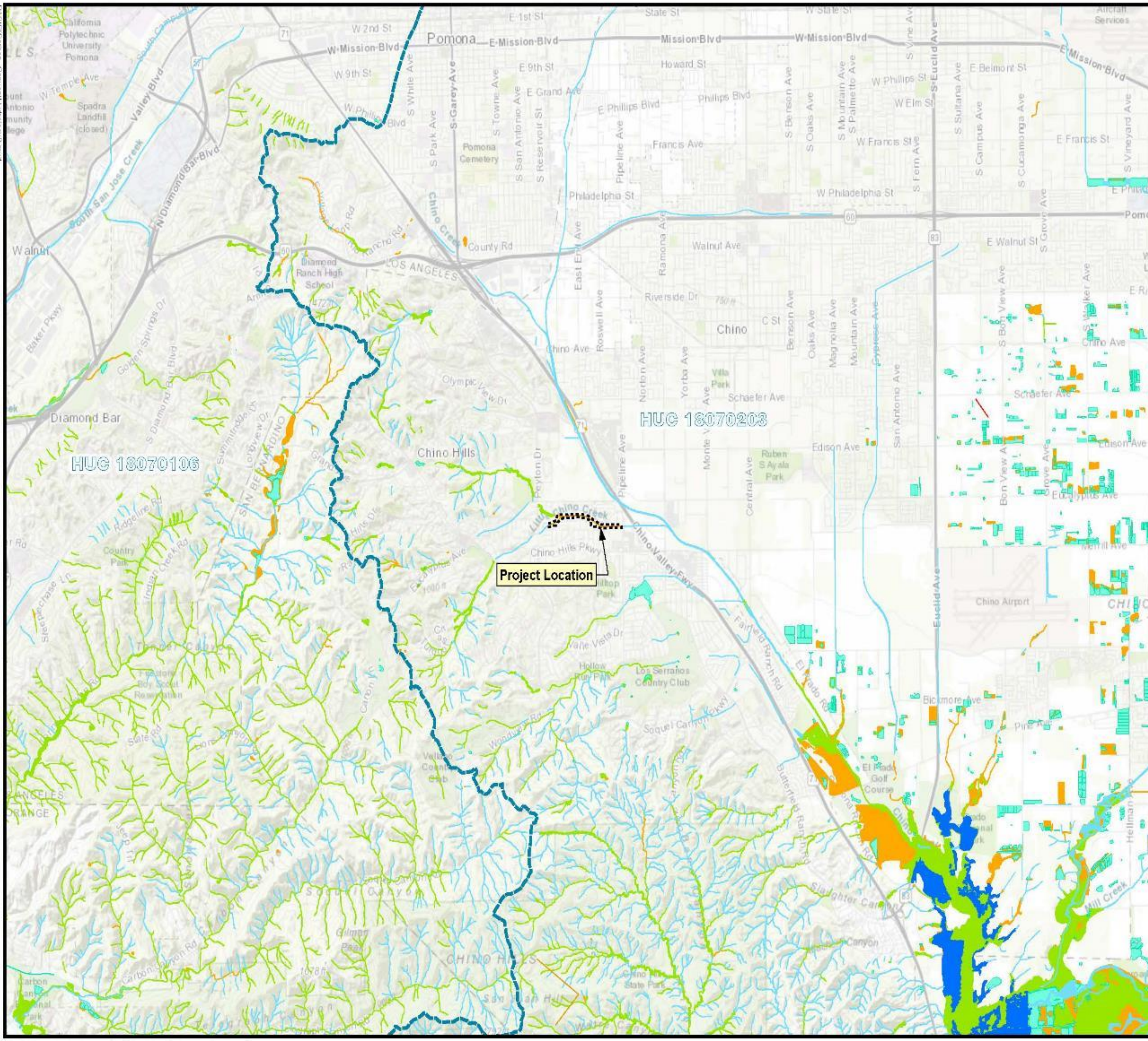
Project Boundary

Note:
Project site located within the Prado Dam 7.5' topographic quadrangle, in Township 2 South, Range 8 West, Section 21. (33.98771 latitude, -117.72339 longitude).

FIGURE 2

Project Site

Carbon Canyon Channel



CARBON CANYON CHANNEL

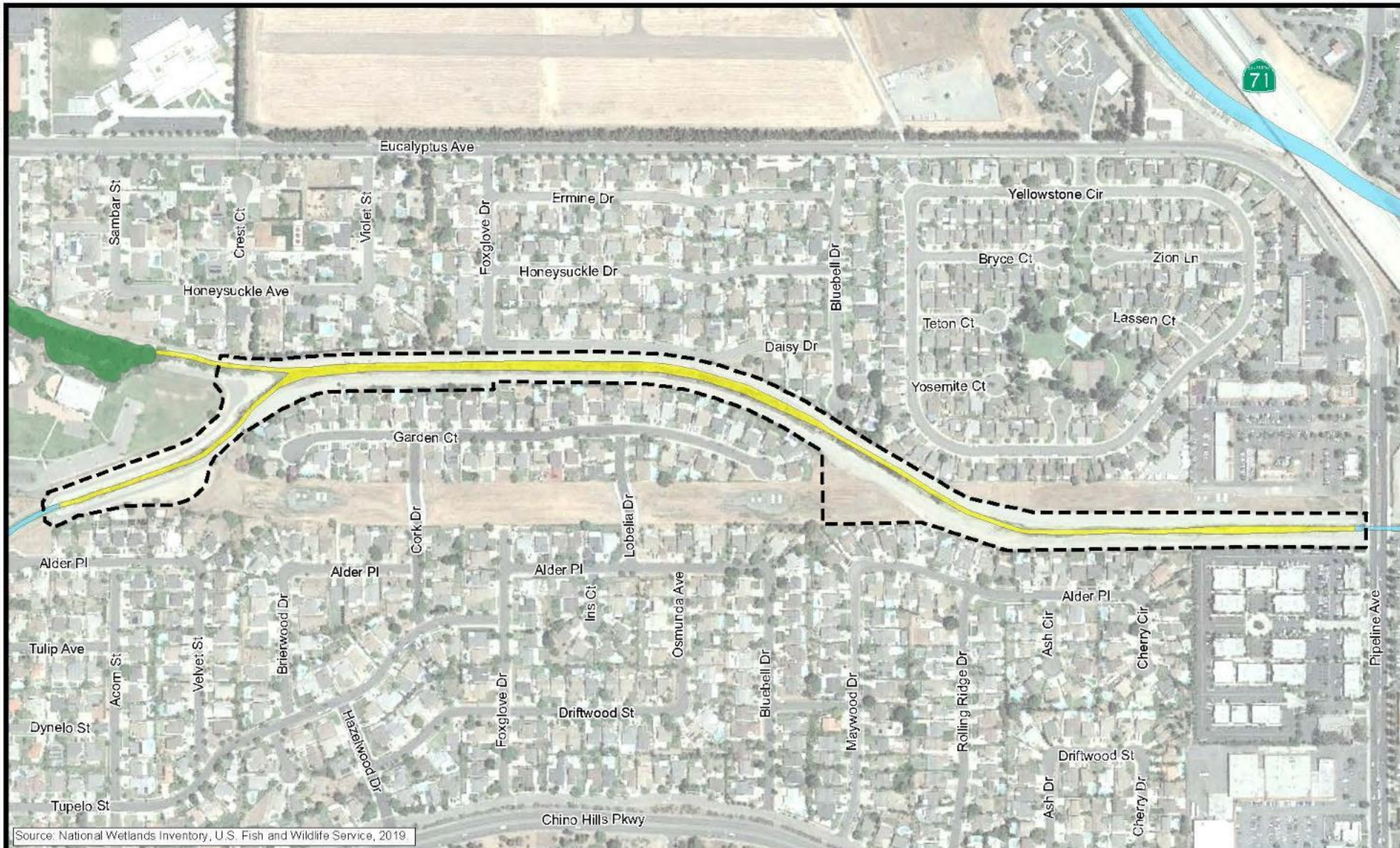
Figure 3

Hydrology

TETRA TECH

Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P

P:\GIS\Carbon_CanyonHydrology.mxd



Ironwood Consulting

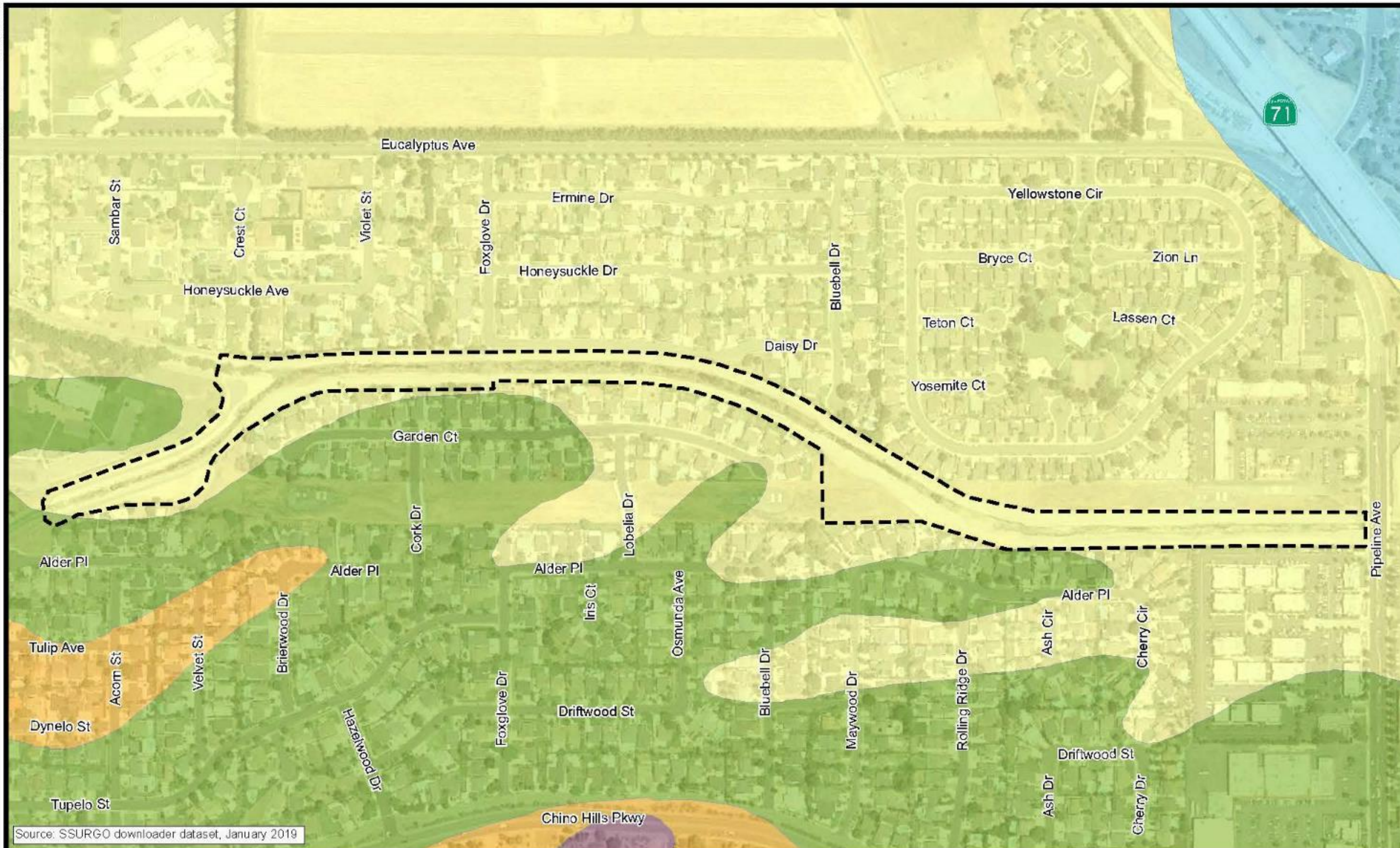
0 250 500 Feet

Project Boundary
Freshwater Emergent Wetland
Freshwater Forested/Shrub Wetland
Riverine

FIGURE 4

National Wetland Inventory (NWI)

Carbon Canyon Channel



Ironwood Consulting

0 250 500
Feet

Project Boundary

Chualar clay loam, 2 to 9 percent slopes

Fontana clay loam, 15 to 30 percent slopes

Fontana clay loam, 30 to 50 percent slopes

Grangeville fine sandy loam, warm MAAT, MLRA 19

Sorrento clay loam, 0 to 2 percent slopes, warm MAAT, MLRA 19

FIGURE 5

Soils

Carbon Canyon Channel

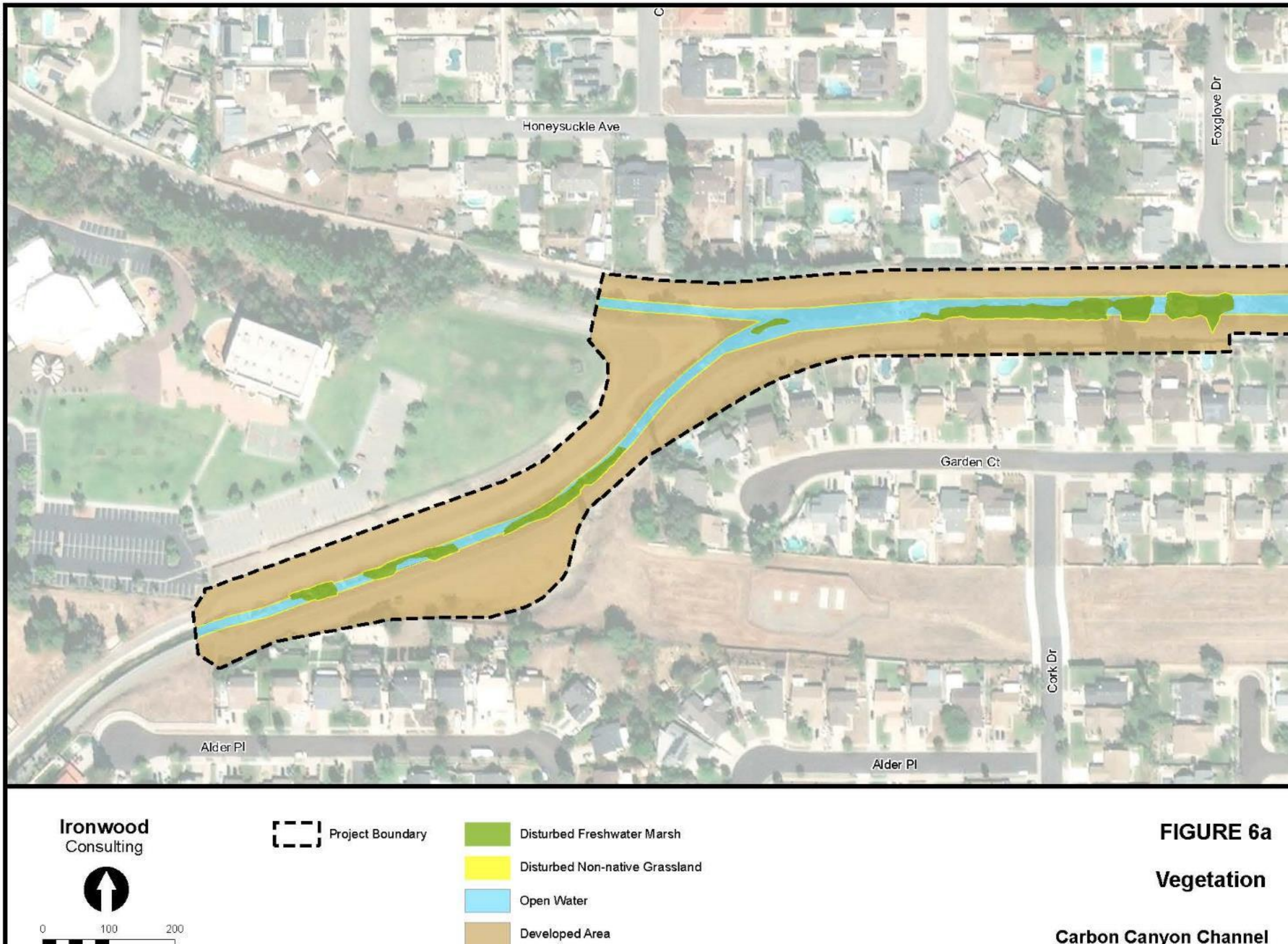
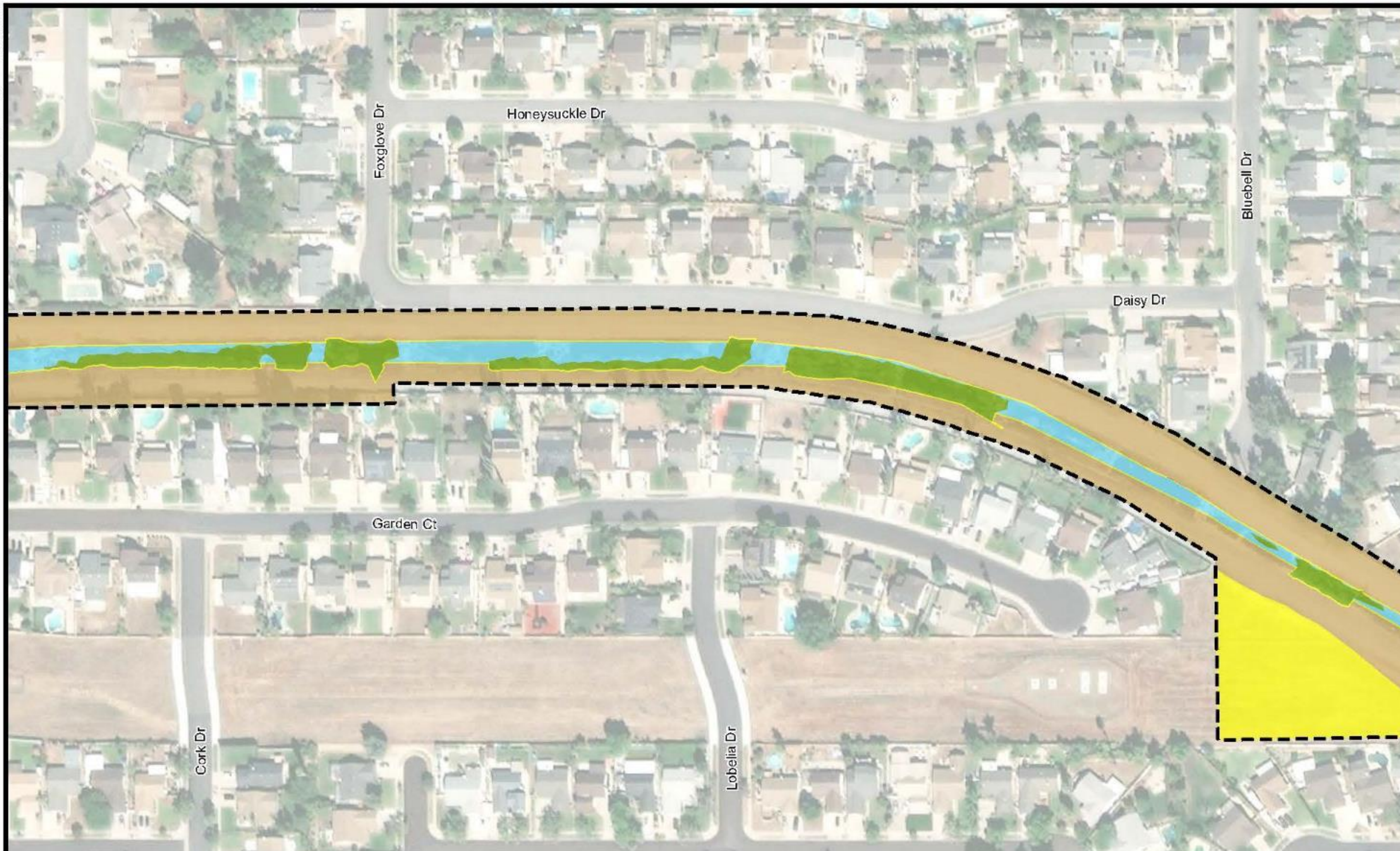


FIGURE 6a

Vegetation

Carbon Canyon Channel



P:\GIS\Carbon_Canyon\Vegetation2.mxd

Ironwood Consulting

0 100 200
Feet

Project Boundary

Disturbed Freshwater Marsh

Disturbed Non-native Grassland

Open Water

Developed Area

FIGURE 6b

Vegetation

Carbon Canyon Channel

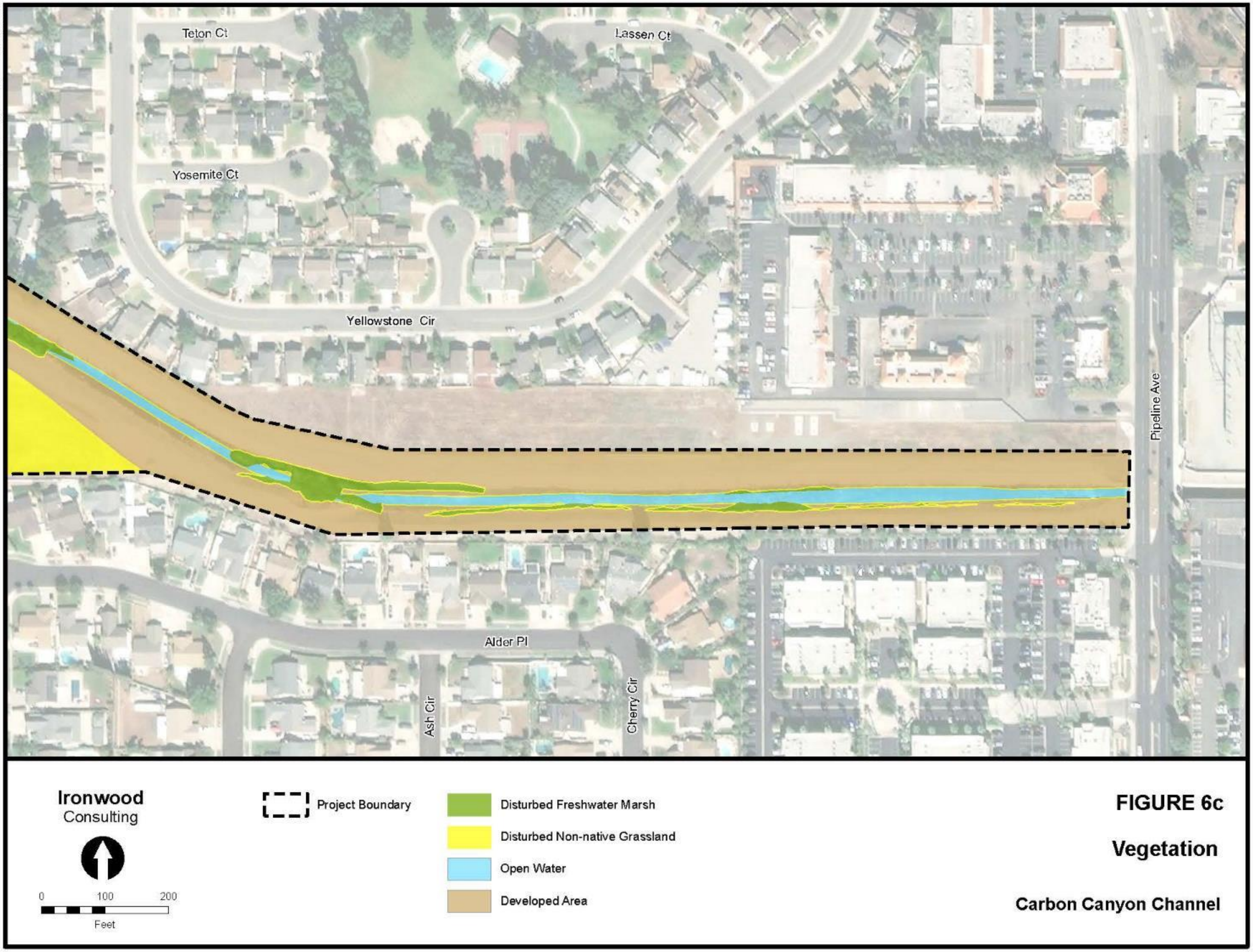


FIGURE 6c

Vegetation

Carbon Canyon Channel

P:\GIS\Carbon_Canyon\Assess_Areas.mxd

Ironwood
Consulting

0 250 500
Feet

CRAM Assessment Area

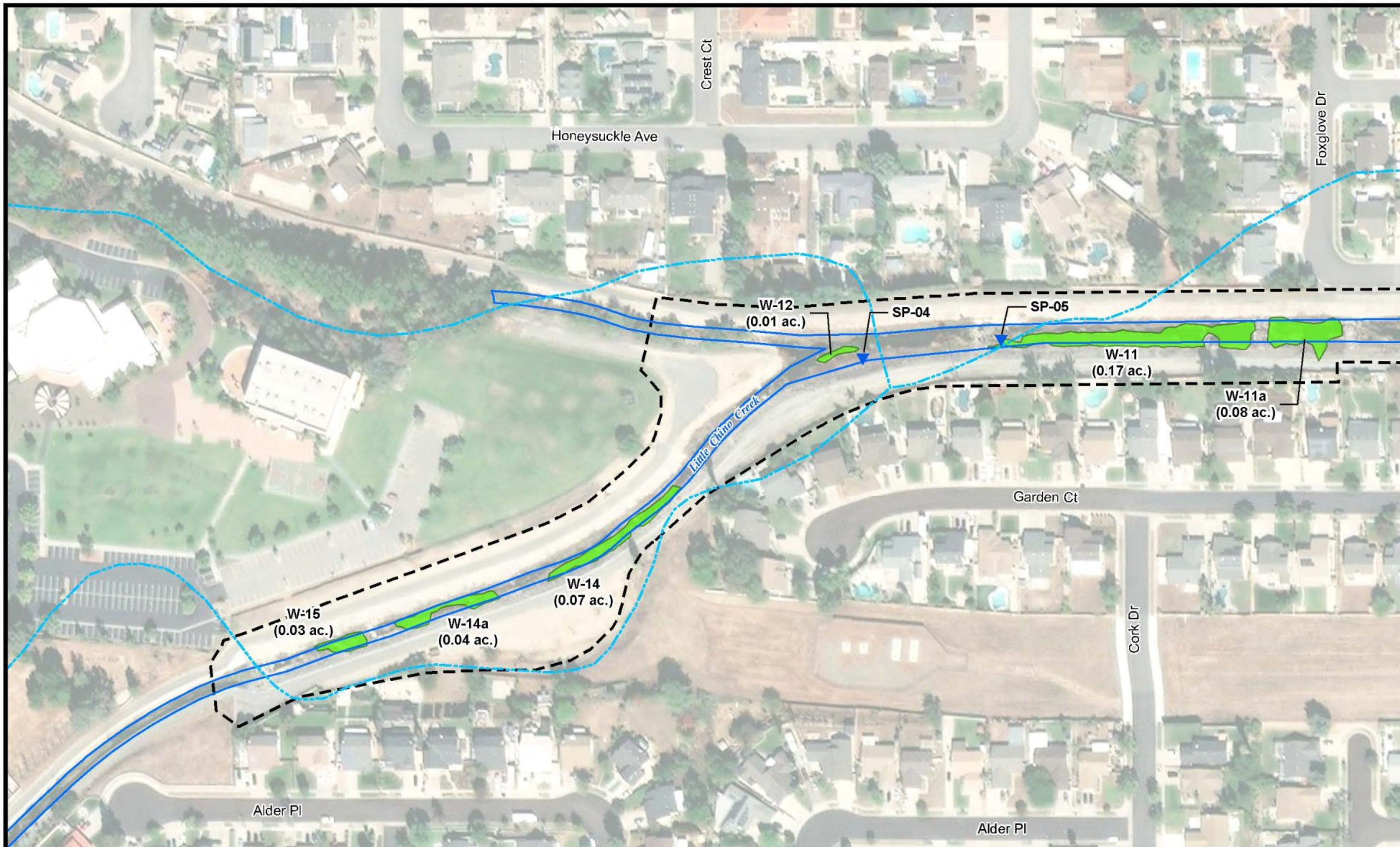
Project Boundary

FIGURE 7

CRAM Assessment Areas

Carbon Canyon Channel

P:\GIS\Carbon_Canyon\Wetlands_1.mxd



Ironwood Consulting

0 100 200
Feet

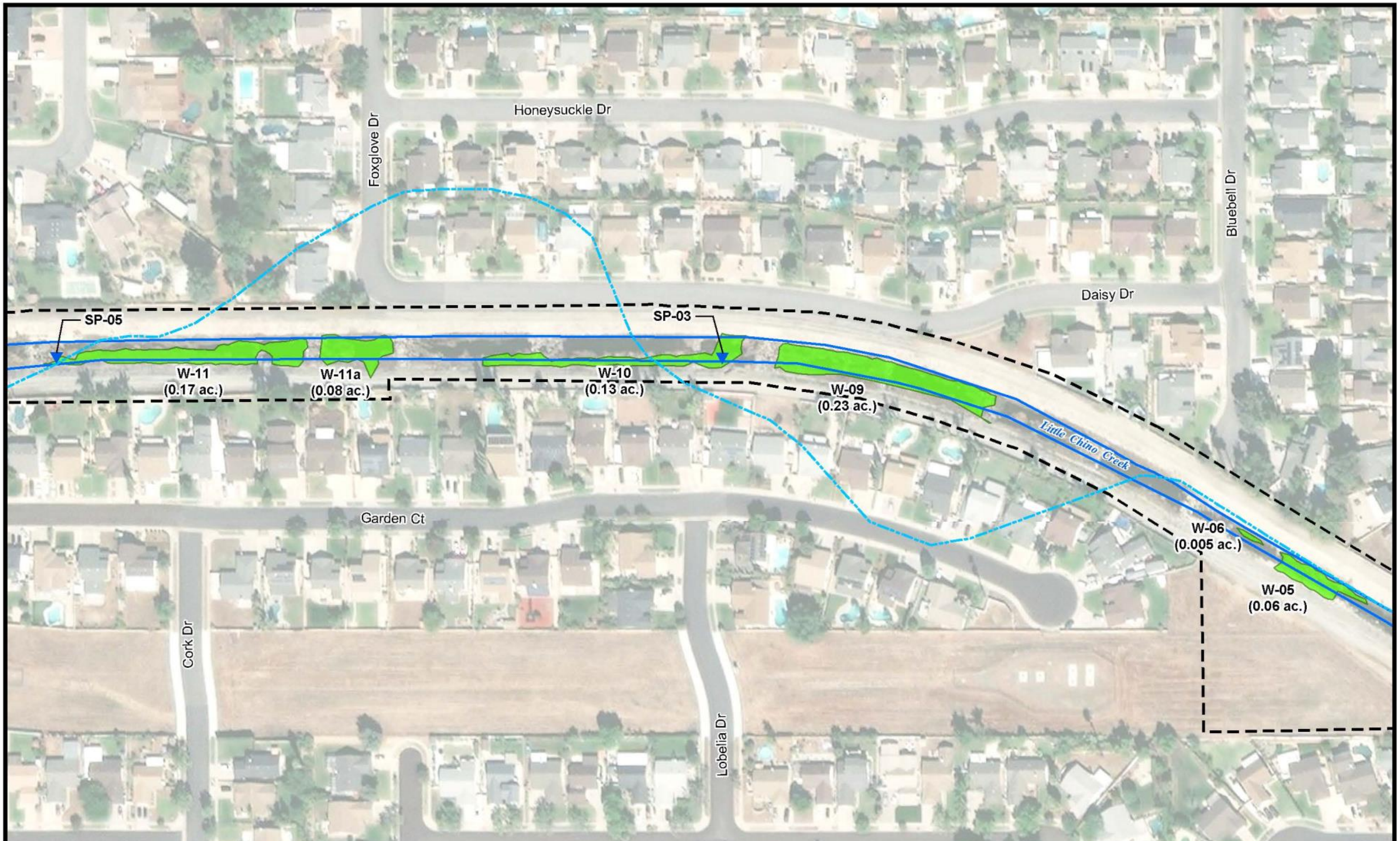
Wetland Data Point
National Hydrography Mapped Waterway
Wetland
Waters (2.63 ac.)
Project Boundary

FIGURE 8a

Potential USACE and CDFW Jurisdictional Areas

Carbon Canyon Channel

P:\GIS\Carbon_Canyon\Wetlands_2.mxd



Ironwood Consulting

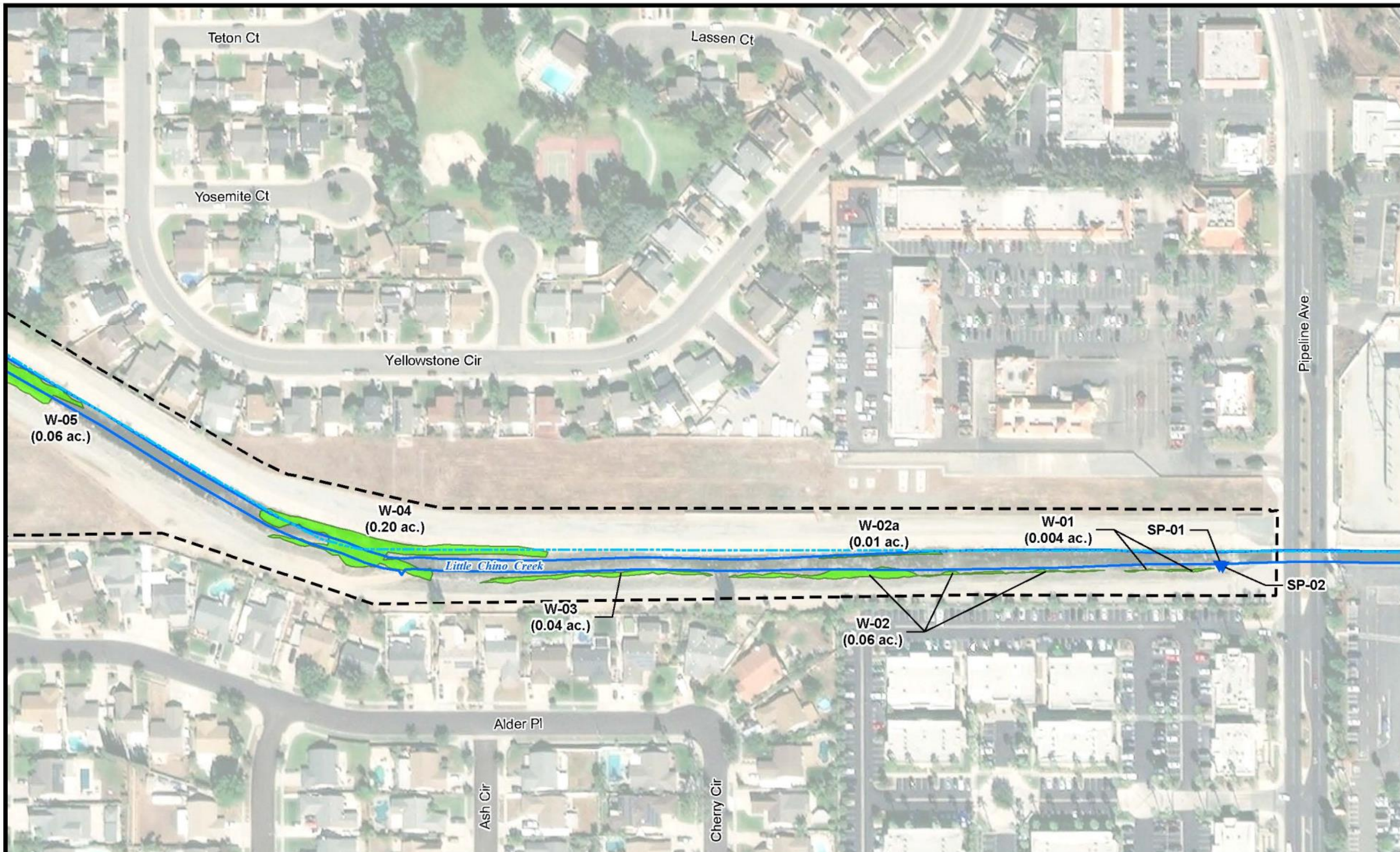
0 100 200
Feet

- Wetland Data Point
- National Hydrography Mapped Waterway
- Wetland
- Waters (2.63 ac.)
- Project Boundary

FIGURE 8b

Potential USACE and CDFW Jurisdictional Areas

Carbon Canyon Channel



P:\GIS\Carbon_Canyon\Wetlands_3.mxd

Ironwood
Consulting

0 100 200
Feet

Wetland Data Point
National Hydrography Mapped Waterway
Waters (2.63 ac.)
Wetland
Project Boundary

FIGURE 8c

Potential USACE and CDFW Jurisdictional Areas

Carbon Canyon Channel

Photo 1. CRAM AA1 western extent, facing east

Photo 2. CRAM AA1 eastern extent, facing west

Photo 3. CRAM AA2 western extent, facing east

Photo 4. CRAM AA2 western extent, facing west

Photo 5. Representative photo of CRAM AA buffer

Photo 6. Wetland, near eastern boundary of study area looking west

Photo 7. Loamy mucky mineral soils at SP-01

Photo 8. SP-03 with wetland vegetation and standing water

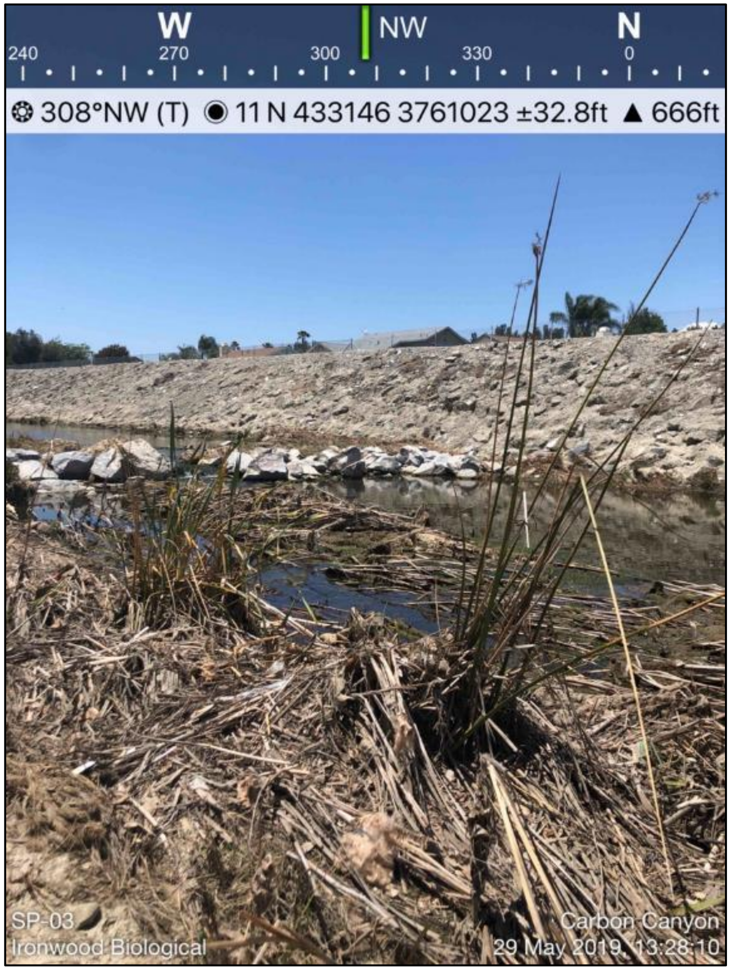


Photo 9. Sandy mucky mineral soils at SP-05

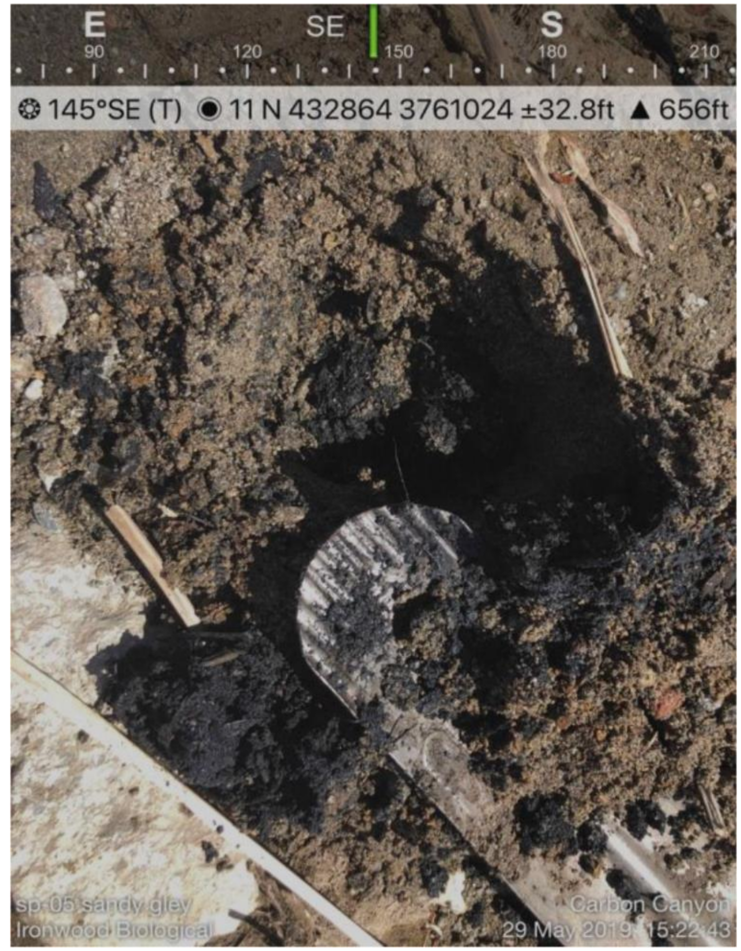


Photo 10. Looking east at wetland W-12, where SP-05 was collected

Photo 11. Representative wetland with characteristics of SP-03 and surrounding uplands (SP-02, SP-04)

APPENDIX

CRAM Datasheets and Field Maps for AA1
CRAM Datasheets and Field Maps for AA2
JD Datasheets

CRAM Data Sheets and Field Maps for AA1

Basic Information Sheet: Riverine Wetlands

Assessment Area Name: Carbon Canyon	
Project Name: Carbon Canyon Channel	
Assessment Area ID #: AA1	
Project ID #: —	**Date:** 28-May-2019
Assessment Team Members for This AA:	
Lehong Chow	
Scott Taylor	
Average Bankfull Width:	
Approximate Length of AA (10 times bankfull width, min 100 m, max 200 m): ~150	
Upstream Point Latitude: UTM: 432600 / 3760901	**Longitude:**
Downstream Point Latitude: UTM: 432702/3760948	**Longitude:**

Wetland Sub-type:

☑ Confined ☐ Non-confined

AA Category:

☐ Restoration ☐ Mitigation ☑ Impacted ☐ Ambient ☐ Reference ☐ Training

☐ Other:

Did the river/stream have flowing water at the time of the assessment? ☑ yes ☐ no

What is the apparent hydrologic flow regime of the reach you are assessing?

The hydrologic flow regime of a stream describes the frequency with which the channel conducts water. *Perennial* streams conduct water all year long, whereas *ephemeral* streams conduct water only during and immediately following precipitation events. *Intermittent* streams are dry for part of the year, but conduct water for periods longer than ephemeral streams, as a function of watershed size and water source.

☑ perennial ☐ intermittent ☐ ephemeral

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		Upstream	432600	376901	WGS84
2		upstream ~~Middle Left~~	"	"	"
3		downstream ~~Middle Right~~	432702	37609408	"
4		Downstream	432702	37609408	WGS84
5					
6					
7					
8					
9					
10					

Site Location Description:

- western end of proj.
- sports field from business (church) to the northwest
- highly disturbed grasses throughout

Comments:

- Culverts nearby
- lots of hydrological breaks from rip rap so adjusted AA to smaller area

Scoring Sheet: Riverine Wetlands

AA Name: AA1			**Date:** 28 May 2019
Attribute 1: Buffer and Landscape Context (pp. 11-19)			**Comments**
	Alpha.	Numeric	
Stream Corridor Continuity (D)	D	3	240 m
Buffer:			
	Alpha.	Numeric	
Buffer submetric A: Percent of AA with Buffer	A	12	100% buffer from maintenance rd
Buffer submetric B: Average Buffer Width	D	3	Avg width = 19 m
Buffer submetric C: Buffer Condition	D	3	buffer compacted, no veg
Raw Attribute Score = D+[C x (A x B)^{½}]^{½}		7	**Final Attribute Score = (Raw Score/24) x 100**: 29
Attribute 2: Hydrology (pp. 20-26)			
	Alpha.	Numeric	
Water Source	C	6	urban runoff
Channel Stability	A	12	4 equilibrium
Hydrologic Connectivity	C	6	1.36 ratio
Raw Attribute Score = sum of numeric scores		24	**Final Attribute Score = (Raw Score/36) x 100**: 66
Attribute 3: Physical Structure (pp. 27-33)			
	Alpha.	Numeric	
Structural Patch Richness	C	6	6 patches
Topographic Complexity	D	3	no micro or macro
Raw Attribute Score = sum of numeric scores		9	**Final Attribute Score = (Raw Score/24) x 100**: 37
Attribute 4: Biotic Structure (pp. 34-41)			
Plant Community Composition (based on sub-metrics A-C)			
	Alpha.	Numeric	
Plant Community submetric A: Number of plant layers	D	3	short layer (grasses)
Plant Community submetric B: Number of Co-dominant species	D	3	no co-dom
Plant Community submetric C: Percent Invasion	D	3	>75% invasion
Plant Community Composition Metric *(numeric average of submetrics A-C)*		3	
Horizontal Interspersion	D	3	no interspersion
Vertical Biotic Structure	D	3	<25% overlap
Raw Attribute Score = sum of numeric scores		9	**Final Attribute Score = (Raw Score/36) x 100**: 25
Overall AA Score (average of four final Attribute Scores)			39

Worksheet for Stream Corridor Continuity Metric for Riverine Wetlands

Lengths of Non-buffer Segments For Distance of 500 m Upstream of AA		Lengths of Non-buffer Segments For Distance of 500 m Downstream of AA	
Segment No.	Length (m)	Segment No.	Length (m)
1	240 m	1	none
2		2	
3		3	
4		4	
5		5	
Upstream Total Length	240	Downstream Total Length	0

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

see map

Percent of AA with Buffer: ______ %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	18
B	18
C	18
D	18
E	18
F	17
G	25
H	23
Average Buffer Width *Round to the nearest integer*	19

Worksheet for Assessing Channel Stability for Riverine Wetlands

Condition	Field Indicators (check all existing conditions)
Indicators of Channel Equilibrium	☑ The channel (or multiple channels in braided systems) has a well-defined bankfull contour that clearly demarcates an obvious active floodplain in the cross-sectional profile of the channel throughout most of the AA. ☐ Perennial riparian vegetation is abundant and well established along the bankfull contour, but not below it. ☑ There is leaf litter, thatch, or wrack in most pools (if pools are present). ☐ The channel contains embedded woody debris of the size and amount consistent with what is naturally available in the riparian area. ☑ There is little or no active undercutting or burial of riparian vegetation. ☑ If mid-channel bars and/or point bars are present, they are not densely vegetated with perennial vegetation. ☐ Channel bars consist of well-sorted bed material (smaller grain size on the top and downstream end of the bar, larger grain size along the margins and upstream end of the bar). ☐ There are channel pools, the spacing between pools tends to be regular and the bed is not planar throughout the AA ☐ The larger bed material supports abundant mosses or periphyton.
Indicators of Active Degradation	☐ The channel is characterized by deeply undercut banks with exposed living roots of trees or shrubs. ☐ There are abundant bank slides or slumps. ☐ The lower banks are uniformly scoured and not vegetated. ☐ Riparian vegetation is declining in stature or vigor, or many riparian trees and shrubs along the banks are leaning or falling into the channel. ☐ An obvious historical floodplain has recently been abandoned, as indicated by the age structure of its riparian vegetation. ☐ The channel bed appears scoured to bedrock or dense clay. ☐ Recently active flow pathways appear to have coalesced into one channel (i.e. a previously braided system is no longer braided). ☐ The channel has one or more knickpoints indicating headward erosion of the bed.
Indicators of Active Aggradation	☐ There is an active floodplain with fresh splays of coarse sediment (sand and larger that is not vegetated) deposited in the current or previous year. ☐ There are partially buried living tree trunks or shrubs along the banks. ☑ The bed is planar (flat or uniform gradient) overall; it lacks well-defined channel pools, or they are uncommon and irregularly spaced. ☐ There are partially buried, or sediment-choked, culverts. ☐ Perennial terrestrial or riparian vegetation is encroaching into the channel or onto channel bars below the bankfull contour. ☐ There are avulsion channels on the floodplain or adjacent valley floor.
Overall	☑ **Equilibrium** ☐ **Degradation** ☐ **Aggradation**

Riverine Wetland Entrenchment Ratio Calculation Worksheet

The following 5 steps should be conducted for each of 3 cross-sections located in the AA at the approximate midpoints along straight riffles or glides, away from deep pools or meander bends. An attempt should be made to place them at the top, middle, and bottom of the AA.				
Steps	**Replicate Cross-sections** ⟶	**TOP**	**MID**	**BOT**
1 Estimate bankfull width.	This is a critical step requiring familiarity with field indicators of the bankfull contour. Estimate or measure the distance between the right and left bankfull contours.	29	34	34
2: Estimate max. bankfull depth.	Imagine a level line between the right and left bankfull contours; estimate or measure the height of the line above the thalweg (the deepest part of the channel).	2.2	2.9	2.7
3: Estimate flood prone depth.	Double the estimate of maximum bankfull depth from Step 2.	4.4	5.8	5.4
4: Estimate flood prone width.	Imagine a level line having a height equal to the flood prone depth from Step 3; note where the line intercepts the right and left banks; estimate or measure the length of this line.	41	47.75	43.5
5: Calculate entrenchment ratio.	Divide the flood prone width (Step 4) by the bankfull width (Step 1).	1.41	1.40	1.27
6: Calculate average entrenchment ratio.	Calculate the average results for Step 5 for all 3 replicate cross-sections. Enter the average result here and use it in Table 13a or 13b.			1.36 C

Structural Patch Type Worksheet for Riverine wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in Table below. In the case of riverine wetlands, their status as confined or non-confined must first be determined (see page 6) to determine with patches are expected in the system (indicated by a "1" in the table below). Any feature onsite should only be counted once as a patch type. If a feature appears to meet the definition of more than one patch type (i.e. swale and secondary channel) the practitioner should choose which patch type best illustrates the feature. Not all features at a site will be patch types.

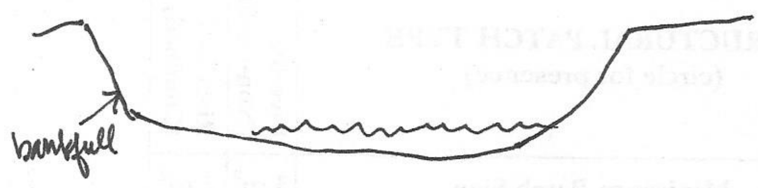
**Please refer to the CRAM Photo Dictionary at www.cramwetlands.org for photos of each of the following patch types.*

STRUCTURAL PATCH TYPE (circle for presence)	**Riverine (Non-confined)**	**Riverine (Confined)**
Minimum Patch Size	**3 m²**	**3 m²**
Abundant wrackline or organic debris in channel, on floodplain	1	1
Bank slumps or undercut banks in channels or along shoreline	1	1
Cobbles and/or Boulders	1	1
Debris jams	1	1
Filamentous macroalgae or algal mats	1	1
Large woody debris	1	1
Pannes or pools on floodplain	1	N/A
Plant hummocks and/or sediment mounds	1	1
Point bars and in-channel bars	1	1
Pools or depressions in channels (wet or dry channels)	1	1
Riffles or rapids (wet or dry channels)	1	1
Secondary channels on floodplains or along shorelines	1	N/A
Standing snags (at least 3 m tall)	1	1
Submerged vegetation	1	N/A
Swales on floodplain or along shoreline	1	N/A
Variegated, convoluted, or crenulated foreshore (instead of broadly arcuate or mostly straight)	1	1
Vegetated islands (mostly above high-water)	1	N/A
Total Possible	17	12
No. Observed Patch Types (enter here and use in Table 14 below)		4

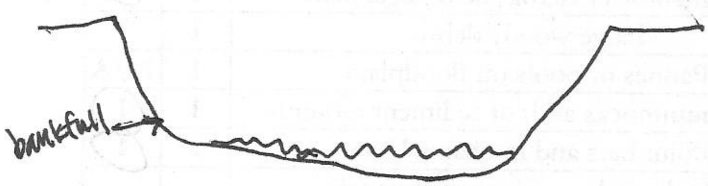
Worksheet for AA Topographic Complexity

At three locations along the AA, make a sketch of the profile of the stream from the AA boundary down to its deepest area then back out to the other AA boundary. Try to capture the benches and the intervening micro-topographic relief. To maintain consistency, make drawings at each of the stream hydrologic connectivity measurements, always facing downstream. Include the water level, an arrow at the bankfull contour, and label the benches. Based on these sketches and the profiles in Figure 10, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

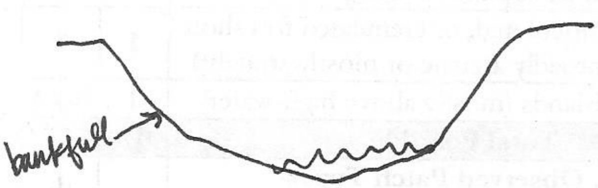
Profile 1



Profile 2



Profile 3



Plant Community Metric Worksheet: Co-dominant species richness for Riverine wetlands
(A dominant species represents ≥10% *relative* cover)

Special Note:

* *Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming (non-confined only)	Invasive?	Short (<0.5 m)	Invasive?
none		Bromus rubens	Y
		Johanson grass?	

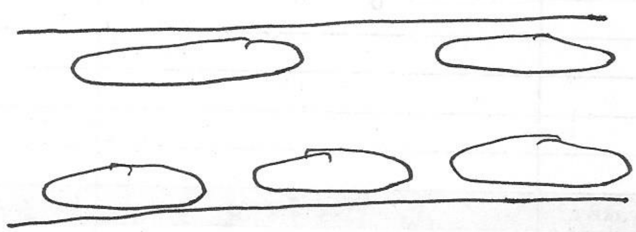
Medium (0.5-1.5 m)	Invasive?	Tall (1.5-3.0 m)	Invasive?
none		none	

Very Tall (>3.0 m)	Invasive?
none	

Total number of co-dominant species for all layers combined (enter here and use in Table 18)	2
Percent Invasion *Round to the nearest integer* (enter here and use in Table 18)	50%

Horizontal Interspersion Worksheet.

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Based on the sketch, choose a single profile from Figure 12 that best represents the AA overall.



Assigned zones:

1) grass zone

2)

3)

4)

5)

6)

Worksheet for Wetland disturbances and conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other maintenance
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✓	✓
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)	✓	✓
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)	✓	✓
Dike/levees	✓	✓
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		

Comments

Engineered channel within developed / urban area

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management	✓	✓
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse	✓	

Comments

some trash from passersby

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)		
Excessive human visitation		
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)		
Tree cutting/sapling removal		
Removal of woody debris		
Treatment of non-native and nuisance plant species	✓	✓
Pesticide application or vector control		
Biological resource extraction or stocking (fisheries, aquaculture)		
Excessive organic debris in matrix (for vernal pools)		
Lack of vegetation management to conserve natural resources		
Lack of treatment of invasive plants adjacent to AA or buffer	✓	

Comments

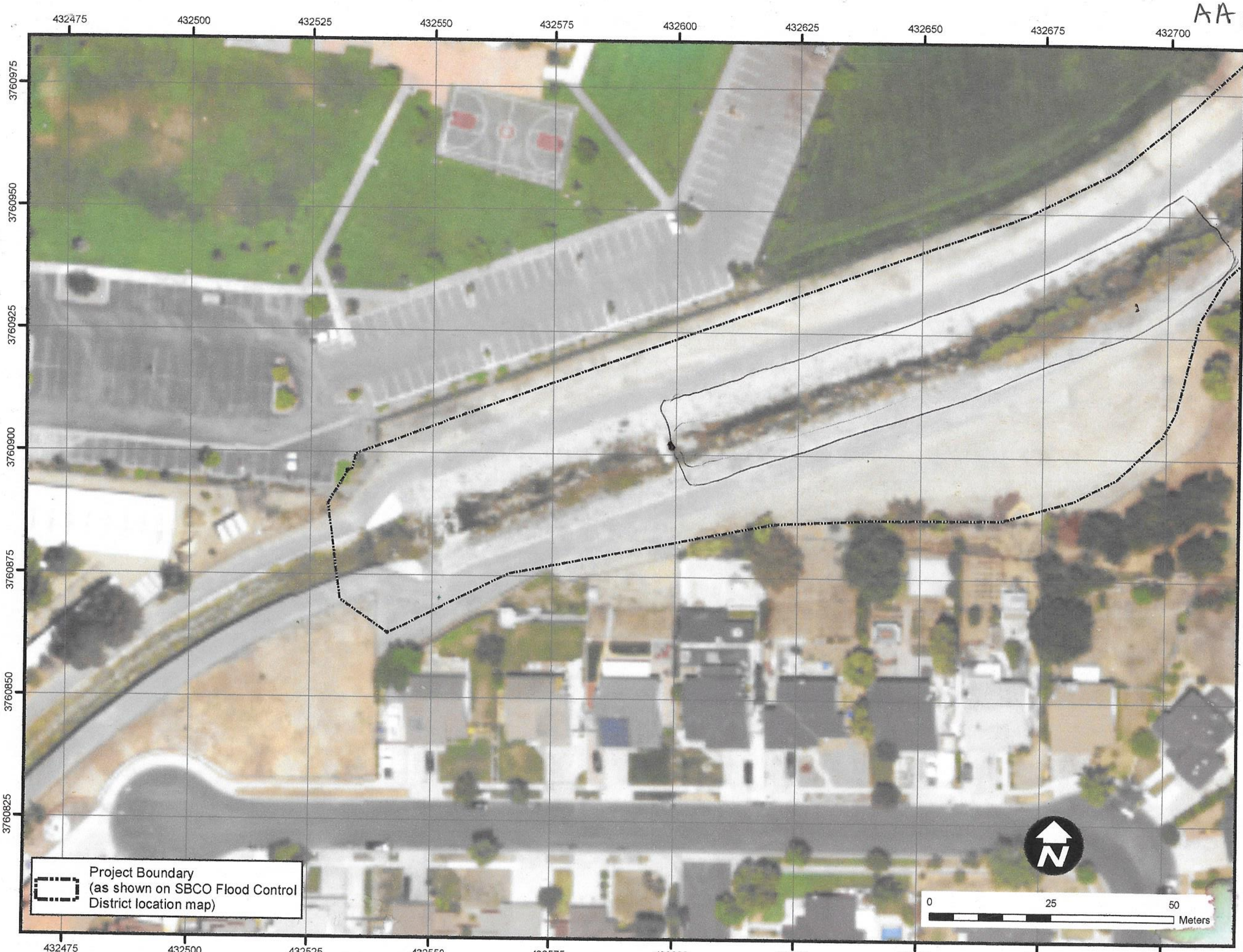
maintenance activities in channel
invasive plants from residents

BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✓	✓
Industrial/commercial	✓	✓
Military training/Air traffic		
Dams (or other major flow regulation or disruption)		
Dryland farming		
Intensive row-crop agriculture		
Orchards/nurseries		
Commercial feedlots		
Dairies		
Ranching (enclosed livestock grazing or horse paddock or feedlot)		
Transportation corridor	✓	✓
Rangeland (livestock rangeland also managed for native vegetation)		
Sports fields and urban parklands (golf courses, soccer fields, etc.)		
Passive recreation (bird-watching, hiking, etc.)	✓	
Active recreation (off-road vehicles, mountain biking, hunting, fishing)		
Physical resource extraction (rock, sediment, oil/gas)		
Biological resource extraction (aquaculture, commercial fisheries)		

Comments

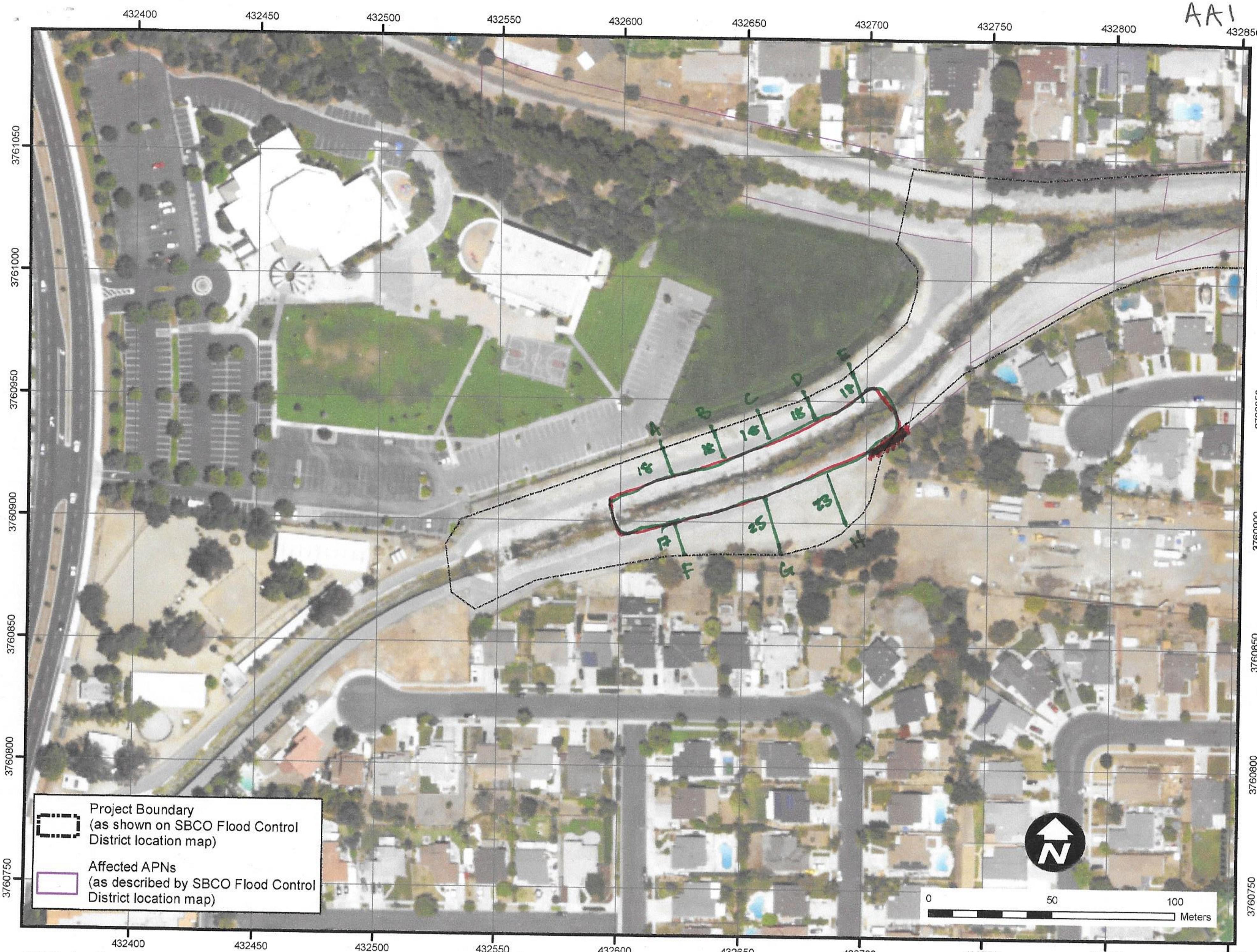
within residential & business areas
busy road near eastern extent of project.

AA1



P:\GIS\Carbon_Canyon\Field_Map 2.mxd

AA1



P:\GIS\Carbon_Canyon\Field_Map 2.mxd

AA1

P:\GIS\Carbon_Canyon\Field_Map 2.mxd

CRAM Data Sheets and Field Maps for AA2

Basic Information Sheet: Riverine Wetlands

Assessment Area Name: Carbon Canyon	
Project Name: Carbon Canyon Channel	
Assessment Area ID #: AA 2	
Project ID #: —	**Date:** 28-May-2019
Assessment Team Members for This AA:	
Lehong Chow	
Scott Taylor	
Average Bankfull Width:	
Approximate Length of AA (10 times bankfull width, min 100 m, max 200 m): ~100	
Upstream Point Latitude:	**Longitude:**
Downstream Point Latitude:	**Longitude:**

Wetland Sub-type:

☑ Confined ☐ Non-confined

AA Category:

☐ Restoration ☐ Mitigation ☑ Impacted ☐ Ambient ☐ Reference ☐ Training

☑ Other: pre-project

Did the river/stream have flowing water at the time of the assessment? ☑ yes ☐ no

What is the apparent hydrologic flow regime of the reach you are assessing?

The hydrologic flow regime of a stream describes the frequency with which the channel conducts water. *Perennial* streams conduct water all year long, whereas *ephemeral* streams conduct water only during and immediately following precipitation events. *Intermittent* streams are dry for part of the year, but conduct water for periods longer than ephemeral streams, as a function of watershed size and water source.

☑ perennial ☐ intermittent ☐ ephemeral

Photo Identification Numbers and Description:

	Photo ID No.	Description	Latitude	Longitude	Datum
1		Upstream	433425	3760916	WGS 84
2		~~Middle Left~~ "	"	"	"
3	Downstream	~~Middle Right~~	433528	3760867	"
4		Downstream	"	"	"
5					
6					
7					
8					
9					
10					

Site Location Description:

- Urban/ residential - some commercial developments nearby
- proposed laydown area nearby
- developed channel
- Mostly grasses - some floating veg - maintenance activities may have cut grasses shorter

Comments:

- turtle, tadpoles, crayfish, small fish observed in AA and nearby

Scoring Sheet: Riverine Wetlands

AA Name: AA2			Date: 28-May-2019

Attribute 1: Buffer and Landscape Context (pp. 11-19)	Alpha.	Numeric	**Comments**
Stream Corridor Continuity (D)	D	3	270 ~~m~~ m non-buffer
Buffer:			
Buffer submetric A: Percent of AA with Buffer	A	12	100% buffer w/ maintenance rd
Buffer submetric B: Average Buffer Width	D	3	Avg buffer width = ~~[scribbled out]~~ 15m
Buffer submetric C: Buffer Condition	D	3	buffer barren
Raw Attribute Score = D+[C x (A x B)^{½}]^{½}		6	**Final Attribute Score = (Raw Score/24) x 100**: 25

Attribute 2: Hydrology (pp. 20-26)	Alpha.	Numeric	
Water Source	C	6	urban runoff
Channel Stability	A	12	4 equil.
Hydrologic Connectivity	D	3	1.18 avg ratio
Raw Attribute Score = sum of numeric scores		21	**Final Attribute Score = (Raw Score/36) x 100**: 58

Attribute 3: Physical Structure (pp. 27-33)	Alpha.	Numeric	
Structural Patch Richness	C	6	6 patches
Topographic Complexity	D	3	no micro or macro
Raw Attribute Score = sum of numeric scores			**Final Attribute Score = (Raw Score/24) x 100**:

Attribute 4: Biotic Structure (pp. 34-41)	Alpha.	Numeric	
Plant Community Composition (based on sub-metrics A-C)			
Plant Community submetric A: Number of plant layers	C	6	2 layers - short, floating
Plant Community submetric B: Number of Co-dominant species	D	3	2 co-dom
Plant Community submetric C: Percent Invasion	D	3	
Plant Community Composition Metric *(numeric average of submetrics A-C)*		4	
Horizontal Interspersion	D	3	little interspersion
Vertical Biotic Structure	C	6	>25% plant overlap
Raw Attribute Score = sum of numeric scores		13	**Final Attribute Score = (Raw Score/36) x 100**: 36

Overall AA Score (average of four final Attribute Scores)	40

Worksheet for Stream Corridor Continuity Metric for Riverine Wetlands

Lengths of Non-buffer Segments For Distance of 500 m Upstream of AA		Lengths of Non-buffer Segments For Distance of 500 m Downstream of AA	
Segment No.	Length (m)	Segment No.	Length (m)
1		1	135
2		2	135
3		3	
4		4	
5		5	
Upstream Total Length	0	Downstream Total Length	270

Percent of AA with Buffer Worksheet

In the space provided below make a quick sketch of the AA, or perform the assessment directly on the aerial imagery; indicate where buffer is present, estimate the percentage of the AA perimeter providing buffer functions, and record the estimate amount in the space provided.

see aerial map

Percent of AA with Buffer: ______ %

Worksheet for calculating average buffer width of AA

Line	Buffer Width (m)
A	15
B	15
C	15
D	15
E	12
F	13
G	22
H	12
Average Buffer Width *Round to the nearest integer*	15

Worksheet for Assessing Channel Stability for Riverine Wetlands

<table>
<tr><th>Condition</th><th>Field Indicators
(check all existing conditions)</th></tr>
<tr><td>Indicators of Channel Equilibrium</td><td>☑ The channel (or multiple channels in braided systems) has a well-defined bankfull contour that clearly demarcates an obvious active floodplain in the cross-sectional profile of the channel throughout most of the AA.
☐ Perennial riparian vegetation is abundant and well established along the bankfull contour, but not below it.
☑ There is leaf litter, thatch, or wrack in most pools (if pools are present).
☐ The channel contains embedded woody debris of the size and amount consistent with what is naturally available in the riparian area.
☑ There is little or no active undercutting or burial of riparian vegetation.
☑ If mid-channel bars and/or point bars are present, they are not densely vegetated with perennial vegetation.
☐ Channel bars consist of well-sorted bed material (smaller grain size on the top and downstream end of the bar, larger grain size along the margins and upstream end of the bar).
☐ There are channel pools, the spacing between pools tends to be regular and the bed is not planar throughout the AA
☐ The larger bed material supports abundant mosses or periphyton.</td></tr>
<tr><td>Indicators of Active Degradation</td><td>☐ The channel is characterized by deeply undercut banks with exposed living roots of trees or shrubs.
☐ There are abundant bank slides or slumps.
☑ The lower banks are uniformly scoured and not vegetated.
☐ Riparian vegetation is declining in stature or vigor, or many riparian trees and shrubs along the banks are leaning or falling into the channel.
☐ An obvious historical floodplain has recently been abandoned, as indicated by the age structure of its riparian vegetation.
☐ The channel bed appears scoured to bedrock or dense clay.
☐ Recently active flow pathways appear to have coalesced into one channel (i.e. a previously braided system is no longer braided).
☐ The channel has one or more knickpoints indicating headward erosion of the bed.</td></tr>
<tr><td>Indicators of Active Aggradation</td><td>☐ There is an active floodplain with fresh splays of coarse sediment (sand and larger that is not vegetated) deposited in the current or previous year.
☐ There are partially buried living tree trunks or shrubs along the banks.
☑ The bed is planar (flat or uniform gradient) overall; it lacks well-defined channel pools, or they are uncommon and irregularly spaced.
☐ There are partially buried, or sediment-choked, culverts.
☐ Perennial terrestrial or riparian vegetation is encroaching into the channel or onto channel bars below the bankfull contour.
☐ There are avulsion channels on the floodplain or adjacent valley floor.</td></tr>
<tr><td>Overall</td><td>☑ Equilibrium ☐ Degradation ☐ Aggradation</td></tr>
</table>

Riverine Wetland Entrenchment Ratio Calculation Worksheet

The following 5 steps should be conducted for each of 3 cross-sections located in the AA at the approximate midpoints along straight riffles or glides, away from deep pools or meander bends. An attempt should be made to place them at the top, middle, and bottom of the AA.

Steps	Replicate Cross-sections ⟶	TOP	MID	BOT
1 Estimate bankfull width.	This is a critical step requiring familiarity with field indicators of the bankfull contour. Estimate or measure the distance between the right and left bankfull contours.	37.8	39.7	43.6
2: Estimate max. bankfull depth.	Imagine a level line between the right and left bankfull contours; estimate or measure the height of the line above the thalweg (the deepest part of the channel).	3.4	1.4	1.6
3: Estimate flood prone depth.	Double the estimate of maximum bankfull depth from Step 2.	6.8	2.8	3.2
4: Estimate flood prone width.	Imagine a level line having a height equal to the flood prone depth from Step 3; note where the line intercepts the right and left banks; estimate or measure the length of this line.	51.8	43	47.5
5: Calculate entrenchment ratio.	Divide the flood prone width (Step 4) by the bankfull width (Step 1).	1.37	1.08	1.09
6: Calculate average entrenchment ratio.	Calculate the average results for Step 5 for all 3 replicate cross-sections. Enter the average result here and use it in Table 13a or 13b.			1.18

Structural Patch Type Worksheet for Riverine wetlands

Circle each type of patch that is observed in the AA and enter the total number of observed patches in Table below. In the case of riverine wetlands, their status as confined or non-confined must first be determined (see page 6) to determine with patches are expected in the system (indicated by a "1" in the table below). Any feature onsite should only be counted once as a patch type. If a feature appears to meet the definition of more than one patch type (i.e. swale and secondary channel) the practitioner should choose which patch type best illustrates the feature. Not all features at a site will be patch types.

**Please refer to the CRAM Photo Dictionary at www.cramwetlands.org for photos of each of the following patch types.*

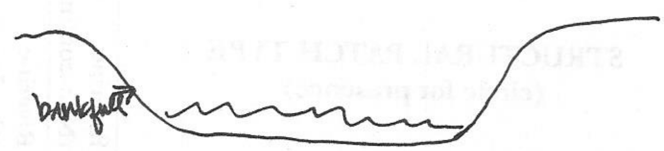
STRUCTURAL PATCH TYPE (circle for presence)	Riverine (Non-confined)	Riverine (Confined)
Minimum Patch Size	3 m^2	3 m^2
Abundant wrackline or organic debris in channel, on floodplain	1	1
Bank slumps or undercut banks in channels or along shoreline	1	1
Cobbles and/or Boulders	1	1
Debris jams	1	1
Filamentous macroalgae or algal mats	1	1
Large woody debris	1	1
Pannes or pools on floodplain	1	N/A
Plant hummocks and/or sediment mounds	1	1
Point bars and in-channel bars	1	1
Pools or depressions in channels (wet or dry channels)	1	1
Riffles or rapids (wet or dry channels)	1	1
Secondary channels on floodplains or along shorelines	1	N/A
Standing snags (at least 3 m tall)	1	1
Submerged vegetation	1	N/A
Swales on floodplain or along shoreline	1	N/A
Variegated, convoluted, or crenulated foreshore (instead of broadly arcuate or mostly straight)	1	1
Vegetated islands (mostly above high-water)	1	N/A
Total Possible	17	12
No. Observed Patch Types (enter here and use in Table 14 below)		6 C

Worksheet for AA Topographic Complexity

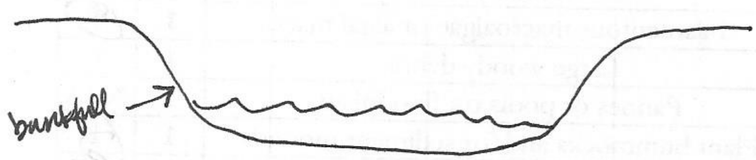
At three locations along the AA, make a sketch of the profile of the stream from the AA boundary down to its deepest area then back out to the other AA boundary. Try to capture the benches and the intervening micro-topographic relief. To maintain consistency, make drawings at each of the stream hydrologic connectivity measurements, always facing downstream. Include the water level, an arrow at the bankfull contour, and label the benches. Based on these sketches and the profiles in Figure 10, choose a description in Table 16 that best describes the overall topographic complexity of the AA.

~~~ = water

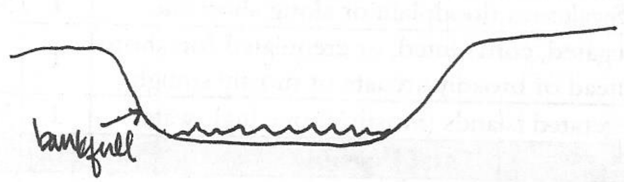
Profile 1



Profile 2



Profile 3


~~~

Plant Community Metric Worksheet: Co-dominant species richness for Riverine wetlands
(A dominant species represents ≥10% *relative* cover)

Special Note:

* *Combine the counts of co-dominant species from all layers to identify the total species count. Each plant species is only counted once when calculating the Number of Co-dominant Species and Percent Invasion submetric scores, regardless of the numbers of layers in which it occurs.*

Floating or Canopy-forming (non-confined only)	Invasive?	Short (<0.5 m)	Invasive?
Racoon tail mat	no	Bromus rubens	yes

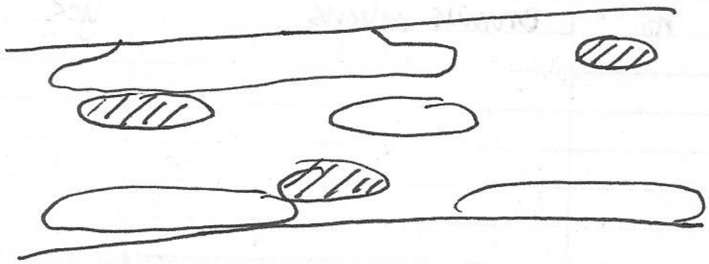
Medium (0.5-1.5 m)	Invasive?	Tall (1.5-3.0 m)	Invasive?
Pine sp.	no		

Very Tall (>3.0 m)	Invasive?

Total number of co-dominant species for all layers combined (enter here and use in Table 18)	2
Percent Invasion *Round to the nearest integer* (enter here and use in Table 18)	50%

Horizontal Interspersion Worksheet.

Use the spaces below to make a quick sketch of the AA in plan view, outlining the major plant zones (this should take no longer than 10 minutes). Assign the zones names and record them on the right. Based on the sketch, choose a single profile from Figure 12 that best represents the AA overall.



Assigned zones:

1) grass layer
2) floating layer
3)
4)
5)
6)

Worksheet for Wetland disturbances and conversions

Has a major disturbance occurred at this wetland?	Yes	No		
If yes, was it a flood, fire, landslide, or other?	flood	fire	landslide	other maintenance
If yes, then how severe is the disturbance?	likely to affect site next 5 or more years	likely to affect site next 3-5 years	likely to affect site next 1-2 years	
Has this wetland been converted from another type? If yes, then what was the previous type?	depressional	vernal pool	vernal pool system	
	non-confined riverine	confined riverine	seasonal estuarine	
	perennial saline estuarine	perennial non-saline estuarine	wet meadow	
	lacustrine	seep or spring	playa	

Stressor Checklist Worksheet

HYDROLOGY ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Point Source (PS) discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) discharges (urban runoff, farm drainage)	✓	✓
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)	✓	✓
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)	✓	✓
Dike/levees	✓	✓
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Actively managed hydrology		

Comments

Engineered channel within developed / urban area

PHYSICAL STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management	✓	✓
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse	✓	

Comments

some trash from passersby

BIOTIC STRUCTURE ATTRIBUTE (WITHIN 50 M OF AA)	Present	Significant negative effect on AA
Mowing, grazing, excessive herbivory (within AA)		
Excessive human visitation		
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators, such as feral pets)		
Tree cutting/sapling removal		
Removal of woody debris		
Treatment of non-native and nuisance plant species	✓	✓
Pesticide application or vector control		
Biological resource extraction or stocking (fisheries, aquaculture)		
Excessive organic debris in matrix (for vernal pools)		
Lack of vegetation management to conserve natural resources		
Lack of treatment of invasive plants adjacent to AA or buffer	✓	

Comments

Maintenance activities
Residential - ~~[illegible]~~ likely have invasive plants / pesticide application

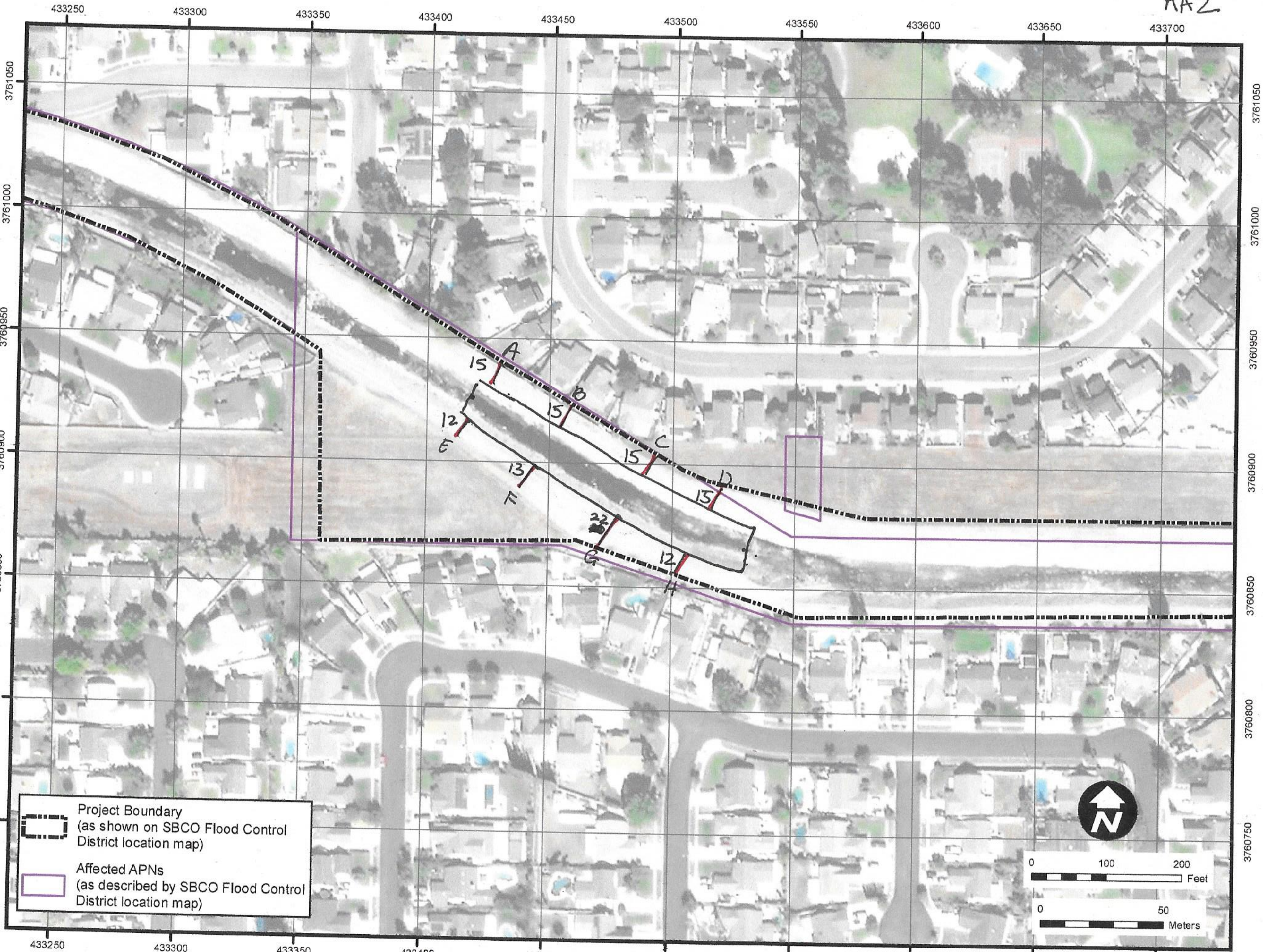
BUFFER AND LANDSCAPE CONTEXT ATTRIBUTE (WITHIN 500 M OF AA)	Present	Significant negative effect on AA
Urban residential	✓	✓
Industrial/commercial	✓	✓
Military training/Air traffic		
Dams (or other major flow regulation or disruption)		
Dryland farming		
Intensive row-crop agriculture		
Orchards/nurseries		
Commercial feedlots		
Dairies		
Ranching (enclosed livestock grazing or horse paddock or feedlot)		
Transportation corridor	✓	✓
Rangeland (livestock rangeland also managed for native vegetation)		
Sports fields and urban parklands (golf courses, soccer fields, etc.)	✓	✓
Passive recreation (bird-watching, hiking, etc.)	✓	
Active recreation (off-road vehicles, mountain biking, hunting, fishing)		
Physical resource extraction (rock, sediment, oil/gas)		
Biological resource extraction (aquaculture, commercial fisheries)		

Comments

Within residential and business areas
sportsfield just west of AA1

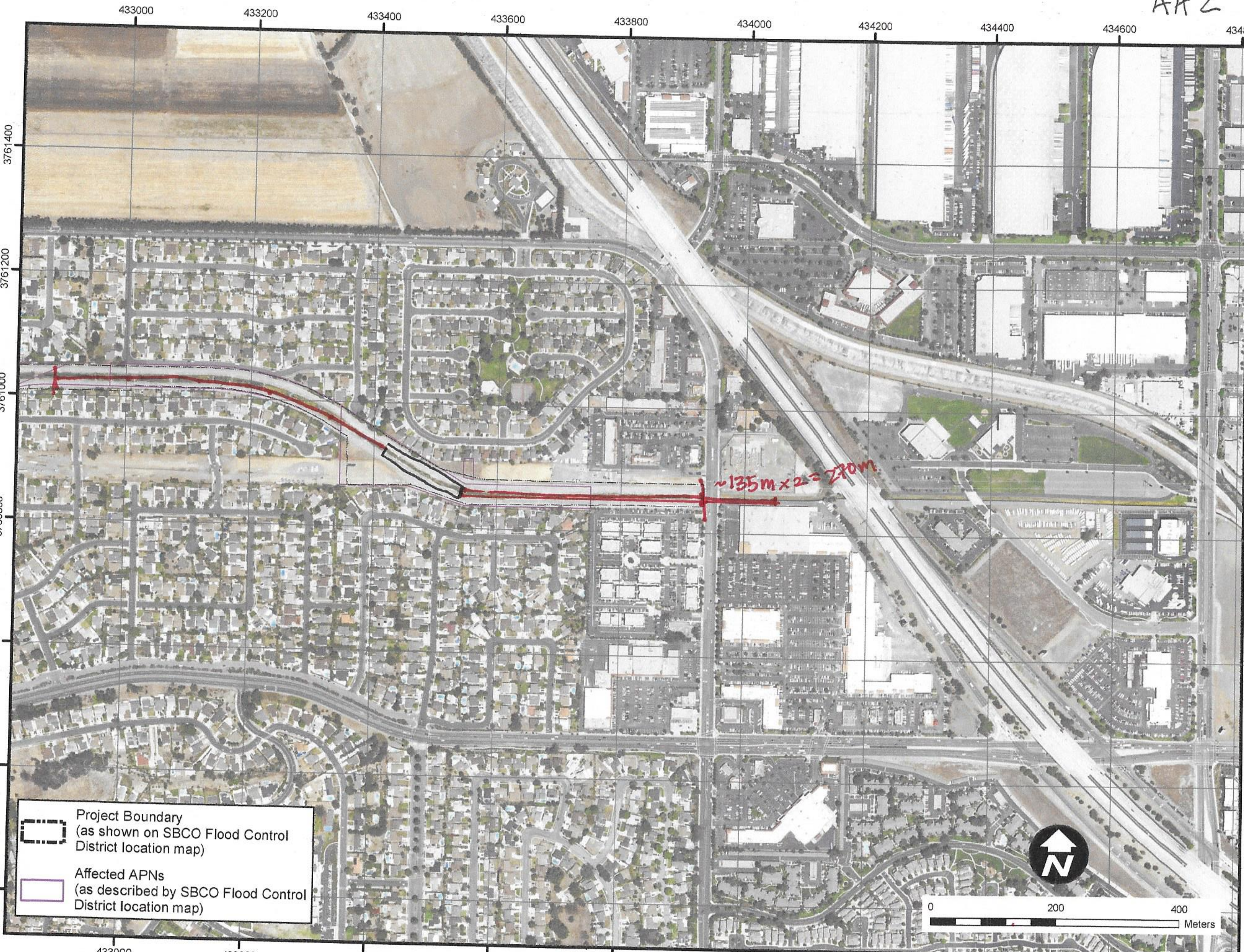
P:\GIS\Carbon_Canyon\Field_Map 5_AA2.mxd

AA2



P:\GIS\Carbon_Canyon\Field_Map 6_AA2.mxd

AA2



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JD Datasheets

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Carbon Canyon City/County: Chino Hills, San Bernardino Sampling Date: 29 May 2019

Applicant/Owner: San Bernardino County State: CO Sampling Point: SP-01

Investigator(s): Lehong Chow, Emily Thorn Section, Township, Range: Sect. 21 2S 8W

Landform (hillslope, terrace, etc.): channel/drainage Local relief (concave, convex, none): none Slope (%): 1

Subregion (LRR): C Lat: 33.98618056 Long: 117.71555556 Datum: ______

Soil Map Unit Name: StA-Sorrento Clay loam, 0-2 percent slopes NWI classification: PEM1Cx

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

Are Vegetation ______, Soil X, or Hydrology X 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 ______	Is the Sampled Area within a Wetland?	Yes X No ______
Hydric Soil Present?	Yes X No ______		
Wetland Hydrology Present?	Yes X No ______		

Remarks: Wetland indicators present at/below waterline where soil accumulation has occurred on top of concrete-lined channel. Concrete and boulder substrate under 9" of soil. Data taken within fringe wetland above spillway structure. Highly altered/engineered streambed with moss and non-vascular vegetation dominant.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. —			
2.			
3.			
4.			
Total Cover:	Ø		
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:	Ø		
Herb Stratum			
1. Ceratophyllum demersum	25	Yes	OBL
2. Schoenoplectus californicus	15	Yes	OBL
3. Juncus xiphioides	10	No	OBL
4. Polypogon maritimus	10	No	OBL
5. Leptochloa fusca uninervia	5	No	FACW
6.			
7.			
8.			
Total Cover:	65		
Woody Vine Stratum			
1. —			
2.			
Total Cover:	Ø		

% 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: 2 (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	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

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

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ______

Remarks: All observed species have wetland indicator status. Open water comprises 35% of area. Fringy ruderal wetland characteristics. Wetland vegetation begins at/below water line/inundation OHWM. Very little/no vegetation above inundation/OHWM where no soil has accumulated.

SOIL

Sampling Point: SP-01

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
0-3	NA						Water	inundation
3-9	10YR 2/1	100					Loamy	Loamy-mucky-mineral texture when rubbed between fingers.

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, 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)
- X 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.

Restrictive Layer (if present):

Type: Concrete lining

Depth (inches): 9"

Hydric Soil Present? Yes X No ______

Remarks: mucky mineral soils present (greasy, with eventual grittiness after rubbing in fingers). Approximately 7-9" of soil build-up on top of concrete channel lining. Inundation and saturated soil surface.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- X 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)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ______ Depth (inches): 0

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

Saturation Present? (includes capillary fringe) Yes X No ______ Depth (inches): 3

Wetland Hydrology Present? Yes X No ______

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

Remarks: Data taken within concrete-lined channel with standing and flowing water present.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Carbon Canyon City/County: Chino Hills, San Bernardino Sampling Date: ~~SP-02~~ 29 May 2019

Applicant/Owner: San Bernardino County State: CA Sampling Point: SP-02

Investigator(s): Lehong Chow, Emily Thorn Section, Township, Range: Sect 21 2S RW

Landform (hillslope, terrace, etc.): channel/drainage Local relief (concave, convex, none): none Slope (%): 1%

Subregion (LRR): C Lat: 33.98617778 Long: 117.71555556 Datum: ______

Soil Map Unit Name: StA. Sorrento clay-loam, 0-2 percent slopes NWI classification: PEM1Cx

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

Are Vegetation X, Soil X, or Hydrology X 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: Data taken within concrete-lined channel. No soil or vegetation observed.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. —			
2.			
3.			
4.			
Total Cover:	∅		
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:	∅		
Herb Stratum			
1. —			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	∅		
Woody Vine Stratum			
1.			
2.			
Total Cover:			

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

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 0 (B)

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

Prevalence Index worksheet:

Total % Cover of:		Multiply by:	
OBL species		x 1 =	
FACW species		x 2 =	
FAC species		x 3 =	
FACU species		x 4 =	
UPL species		x 5 =	
Column Totals:	(A)		(B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

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

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks: No vegetation. Concrete substrate

SOIL

Sampling Point: SP-02

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
0-	NA						NA	Concrete

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, 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.

Restrictive Layer (if present):
Type: Concrete
Depth (inches): 0"

Hydric Soil Present? Yes ___ No X

Remarks: No soil accumulation on concrete-lined channel.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

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

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (**Riverine**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Thin Muck Surface (C7)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ___ No 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 ___ No X

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

Remarks: Data taken above inundation/OHWM.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Carbon Canyon City/County: Chino Hills, San Bernardino Sampling Date: 29 May 2019

Applicant/Owner: San Bernardino County State: CA Sampling Point: SP-03

Investigator(s): Lehong Chow, Emily Thorn Section, Township, Range: Sect. 21 2S 8W

Landform (hillslope, terrace, etc.): Channel / Drainage Local relief (concave, convex, none): none Slope (%): 1

Subregion (LRR): C Lat: 33.98768611 Long: 117.72388889 Datum: ______

Soil Map Unit Name: StA - Sorrento clay loam, 0-2 percent slopes NWI classification: PEM1Cx

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

Are Vegetation ______, Soil X, or Hydrology X 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:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. —			
2.			
3.			
4.			
Total Cover:	Ø		
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:	Ø		
Herb Stratum			
1. Typha angustifolia	15	Yes	OBL
2. Scheonoplectus californicus	15	Yes	OBL
3. Leptochloa fusca uninervia	15	Yes	FACW
4. Bromus rubens	5	No	UPL
5. Urtica dioica	5	No	~~F~~ UPL
6. Veronica americana	5	No	OBL
7. Caratophyllum demersum	5	No	OBL
8. Unk annual forb (AAFF)	<1	NA	—
Total Cover:	66		
Woody Vine Stratum			
1. —			
2.			
Total Cover:	Ø		

% Bare Ground in Herb Stratum 40 % Cover of Biotic Crust —

Dominance Test worksheet:

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

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

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

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species	______	x 1 = ______
FACW species	______	x 2 = ______
FAC species	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

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

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ______ No ______

Remarks:

SOIL

Sampling Point: SP-03

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
0-10+"	water	100					water	no soil at surface, inundated under Carbon Canyon Channel

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, 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)
- X Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

Restrictive Layer (if present):

Type: —

Depth (inches): —

Hydric Soil Present? Yes X No ______

Remarks:
Soil surface under water with wetland vegetation covering greater than 60% of surface. Boulder rip-rap bars intersect wetland area's soil/water surface. Soil accumulation along channel bottom.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

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

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ______ Depth (inches): 0

Water Table Present? Yes X No ______ Depth (inches): 0

Saturation Present? (includes capillary fringe) Yes X No ______ Depth (inches): 0

Wetland Hydrology Present? Yes X No ______

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

Remarks:
Flowing water along Carbon Canyon channel.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Carbon Canyon City/County: Chino Hills, San Bernardino Sampling Date: 29 May 2019

Applicant/Owner: San Bernardino County State: CA Sampling Point: SP04

Investigator(s): Lehong Chow, Emily Thorn Section, Township, Range: Sect 21 2S 8W

Landform (hillslope, terrace, etc.): Channel/drainage Local relief (concave, convex, none): none Slope (%): 1

Subregion (LRR): C Lat: 33.987606944 Long: 117.~~7750000~~ .766094444 Datum:

Soil Map Unit Name: StA - Sorrento Clay-loam, 0-2 percent slope NWI classification: PEM1Cx

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

Are Vegetation X, Soil X, or Hydrology X 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 X No ___	

Remarks:

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. —			
2.			
3.			
4.			
Total Cover:			
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:			
Herb Stratum			
1. Bromus rubens	70	Yes	–
2. Urtica dioica	5	No	FACU
3.			
4.			
5.			
6.			
7.			
8.			
Total Cover:	75		
Woody Vine Stratum			
1. —			
2.			
Total Cover:			

% Bare Ground in Herb Stratum 10 % Cover of Biotic Crust ___

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

Prevalence Index worksheet:

Total % Cover of:		Multiply by:
OBL species		x 1 =
FACW species		x 2 =
FAC species		x 3 =
FACU species		x 4 =
UPL species		x 5 =
Column Totals:	(A)	(B)

Prevalence Index = B/A = ___

Hydrophytic Vegetation Indicators:

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

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks: Dominated by ruderal and non-native upland species. Litter cover = 15%

SOIL

Sampling Point: SP-04

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
0-10	10 YR 6/2						sandy	uniform color + texture

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, 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.

Restrictive Layer (if present):

Type: Concrete

Depth (inches): 10"

Hydric Soil Present? Yes ______ No X

Remarks: uniform sandy soil to 10" with no hydric indicators observed.

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

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

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes ______ No 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: Data taken below OHWM where indicators of frequent inundation were observed, but no other wetland indicators present.

WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Carbon Canyon City/County: Chino Hills, San Bernardino Sampling Date: 29 May 2019
Applicant/Owner: San Bernardino County State: CA Sampling Point: SP-05
Investigator(s): Lehong Chow, Emily Thorn Section, Township, Range: Sect. 21 2S 8W
Landform (hillslope, terrace, etc.): channel/drainage Local relief (concave, convex, none): none Slope (%): 1
Subregion (LRR): C Lat: 33.98766944 Long: 117.72750000 Datum: ______
Soil Map Unit Name: StA - Sorrento clay-loam, 0-2 percent slopes NWI classification: PEM1Cx
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)
Are Vegetation ______, Soil X, or Hydrology X 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 ______	**Is the Sampled Area within a Wetland?** Yes X No ______
Hydric Soil Present?	Yes X	No ______	
Wetland Hydrology Present?	Yes X	No ______	

Remarks: Soils transition from loamy mucky mineral to sandy mucky mineral, and vegetation shifts to cattail-dominated patches with wetland species dominant.

VEGETATION

Tree Stratum (Use scientific names.)	Absolute % Cover	Dominant Species?	Indicator Status
1. —			
2.			
3.			
4.			
Total Cover:	Ø		
Sapling/Shrub Stratum			
1. —			
2.			
3.			
4.			
5.			
Total Cover:	Ø		
Herb Stratum			
1. Typha angustifolia	50	Yes	OBL
2. Urtica dioica	10	No	FACU
3. Veronica americana	5	No	OBL
4. Veronica anagallis-aquatica	5	No	OBL
5. Polypogon maritimus	3	No	FACW
6. Nasturtium officinale	3	No	OBL
7.			
8.			
Total Cover:			
Woody Vine Stratum			
1. —			
2.			
Total Cover:			

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

Dominance Test worksheet:

Number of Dominant Species That Are OBL, FACW, or FAC: 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	______	x 3 = ______
FACU species	______	x 4 = ______
UPL species	______	x 5 = ______
Column Totals:	______ (A)	______ (B)

Prevalence Index = B/A = ______

Hydrophytic Vegetation Indicators:

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

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ______

Remarks: Narrowleaf cattail-dominant vegetation community with non-dominant wetland species present.

SOIL

Sampling Point: SR05

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

Depth (inches)	Matrix Color (moist)	Matrix %	Redox Color (moist)	Redox %	Type[1]	Loc[2]	Texture	Remarks
1-5	10YR 6/2	100					Sandy	uniform color
5-10	10YR 3/2	100					sandy	organic matter, mucky texture when rubbed between fingers; greasy gritty soil modifier.

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, 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)
- X 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.

Restrictive Layer (if present):

Type: Concrete

Depth (inches): 10"

Hydric Soil Present? Yes X No ___

Remarks: Sharp change in color and texture modification. Mucky sandy surface present within proximity to data point; sandy mucky texture present at 5-10"; high organic material content (>20%) at 5-10". Saturated at 8"

HYDROLOGY

Wetland Hydrology Indicators:

Primary Indicators (any one indicator is sufficient)

- X 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)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

Field Observations:

Surface Water Present? Yes X No ___ Depth (inches): 0

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

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 8

Wetland Hydrology Present? Yes X No ___

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

Remarks: Surface water present within 1m. of data point; Soil saturated at 8" within Soil pit.

Appendix E

Paleontological Resources Management and Monitoring Plan

PALEONTOLOGICAL RESOURCES MANAGEMENT AND MONITORING PLAN

CARBON CANYON FLOOD CONTROL CHANNEL IMPROVEMENT PROJECT, PIPELINE AVENUE TO PEYTON DRIVE

San Bernardino County Flood Control District

Prepared for: **Tetra Tech, Inc.**
301 East Vanderbilt Way, Suite 450
San Bernardino, CA 92408

Prepared by: **Paleo Solutions, Inc.**
911 S. Primrose Ave., Unit N
Monrovia, CA 91016

Courtney Richards, M.S. – Principal Investigator
Mathew Carson, M.S. – Report Author

PSI Report: CA19SanBernardinoTET02R

January 6, 2020

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1.0 EXECUTIVE SUMMARY

This Paleontological Resources Management and Monitoring Plan (PRMMP) presents the results of the paleontological assessment and outlines paleontological mitigation and monitoring procedures for the Carbon Canyon Flood Control Channel Improvement Project Pipeline Avenue to Peyton Drive (Project) located in the vicinity of the City of Chino Hills, San Bernardino County, California. This work was required by the San Bernardino County Flood Control District (District) as the lead agency under the California Environmental Quality Act (CEQA) and the United States Army Corps of Engineers (USACE) under the National Environmental Policy Act (NEPA). All paleontological work was completed in compliance with NEPA, CEQA, state and local regulations, and best practices in mitigation paleontology (Murphey et al., 2019).

The Project consists of flood control channel improvements, including modification of an approximately 4,680-foot segment of the Carbon Canyon Channel and an approximately 200-foot segment of the English Channel, with 160 feet width where the existing interim channel already exists. The Project consists of the construction of a trapezoidal channel with articulating block invert with hardened sidewalls. The improved channel will replace an undersized earthen channel. The channel will include two transition structures, which will transition existing regular concrete channels to the improved channel. The channel will also consist of a junction structure with English Channel, which joins from the northwest. The new channel will allow for flows to be conveyed within the District right of way (ROW). Excavations for the Project will impact maximum depths of 12 feet below existing grade, with construction expected to last 10 months. The Project is situated between Peyton Drive to the west, Pipeline Avenue to the east, Eucalyptus Avenue to the north, and Chino Hills Parkway to the south in the vicinity of the City of Chino Hills, San Bernardino County, California.

The paleontological assessment conducted for the Project consisted of an analysis of existing data, which included a geologic map review, a literature and online database review, and a museum record search from the San Bernardino County Museum (SBCM) and the Natural History Museum of Los Angeles County (LACM). The analysis of existing data was supplemented with a pedestrian field survey. The results of the analysis of existing data and the pedestrian field survey were compiled to determine the potential impacts or adverse effects to scientifically significant paleontological resources from construction activities associated with the Project. Based on geologic mapping by Dibblee and Ehrenspeck (2001) and Morton and Miller (2006), the Project area is primarily underlain by Holocene-age alluvial gravel, sand, and silt of valleys and floodplains (Qa) with a minor amount of middle Miocene-age Puente Formation, Yorba Member (Tpy). Although not mapped within the boundaries of the Project area, middle Miocene-age Puente Formation, Soquel Sandstone Member (Tpss), middle Miocene-age Puente Formation, unassigned sandstone (Tps), and Holocene-age gravel/sand of the Santa Ana River (Qg) are mapped within a half-mile and may be present within the subsurface of the Project area. Additionally, unmapped Pleistocene-age older alluvial deposits (Qoa) may underlie Holocene-age deposits, and unmapped Recent previously disturbed sediments and artificial fill (af) are present within the Project area based on aerial imagery. Thus, these geologic units within the Project's vicinity were also assessed. According to the literature and online database review, no fossil localities have been recorded within the bounds of the Project area; however, several fossil localities have been recorded in the vicinity of the Project area. At the time of submission of this report for final agency review (January 6, 2020), the SBCM has not returned the museum records search results; however, museum records search results from the LACM indicates that no paleontological resources have been recovered from within the bounds of the Project area, but several fossil localities have been recorded within its immediate vicinity. No native geologic units or fossil localities were observed or recorded during the pedestrian field survey, conducted on August 7, 2019.

The Bureau of Land Management (BLM) Potential Fossil Yield Classification (PFYC) system (BLM, 2016) was used to evaluate the paleontological potential of the geologic units within the Project area and its half-mile buffer. Middle Miocene-age Puente Formation, Yorba Member (Tpy), middle Miocene-age Puente Formation, Soquel Sandstone Member (Tpss), and middle Miocene-age Puente Formation, unassigned sandstone (Tps) were determined to have a very high (PFYC 5) paleontological potential using BLM (2016) guidelines. Additionally, Holocene-age alluvial gravel, sand, and silt of valleys and floodplains (Qa), Holocene-age gravel/sand of the Santa Ana River (Qg), and unmapped Recent previously disturbed sediments and artificial fill (af) have a low (PFYC 2) paleontological potential, increasing with depth to moderate (PFYC 3) paleontological potential in the underlying Pleistocene-age older alluvial deposits, using BLM (2016) guidelines. Excavations for the Project area are anticipated to extend 12 feet below existing grade, with a width of 160 feet over a total length of 4,860 feet, and may potentially impact middle Miocene-age Puente Formation, Yorba Member (Tpy), which may result in significant impacts and/or adverse effects to paleontological resources. Additionally, ground-disturbing activities may impact the Puente Formation, Soquel Member (Tpss) or Puente Formation, unassigned sandstone (Tps) at shallow or unknown depths the transitions between these members is gradational. Surface grading or shallow excavations entirely within Holocene-age gravel/sand of Santa Ana River, Holocene-age alluvial gravel, sand, and silt of valleys and floodplains (Qa), and Recent previously disturbed sediments and artificial fill (af) are unlikely to uncover significant fossil vertebrate remains; however, they may shallowly overlie older in-situ sedimentary deposits of Miocene-age, primarily the Puente Formation, or Pleistocene-age. Therefore, grading and other earthmoving activities may potentially result in significant adverse direct impacts/effects to paleontological resources in the subsurface of the Project area.

In order to reduce potential impacts or adverse effects to scientifically significant paleontological resources to less than significant levels, pursuant to NEPA and CEQA, it is recommended that construction excavations, including trenching, grading, cutting, and drilling that is 36-inches in diameter or greater in all areas of the Project be initially spot-checked in order to determine if paleontologically sensitive sediments are being impacted beneath the ground surface. It is recommended that spot-checking efforts be reduced if it is determined that only geologic units with low paleontological potential (PFYC 2), including Recent previously disturbed sediments and artificial fill (Qf) and/or Holocene-age deposits (Qa, Qg), are being impacted, or if sediments are deemed to be non-conducive to fossil preservation. The Qualified Paleontologist will provide recommendations based on sediments types, depths, and distributions observed during spot-checking. In the event that geologic units with very high (PFYC 5) or moderate (PFYC 3) paleontological potentials are observed, including middle Miocene-age Puente Formation, Yorba Member (Tpy), Soquel Member (Tpss), and unassigned sandstone (Tps) and Pleistocene-age older alluvial deposits (Qoa), the District will be notified immediately, and updated sediment observations will subsequently be provided on a weekly basis by the Qualified Paleontologist. District will determine where monitoring should occur within the Project area. Any modifications to monitoring decisions should be communicated from the District to the USACE.

2.0 INTRODUCTION

This PRMMP presents the results of the paleontological assessment and outlines paleontological mitigation and monitoring procedures for the Carbon Canyon Flood Control Channel Improvement Project Pipeline Avenue to Peyton Drive (Project) located in the vicinity of the City of Chino Hills, San Bernardino County, California (Figure 1). This work was required by the District as the lead agency under CEQA and the USACE under NEPA. All paleontological work was completed in compliance with NEPA, CEQA, state and local regulations, and best practices in mitigation paleontology (Murphey et al., 2019).

2.1 PROJECT DESCRIPTION AND LOCATION

The Project consists of flood control channel improvements, including modification of an approximately 4,680-foot segment of the Carbon Canyon Channel and an approximately 200-foot segment of the English Channel, with 160 feet width where the existing interim channel already exists (Figures 1 and 2). Both channels convey flow from west to east, with 10-foot-deep channels. The Carbon Canyon Channel has been determined by the Federal Emergency Management Agency (FEMA) to not have the ability to convey a 100-year storm event to their standards without allowing flooding to occur in the area. In order to meet their requirements, the District proposed improving the Carbon Canyon Channel from an interim to an ultimate condition channel and improve the capacity and conveyance of the District maintained facility. The Project consists of the construction of a trapezoidal channel with articulating block invert with hardened sidewalls. The improved channel will replace an undersized earthen channel. The channel will include two transition structures, which will transition existing regular concrete channels to the improved channel. The channel will also consist of a junction structure with English Channel, which joins from the northwest. The new channel will allow for flows to be conveyed within the District ROW. Excavations for the Project will impact depths of up to 12 feet below existing grade, with construction expected to last 10 months.

The Project is located in the vicinity of the City of Chino Hills, San Bernardino County, California. Specifically, the Project is situated between Peyton Drive to the west, Pipeline Avenue to the east, Eucalyptus Avenue to the north, and Chino Hills Parkway to the south (Figure 2 and Table 1) in the vicinity of the City of Chino Hills, on unsectioned land of the Prado Dam, California U.S. Geological Survey (USGS) 7.5’ topographic quadrangle.

Based on geologic mapping by Dibblee and Ehrenspeck (2001) and Morton and Miller (2006), the Project area is primarily underlain by Holocene-age alluvial gravel, sand, and silt of valleys and floodplains (Qa) with minor amounts of middle Miocene-age Puente Formation, Yorba Member (Tpy) (Table 1). Although not mapped within the boundaries of the Project area, middle Miocene-age Puente Formation, Soquel Sandstone Member (Tpss), middle Miocene-age Puente Formation, unassigned sandstone (Tps), and Holocene-age gravel/sand of the Santa Ana River (Qg) are mapped within a half-mile and may be present within the subsurface of the Project area. Additionally, unmapped Pleistocene-age older alluvial deposits (Qoa) may underlie Holocene-age deposits, and unmapped previously disturbed sediments and artificial fill (af) are present within the Project area based on aerial imagery. Thus, these geologic units within the Project’s vicinity are discussed as well (Table 1).

Figure 1. Project location.

Figure 2. Project vicinity.

Table 1. Carbon Canyon Flood Control Channel Improvement Project Summary

<table>
<tr><td>Project Name</td><td colspan="4">Carbon Canyon Flood Control Channel Improvement Project</td></tr>
<tr><td>Project Description</td><td colspan="4">The Project consists of flood control channel improvements, including modification of an approximately 4,680-foot segment of the Carbon Canyon Channel and an approximately 200-foot segment of the English Channel, with 160 feet width where the existing interim channel already exists. The Project consists of the construction of a trapezoidal channel with articulating block invert with hardened sidewalls. The improved channel will replace an undersized earthen channel. The channel will include two transition structures, which will transition existing regular concrete channels to the improved channel. The channel will also consist of a junction structure with English Channel, which joins from the northwest. The new channel will allow for flows to be conveyed within the District ROW. Excavations for the Project will impact depths of up to 12 feet below existing grade, with construction expected to last 10 months.</td></tr>
<tr><td>Project Area</td><td colspan="4">The Project is situated between Peyton Drive to the west, Pipeline Avenue to the east, Eucalyptus Avenue to the north, and Chino Hills Parkway to the south in the vicinity of the City of Chino Hills, San Bernardino County, California.</td></tr>
<tr><td>Total Acres</td><td colspan="4">Approximately 14.66 acres</td></tr>
<tr><td rowspan="2">Location (PLSS)</td><td>Quarter-Quarter</td><td>Section</td><td>Township</td><td>Range</td></tr>
<tr><td>N/A - Unsectioned</td><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Land Owner</td><td colspan="4">County of San Bernardino</td></tr>
<tr><td>Topographic Map(s)</td><td colspan="4">Prado Dam (1967), California USGS 7.5' Topographic Quadrangle</td></tr>
<tr><td>Geologic Map(s)</td><td colspan="4">Dibblee, T.W., Jr., and H.E. Ehrenspeck. 2001. Geologic Map of the Yorba Linda & Prado Dam Quadrangles (East Puente Hills), Los Angeles, Orange, San Bernardino, and Riverside counties, California: Dibblee Geology Center, Map #DF-75, scale 1:24,000.

Morton, D.M., and F.K. Miller. 2006. Geologic Map of the San Bernardino and Santa Ana 30' x 60' quadrangles, California: USGS, Open-File Report 2006-1217, scale 1:100,000.</td></tr>
<tr><td rowspan="8">Mapped Geologic Unit(s) and Age(s)</td><td>Geologic Unit</td><td>Map Symbol</td><td>Age</td><td>Paleontological Potential (PFYC)</td></tr>
<tr><td>Unmapped previously disturbed sediments and artificial fill</td><td>af</td><td>Recent</td><td>2 (Low)</td></tr>
<tr><td>Alluvial gravel, sand, and silt of valleys and floodplains</td><td>Qa</td><td>Holocene</td><td>2 (Low)</td></tr>
<tr><td>Gravel/sand of Santa Ana River</td><td>Qg</td><td>Holocene</td><td>2 (Low)</td></tr>
<tr><td>Unmapped older alluvial deposits</td><td>Qoa</td><td>Pleistocene</td><td>3 (Moderate)</td></tr>
<tr><td>Puente Formation, unassigned sandstone</td><td>Tps</td><td>middle Miocene</td><td>5 (Very High)</td></tr>
<tr><td>Puente Formation, Soquel Member</td><td>Tpss</td><td>middle Miocene</td><td>5 (Very High)</td></tr>
<tr><td>Puente Formation, Yorba Member</td><td>Tpy</td><td>middle Miocene</td><td>5 (Very High)</td></tr>
<tr><td>Surveyor(s)</td><td colspan="4">Betsy Kruk, M.S.</td></tr>
<tr><td>Date(s) Surveyed</td><td colspan="4">August 7, 2019</td></tr>
<tr><td>Geologic Units Surveyed</td><td colspan="4">Puente Formation, Yorba Member (Tpy)</td></tr>
<tr><td>Previously Documented Fossil</td><td colspan="4">Paleo Solutions requested paleontological record searches maintained by SBCM and LACM. At the time of submission of this report for final agency review (January 6, 2020), the SBCM</td></tr>
</table>

Localities within the Project area	has not returned the museum records search results; however, museum records search results from the LACM indicates that no paleontological resources have been recovered from within the bounds of the Project area, but several fossil localities have been recorded within its immediate vicinity.
Paleontological Results	No paleontological resources were discovered during the survey. Therefore, no fossils were collected.
Disposition of Fossils	Not applicable; no fossils observed or collected during survey.
Recommendation(s)	In order to reduce potential impacts or adverse effects to scientifically significant paleontological resources to less than significant levels, pursuant to NEPA and CEQA, it is recommended that construction excavations, including trenching, grading, cutting, and drilling that is 36-inches in diameter or greater in all areas of the Project be initially spot-checked in order to determine if paleontologically sensitive sediments are being impacted beneath the ground surface. It is recommended that spot-checking efforts be reduced if it is determined that only geologic units with low paleontological potential (PFYC 2), including Recent previously disturbed sediments and artificial fill (Qf) and/or Holocene-age deposits (Qa, Qg), are being impacted, or if sediments are deemed to be non-conducive to fossil preservation. The Qualified Paleontologist will provide recommendations based on sediments types, depths, and distributions observed during spot-checking. In the event that geologic units with very high (PFYC 5) or moderate (PFYC 3) paleontological potentials are observed, including middle Miocene-age Puente Formation, Yorba Member (Tpy), Soquel Member (Tpss), and unassigned sandstone (Tps) and Pleistocene-age older alluvial deposits (Qoa), the District will be notified immediately, and updated sediment observations will subsequently be provided on a weekly basis by the Qualified Paleontologist. District will determine where monitoring should occur within the Project area. Any modifications to monitoring decisions should be communicated from the District to the USACE.

3.0 DEFINITION AND SIGNIFICANCE OF PALEONTOLOGICAL RESOURCES

As defined by Murphey and Daitch (2007): "Paleontology is a multidisciplinary science that combines elements of geology, biology, chemistry, and physics in an effort to understand the history of life on earth. Paleontological resources, or fossils, are the remains, imprints, or traces of once-living organisms preserved in rocks and sediments. These include mineralized, partially mineralized, or unmineralized bones and teeth, soft tissues, shells, wood, leaf impressions, footprints, burrows, and microscopic remains. Paleontological resources include not only fossils themselves, but also the associated rocks or organic matter and the physical characteristics of the fossils' associated sedimentary matrix.

The fossil record is the only evidence that life on earth has existed for more than 3.6 billion years. Fossils are considered non-renewable resources because the organisms they represent no longer exist. Thus, once destroyed, a fossil can never be replaced. Fossils are important scientific and educational resources because they are used to:

- Study the phylogenetic relationships amongst extinct organisms, as well as their relationships to modern groups;
- Elucidate the taphonomic, behavioral, temporal, and diagenetic pathways responsible for fossil preservation, including the biases inherent in the fossil record;
- Reconstruct ancient environments, climate change, and paleoecological relationships;
- Provide a measure of relative geologic dating that forms the basis for biochronology and biostratigraphy, and which is an independent and corroborating line of evidence for isotopic dating;
- Study the geographic distribution of organisms and tectonic movements of land masses and ocean basins through time;
- Study patterns and processes of evolution, extinction, and speciation; and
- Identify past and potential future human-caused effects to global environments and climates."

Fossil resources vary widely in their relative abundance and distribution and not all are regarded as significant. According to BLM Instructional Memorandum (IM) 2009-011, a "Significant Paleontological Resource" is defined as:

> "Any paleontological resource that is considered to be of scientific interest, including most vertebrate fossil remains and traces, and certain rare or unusual invertebrate and plant fossils. A significant paleontological resource is considered to be of scientific interest if it is a rare or previously unknown species, it is of high quality and well-preserved, it preserves a previously unknown anatomical or other characteristic, provides new information about the history of life on earth, or has an identified educational or recreational value. Paleontological resources that may be considered not to have scientific significance include those that lack provenience or context, lack physical integrity due to decay or natural erosion, or that are overly redundant or are otherwise not useful for research. Vertebrate fossil remains and traces include bone, scales, scutes, skin impressions, burrows, tracks, tail drag marks, vertebrate coprolites (feces), gastroliths (stomach stones), or other physical evidence of past vertebrate life or activities" (BLM, 2008).

Vertebrate fossils, whether preserved remains or track ways, are classified as significant by most state and federal agencies and professional groups. In some cases, fossils of plants or invertebrate animals are also considered significant and can provide important information about ancient local environments.

The full significance of fossil specimens or fossil assemblages cannot be accurately predicted before they are collected, and in many cases, before they are prepared in the laboratory and compared with previously collected fossils. Pre-construction assessment of significance associated with an area or formation must be made based on previous finds, characteristics of the sediments, and other methods that can be used to determine paleoenvironmental and taphonomic conditions.

4.0 LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

This section of the report presents the regulatory requirements pertaining to paleontological resources that apply to this Project.

4.1 FEDERAL REGULATORY SETTING

4.1.1 National Environmental Policy Act (16 USC Section 431 et seq.)

NEPA, as amended, requires analysis of potential environmental impacts to important historic, cultural, and natural aspects of our national heritage (United States Code [USC], Section 431 et seq.; 40 Code of Federal Regulations [CFR], Section 1502.25). NEPA directs federal agencies to use all practicable means to "Preserve important historic, cultural, and natural aspects of our national heritage..." (Section 101(b) (4)). Regulations for implementing the procedural provisions of NEPA are found in 40 CFR 1500 1508.

4.2 STATE REGULATORY SETTING

4.2.1 California Environmental Quality Act (CEQA)

The procedures, types of activities, persons, and public agencies required to comply with CEQA are defined in the Guidelines for Implementation of CEQA (State CEQA Guidelines), as amended on March 18, 2010 (Title 14, Section 15000 et seq. of the California Code of Regulations) and further amended January 4, 2013 and December 28, 2018. One of the questions listed in the CEQA Environmental Checklist is: "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?" (State CEQA Guidelines Appendix G, Section VII, Part F).

4.2.2 State of California Public Resources Code

The State of California Public Resources Code (Chapter 1.7), Sections 5097 and 30244, includes additional state level requirements for the assessment and management of paleontological resources. These statutes require reasonable mitigation of adverse impacts to paleontological resources resulting from development on state lands, and define the excavation, destruction, or removal of paleontological "sites" or "features" from public lands without the express permission of the jurisdictional agency as a misdemeanor. As used in Section 5097, "state lands" refers to lands owned by, or under the jurisdiction of, the state or any state agency. "Public lands" is defined as lands owned by, or under the jurisdiction of, the state, or any city, county, district, authority, or public corporation, or any agency thereof.

4.3 LOCAL REGULATORY SETTING

4.3.1 County of San Bernardino

The Conservation Element of the San Bernardino County General Plan (2007) contains one goal (CO 3) and one map (Paleontologic Resources Overlay Map, noted in the General Plan as "not available yet"), as well as three programs regarding paleontological resources within the County. Goal CO 3 requires that the County will preserve and promote its historic and prehistoric cultural heritage. Three programs within the General Plan delineate the required County actions regarding paleontological resources. In areas of potential but unknown sensitivity, field surveys prior to grading will be required to establish the need for paleontologic monitoring. Projects requiring grading plans that are located in areas of known fossil occurrences, or demonstrated in a field survey to have fossils present, will have all rough grading (cuts greater than 3 feet) monitored by trained paleontologic crews working under the direction of a qualified professional, so that fossils exposed during grading can be recovered and preserved. Fossils include large and small vertebrate fossils; the latter recovered by screen washing of bulk samples. Finally, a report of findings with an itemized accession inventory will be prepared as evidence that monitoring has been successfully completed. A preliminary report will be submitted and approved prior to granting of building permits, and a final report will be submitted and approved prior to granting of occupancy permits. The adequacy of paleontologic reports will be determined in consultation with the Curator of Earth Science, SBCM.

4.3.2 City of Chino Hills

The Conservation Element of the City of Chino Hills General Plan (2015) states that numerous fossil findings have been recorded in the City of Chino Hills, and as such, the entire city is sensitive for paleontological resources. The Conservation Element of the general plan (City of Chino Hills, 2015) contains one policy and three actions regarding the preservation of paleontological resources. Under Goal CN-2: Protect Chino Hill's Cultural Resources, Policy CN-2.2 requires the City of Chino Hills to protect paleontological resources. Action CN-2.2.1 requires appropriate paleontological surveys as part of the environmental review process where paleontological resources may be present. Action CN-2.2.2 states where paleontological resources are found during development activities, on-site inspections by a qualified paleontologist are required during grading activities where paleontological resources may be present. Action CN-2.2.3 requires identified paleontological materials to be preserved, restored, cataloged, and/or transmitted to the appropriate repository or as otherwise directed by a qualified professional paleontologist.

4.4 PERMITS

No paleontological use permits were required for this paleontological assessment and PRMMP.

5.0 METHODS

This paleontological analysis of existing data included a geologic map review, a literature search, and a museum record search. The analysis of existing data was supplemented with a pedestrian field survey. The goal of this report is to evaluate the paleontological potential of the Project area and provide paleontological mitigation and monitoring requirements to reduce potential impacts to paleontological resources to less than significant levels pursuant to CEQA, and to reduce adverse effects to paleontological resources to less than significant levels pursuant to NEPA. Senior Paleontologist Mathew Carson, M.S., performed the background research, and Mr. Carson and Paleontologist Betsy Kruk, M.S., authored this report. Ms. Kruk conducted the pedestrian field survey on August 7, 2019. Paleontological Principal Investigator Courtney Richards, M.S., performed the technical review of this report. GIS maps were prepared by GIS Specialist Barbara Webster, M.S.

Copies of this report will be submitted to the District. The District will submit the report to the USACE. A non-confidential version of the report will be submitted to Tetra Tech, Inc. Paleo Solutions will retain an archival copy of all Project information including field notes, maps, and other data.

5.1 ANALYSIS OF EXISTING DATA

Paleo Solutions reviewed geologic mapping of the Project area by Dibblee and Ehrenspeck (2001) and Morton and Miller (2006). The literature reviewed included published and unpublished scientific papers. A paleontological records search request was submitted to the SBCM and LACM; however, the results of the SBCM museum record search was not received by the date of this report submission. Additional record searches of online databases, such as the University of California Museum of Paleontology (UCMP) and the Paleobiology Database (PBDB), were completed by Paleo Solutions' staff.

5.2 FIELD SURVEY

The pedestrian field survey was conducted on August 7, 2019 by Paleo Solutions staff member Betsy Kruk, M.S. The paleontological survey was performed in order to determine the paleontological potential of the geologic deposits underlying the Project area. The pedestrian survey included inspection of the Project area with the majority of focus occurring in areas with native sediment exposures of geologic units mapped as very high (PFYC 5) paleontological potential. This included close inspection of sediment and bedrock outcrops. Rock exposures as well as the surrounding areas were photographed and documented. Geologic units of low paleontological potential (PFYC 2) were confirmed as mapped and not included in the extensive pedestrian survey due to their young age (i.e., less than 11,000). During the survey, reference points and locality information were acquired using a Garmin™ GPS. Sediment and bedrock lithologies were recorded and used to better interpret the Project's paleontological potential, and thus better understand the Project's potential impact or effect on paleontological resources.

5.3 CRITERIA FOR EVALUATING PALEONTOLOGICAL POTENTIAL

The PFYC system was developed by the BLM (BLM, 2016). Because of its demonstrated usefulness as a resource management tool, the PFYC has been utilized for many years for projects across the country, regardless of land ownership. It is a predictive resource management tool that classifies geologic units on their likelihood to contain paleontological resources on a scale of 1 (very low potential) to 5 (very high potential). This system is intended to aid in predicting, assessing, and mitigating paleontological resources. The PFYC ranking system is summarized in Table 2.

Table 2. Potential Fossil Yield Classification (BLM, 2016)

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary (PFYC System)
1 = Very Low Potential	Geologic units are not likely to contain recognizable paleontological resources.
	Units are igneous or metamorphic, excluding air-fall and reworked volcanic ash units.
	Units are Precambrian in age.
	Management concern is usually negligible, and impact mitigation is unnecessary except in rare or isolated circumstances.
2 = Low Potential	Geologic units are not likely to contain paleontological resources.
	Field surveys have verified that significant paleontological resources are not present or are very rare.
	Units are generally younger than 10,000 years before present.
	Recent eolian deposits.

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary (PFYC System)
	Sediments exhibit significant physical and chemical changes (i.e., diagenetic alteration) that make fossil preservation unlikely.
	Management concern is generally low, and impact mitigation is usually unnecessary except in occasional or isolated circumstances.
3 = Moderate Potential	Sedimentary geologic units where fossil content varies in significance, abundance, and predictable occurrence.
	Marine in origin with sporadic known occurrences of paleontological resources.
	Paleontological resources may occur intermittently, but these occurrences are widely scattered.
	The potential for authorized land use to impact a significant paleontological resource is known to be low-to-moderate.
	Management concerns are moderate. Management options could include record searches, pre-disturbance surveys, monitoring, mitigation, or avoidance. Opportunities may exist for hobby collecting. Surface-disturbing activities may require sufficient assessment to determine whether significant paleontological resources occur in the area of a proposed action and whether the action could affect the paleontological resources.
4 = High Potential	Geologic units that are known to contain a high occurrence of paleontological resources.
	Significant paleontological resources have been documented but may vary in occurrence and predictability.
	Surface-disturbing activities may adversely affect paleontological resources.
	Rare or uncommon fossils, including nonvertebrate (such as soft body preservation) or unusual plant fossils, may be present.
	Illegal collecting activities may impact some areas.
	Management concern is moderate to high depending on the proposed action. A field survey by a qualified paleontologist is often needed to assess local conditions. On-site monitoring or spot-checking may be necessary during land disturbing activities. Avoidance of known paleontological resources may be necessary.
5 = Very High Potential	Highly fossiliferous geologic units that consistently and predictably produce significant paleontological resources.
	Significant paleontological resources have been documented and occur consistently.
	Paleontological resources are highly susceptible to adverse impacts from surface disturbing activities.
	Unit is frequently the focus of illegal collecting activities.
	Management concern is high to very high. A field survey by a qualified paleontologist is almost always needed and on-site monitoring may be necessary during land use activities. Avoidance or resource preservation through controlled access, designation of areas of avoidance, or special management designations should be considered.
U = Unknown Potential	Geologic units that cannot receive an informed PFYC assignment.
	Geological units may exhibit features or preservational conditions that suggest significant paleontological resources could be present, but little information about the actual paleontological resources of the unit or area is unknown.
	Geologic units represented on a map are based on lithologic character or basis of origin, but have not been studied in detail.
	Scientific literature does not exist or does not reveal the nature of paleontological resources.
	Reports of paleontological resources are anecdotal or have not been verified.
	Area or geologic unit is poorly or under-studied.
	BLM staff has not yet been able to assess the nature of the geologic unit.

BLM PFYC Designation	Assignment Criteria Guidelines and Management Summary (PFYC System)
	Until a provisional assignment is made, geologic units with unknown potential have medium to high management concerns. Field surveys are normally necessary, especially prior to authorizing a ground-disturbing activity.

6.0 ANALYSIS OF EXISTING DATA

The Project area is located within the Chino Hills-Los Angeles Basin area of the Peninsular Ranges Geomorphic Province (Harden, 2004). A geomorphic province is a geographical area of distinct landscape character, with related geophysical features, including relief, landforms, orientations of valleys and mountains, type of vegetation, and other geomorphic attributes (Harden, 2004). Attributes of the Peninsular Ranges Geomorphic Province consist of northwest-southeast-trending, fault-bounded discrete blocks, with mountain ranges, broad intervening valleys, and low-lying coast plains (Yerkes et al., 1965; Norris and Webb, 1990). Within California, the province extends approximately 125 miles from the Transverse Ranges and the Los Angeles Basin south to the Mexican border, extending southward approximately 775 miles toward to the tip of Baja California, and it is bound on the east by the right-slip San Andreas Fault Zone, the Eastern Transverse Ranges, and the Colorado Desert (Norris and Webb, 1990; Hall, 2007). Most of the geomorphic province is located offshore and includes the Santa Catalina and San Clemente islands (Hall, 2007). Topographically on the mainland, the Peninsular Ranges are steeper on the eastern slopes, where they are truncated by normal faults like the Elsinore or San Jacinto faults, and are more gradual on their western slopes toward the Pacific Ocean, similar to the topography of the Sierra Nevada (Norris and Webb, 1990; Prothero, 2017). Within the province, the highest elevations are found in the eastern-most block, with San Jacinto Peak reaching approximately 10,805 feet in elevation and various summits of the Santa Rosa Mountains averaging 6,000 feet in elevation (Norris and Webb, 1990). Westward toward the coast, elevations are less dramatic.

The pre-Phanerozoic history of the Peninsular Ranges is not represented within the province, and few locations contain rocks older than the Mesozoic (Norris and Webb, 1990), and sparse Paleozoic strata within the Peninsular Ranges is in stark contrast to the Sierra Nevada, which contains thick sections of Paleozoic rocks. The oldest pre-batholithic rocks in the Peninsular Ranges are Paleozoic in age and consist of metamorphosed remnants of a stable carbonate platform (now marble and schist) on a passive continental margin that existed along western North America at that time (Harden, 2004). Moreover, late Paleozoic limestone is present near Riverside (Norris and Webb, 1990), further supporting the presence of a shallow marine environment prior to the Mesozoic. Most of the geologic history of the Peninsular Ranges is represented by Mesozoic-age plutonic rocks and Cenozoic-age uplift, erosion, and sedimentary deposition in basins (Sylvester and O'Black Gans, 2016).

During the Triassic and Jurassic, marine sedimentary rocks composed of sandstone and shale were deposited in turbidite sequences along a submarine fan (Harden, 2004). Throughout the Jurassic and Cretaceous, the continental margin became active as the Farallon Plate, which ferried old island arcs, subducted beneath the North American Plate, creating a large pluton complex (i.e., batholith) beneath the surface that rose into the upper crust and intruded into Paleozoic and Mesozoic sedimentary and volcanic rocks (Harden, 2004; Sylvester and O'Black Gans, 2016). The large complex of batholiths resulted in the formation of the San Marcos Gabbro, Bonsall Tonalite, and Woodson Mountain Granodiorite among others in the Peninsular Ranges (Norris and Webb, 1990). Contact metamorphism from the plutons metamorphosed older sedimentary and volcanic rocks into marble, slate, schist, quartzite, gneiss, and metavolcanic rocks (Sylvester and O'Black Gans, 2016). The timing of the Peninsular Ranges Batholith is similar to that of the Sierra Nevada, ranging in age from 70 to 120 million years ago (Norris and Webb, 1990). The batholith complex originally formed south of the Mexican border but has since moved along the right-slip San Andreas Fault over the past 40 million years (Prothero, 2017). During the Late Cretaceous through the Paleogene, the Peninsular Ranges Batholith was uplifted and eroded into a broad plain, where fluvial systems transported sediments westward across the plain and onto the seafloor (Sylvester and O'Black Gans, 2016). Sedimentary rocks were deposited in a forearc basin by turbidity currents representing both deep and shallow marine and nonmarine environments, including the marine Williams, Ladd, and Rosario formations and the nonmarine Trabuco Formation, with extensive exposures in the western flank of the Santa Ana Mountains (Norris and Webb, 1990; Harden, 2004).

Throughout the Cenozoic, thick sections of sedimentary rocks were deposited in large basins, such as the Los Angeles, Imperial, and offshore basins, due to erosion (Norris and Webb, 1990). Most exposures of early Tertiary strata are restricted to the coastal margins, with a maximum thickness of approximately 4,500 feet in the Santa Ana Mountains (Norris and Webb, 1990). Most Cenozoic strata represent nonmarine depositional environments; however, approximately 600 feet of marine sediments are present near San Diego (Norris and Webb, 1990). Thick nonmarine deposits formed during the Oligocene, followed by a pause of sedimentation at the end of the Oligocene due to tectonic uplift (Norris and Webb, 1990). By the beginning of the Miocene, most of the Farallon Plate had been subducted beneath the North American Plate, and the Pacific Plate came into contact with the North American Plate (Sylvester and O'Black Gans, 2016). As the Pacific Plate slid northwest along the North American Plate, a section of forearc basin was rafted, rotated clockwise approximately 110 degrees, and carried north approximately 130 miles; while carried northward, the forearc basin was compressed and formed the Transverse Ranges located immediately north of the Peninsular Ranges (Sylvester and O'Black Gans, 2016). Additionally, movement along the San Jacinto Fault Zone, which bifurcates from the San Andreas Fault Zone in an area north of the Peninsular Ranges, occurred in the middle to late Tertiary through the Quaternary, with a right-slip and vertical motion resulting in approximately 18 miles of lateral displacement (Norris and Webb, 1990). During this time, thick accumulations of nonmarine sediments filled basins, as well as coastal and offshore areas, in the northern Peninsular Ranges during the Pliocene, with up to 7,000-foot thick sections of siltstone, sandstone, and conglomerate in the Mount Eden and San Timoteo canyons (Norris and Webb, 1990). Despite widespread volcanism elsewhere in southern California during the late Tertiary, little volcanism occurred within the Peninsular Ranges during this time (Norris and Webb, 1990). Throughout the Quaternary, fluvial and lacustrine sediments continued to fill basins within the province, with restricted volcanic and marine terrace deposits along the coast (Norris and Webb, 1990).

6.1 LITERATURE SEARCH

Based on geologic mapping by Dibblee and Ehrenspeck (2001) and Morton and Miller (2006), the Project area is underlain by middle Miocene-age Puente Formation, Yorba Member (Tpy) and Holocene-age alluvial gravel, sand, and silt of valleys and floodplains (Qa) (Figure 3). Although not mapped within the boundaries of the Project area, middle Miocene-age Puente Formation, Soquel Sandstone Member (Tpss), middle Miocene-age Puente Formation, unassigned sandstone (Tps), and Holocene-age gravel/sand of the Santa Ana River (Qg) are mapped within a half-mile and may be present within the subsurface of the Project area. Additionally, unmapped Pleistocene-age older alluvial deposits (Qoa) may underlie Holocene-age deposits, and unmapped previously disturbed sediments and artificial fill (af) are present within the Project area based on aerial imagery. Thus, these geologic units within the Project's vicinity are discussed as well (Figure 3).

6.1.1 Puente Formation, Yorba Member (Tpy), Soquel Member (Tpss), Unassigned Sandstone (Tps)

The middle Miocene-age Puente Formation was first named by Eldridge and Arnold (1907) for exposures in the Puente Hills-Chino Hills area (Morton and Miller, 2006). Work by English (1926) extended the Puente Formation to areas south of the Puente Hills and subdivided the unit based on distinct lithologies. Later, Daviess and Woodford (1949) and Schoellhamer et al. (1954) formalized four gradational members of the Puente Formation: 1) the Sycamore Canyon Member, Yorba Member, Soquel Member, and the La Vida Member. According to Dibblee and Ehrenspeck (2001), the Puente Formation is considered equivalent to the Miocene-age Monterey Formation, with the members being renamed as the Yorba Shale Member, Soquel Sandstone Member, and La Vida Shale Member and with the Sycamore Canyon Member being promoted to the Sycamore Canyon Formation. However, Morton and Miller (2006) state that because the Monterey Formation is a consistent and distinct lithologic unit over its extent from the Monterey area into the San Joaquin Hills, and is distinctly different lithologically from the Puente Formation in the Puente Hills area, the nomenclature of Schoellhamer et al. (1954) should be used. Thus, Paleo Solutions has amended the nomenclature of Morton and Miller (2006) to the higher resolution Dibblee and Ehrenspeck (2001) geologic mapping of this formation.

The Puente Formation was deposited as a marine fan and consists of very thick sections of sandstone, siltstone, and shale within most of the Puente Hills and adjacent regions. According to Morton and Miller (2006), the Puente Formation reaches a maximum thickness of nearly 13,124 feet (4,000 meters) within the Puente Hills region. Puente Formation rocks coeval to the Monterey Formation have been correlated to middle Miocene; however, biochronologic data based on foraminifera within the Puente Formation extend this age to early Pliocene to late Miocene. The Puente Formation, Yorba Member (Tpy) consists of siltstone and sandstone, described as white to gray, thin bedded, micaceous and siliceous siltstone and sandy siltstone by Schoellhamer et al. (1954), which includes beds of fine-grained sandstone and white to pale gray limy or dolomitic concretions and concretionary beds (Dibblee and Ehrenspeck, 2001; Morton and Miller, 2006). Additionally, the Yorba Member contains local conglomeratic intervals deposited in submarine landslide deposits and turbidites (Morton and Miller, 2006). The Yorba Member (Tpy) immediately underlies the central section of the Project area, as well as a large area immediately south and adjacent to the Project area (Figure 3). The Puente Formation, Soquel Member (Tpss) consists of sandstone and siltstone, described as gray to yellowish-gray weathering to tan, akrosic, massive to well bedded, medium- to coarse-grained, poorly sorted sandstone interbedded with matrix-supported pebbly sandstone, with sandstone beds exhibiting grading and local conglomerates and with ellipsoidal calcareous concretions ranging from 30 centimeters to 1.5 meters in diameter (Dibblee and Ehrenspeck, 2001; Morton and Miller, 2006). Dibblee and Ehrenspeck (2001) described it as locally coarse-grained and pebbly, with minor silty clay shale. The Soquel Member (Tpss) is situated southwest of the Project area and is not mapped with the bounds of the Project area at the surface but may shallowly underlie or interfinger with the Yorba Member (Dibblee and Ehrenspeck, 2001) (Figure 3). The Puente Formation, unassigned sandstone (Tps) consists of sandstone and siltstone comparably to the Soquel Member (Tpss) according to Dibblee and Ehrenspeck (2001). This unit remains unassigned to one of the four members of the Puente Formation, but may be equivalent to the Soquel Member (Tpss). The unassigned sandstone (Tps) is situated west of the Project area and is not mapped within the bounds of the Project area at the surface but may shallowly underlie or interfinger with the Yorba Member (Dibblee and Ehrenspeck, 2001) (Figure 3).

According to the paleontological assessment conducted by Cogstone Resource Management Inc. (Cogstone) (2011) for the City of Chino Hills Program Environmental Impact Report (EIR) for the General Plan Update (City of Chino Hills, 2013), fossil localities recorded from Miocene-age rocks, including the Puente Formation, within the Chino Hills area include marine mammals, such as whale, dolphin, and seal; birds; boney fishes; cartilaginous fishes; marine invertebrates; marine plants; and terrestrial plants (Table 3). A review of the UCMP online fossil locality database indicates that fossil plants have been recovered from the Puente Formation, Soquel Member in San Bernardino County, as well as from undifferentiated Puente Formation in Riverside County (UCMP, 2019) (Table 3). Los Angeles County also contains records of fossil foraminifera, marine invertebrates, plants, and indeterminant vertebrates (UCMP, 2019) (Table 3). According to the PBDB, no fossil localities are recorded within the immediately vicinity of the Project area; however, one locality near La Habra in Orange County yielded fossil insect from the Puente Formation in a marine shale bed (Pierce, 1945; PBDB, 2019) (Table 3). Additionally, two localities near Villa Park in Orange County yielded shark, extinct hippo-like mammal, whale, seal, and fish (Rigby and Albi, 1996; Pimiento, 2014; Sherzer, 2017; PBDB, 2019) (Table 3).

Based on the potential to yield scientifically significant fossil taxa, the Puente Formation, Yorba Member (Tpy), Puente Formation, Soquel Member (Tpss), and Puente Formation, unassigned sandstone (Tps) all have a very high paleontological potential (PFYC 5) using BLM (2016) guidelines.

6.1.2 Unmapped Pleistocene-age older alluvial deposits (Qoa)

According to McLeod (2019), Pleistocene-age fossils have been recovered from sediments at depths of 15 to 20 feet below ground surface with close proximity to the Project area. Therefore, unmapped Pleistocene-age older alluvial deposits (Qoa), consisting of elevated, dissected remnants of alluvial gravel, sand, and silt, may be present within the Project area at shallow or unknown depth.

Within San Bernardino County, Ice Age taxa have been recovered from Pleistocene-age deposits of San Bernardino County, including specimens of rodents (*Peromyscus* sp., *Dipodomys ordii*, *Neotoma* sp., *Thomomys* sp., among others), rabbits (*Lepus* sp.), horse (*Equus conversidens*), badger (*Taxidea taxus*), cats (*Smilodon* sp., *Puma concolor*), mammoth (*Mammuthus* sp.), camel (*Camelops* sp.), llama (*Hemiauchenia* sp.), ground sloth (*Nothrotheriops* sp., *Megalonyx* sp.), and tortoise (*Opherus agassizi*), as well as bison, antelope, and many other taxa of mammals (Jefferson, 1991; Reynolds, 1991; Brattstrom, 1961). A review of the UCMP (2019) paleontological locality database indicates that Pleistocene-age fossils have been recovered from San Bernardino County, including plants (*Juniperus* sp.) and vertebrates, such as wolf (*Canis* sp., *Canis dirus*), bobcat (*Lynx rufus*), fox (*Urocyon cinereoargenteus*), horse (*Equus* sp.), camel (*Camelops* sp., *Camelops hesternus*, *Camelus* sp.), llama (*Tanupolama stevensi*), bighorn sheep (*Ovis canadensis*), skunk (*Spilogale* sp.), rabbit (*Lepus californicus*), pika (*Ochotona* sp.), ring-tailed cat (*Bassariscus astutus*), rodent (*Marmota flaviventris*, *Microtus* sp., *Lemmiscus curtatus*, *Neotoma cinerea*, *Dipodomys* sp., *Chaetodipus* sp., *Baiomys* sp., *Sciurus* sp., *Spermophilus* sp., *Otospermophilus* sp., *Thomomys* sp.), bird (*Buteo* sp.), lizard (*Crotaphytus* sp., *Cnemidophorus tigris*, *Sceloporus occidentalis*), tortoise (*Hesperotestudo* sp., *Gopherus agassizii*), and amphibian.

Based on BLM (2016) guidelines, Pleistocene-age older alluvial deposits (Qoa) have a moderate paleontological potential (PFYC 3).

6.1.3 Gravel/Sand of Santa Ana River (Qg), Alluvial Gravel, Sand, and Silt of Valleys and Floodplains (Qa)

Holocene-age (less than 11,000 years old) sediments are typically too young to contain fossilized material Society of Vertebrate Paleontology (SVP) (2010), but they may overlie sensitive older (e.g., Miocene- to Pleistocene-age) deposits at variable depths. Underlying the Project area, Holocene-age alluvial gravel, sand, and silt of valleys and floodplains (Qa) consist of undissected alluvial deposits derived from local alluvial fans and washes (Dibblee and Ehrenspeck, 2001). Additionally, Holocene-age gravel/sand of Santa Ana River (Qg) consists of coarse-grained fluvial and wash deposits from the nearby Santa Ana River (Dibblee and Ehrenspeck, 2001).

Based on BLM (2016) guidelines, Holocene-age gravel/sand of Santa Ana River (Qg), and Holocene-age alluvial gravel, sand, and silt of valleys and floodplains (Qa) have a low paleontological potential (PFYC 2).

6.1.4 Previously Disturbed Sediments and Artificial Fill (af)

The Project area is underlain by unmapped Recent previously disturbed sediments and artificial fill (af). These sediments were deposited during previous ground-disturbing activities involved in the construction of the existing Carbon Canyon Channel and consist of loose gravel and silty sand either from reworked native material or imported from other areas. Previously disturbed sediments and artificial fill are assigned low paleontological potential (PFYC 2) at the surface using BLM (2016) guidelines since any fossil discovered in artificial fill has been removed from its geologic context. However, they may overlie older geologic units with relatively higher paleontological potential at shallow or unknown depth.

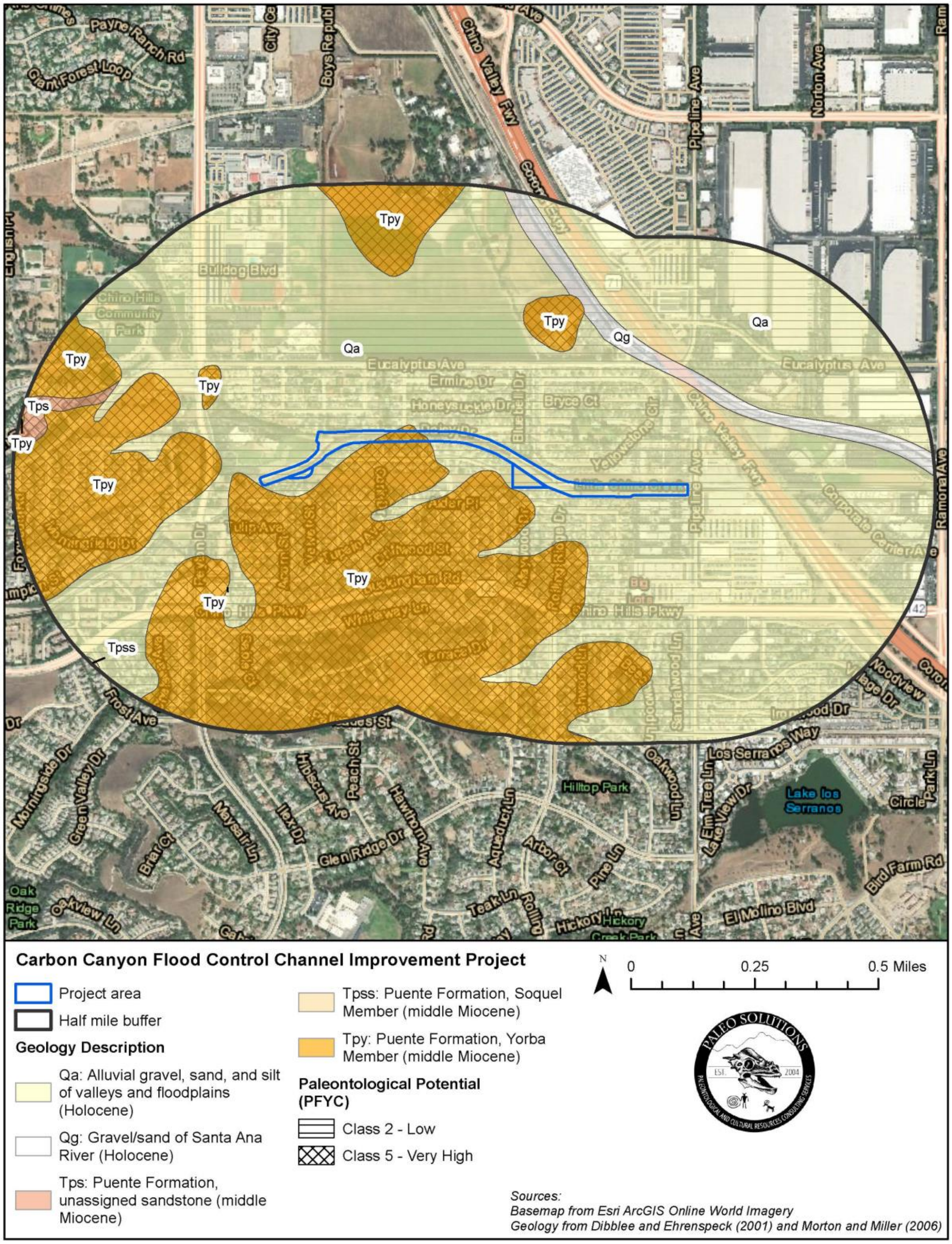

Figure 3. Project geology and paleontological potential.

6.2 PALEONTOLOGICAL RECORD SEARCH RESULTS

Paleo Solutions requested paleontological record searches maintained by SBCM and LACM. At the time of submission of this report for agency review, the SBCM has not returned the museum record search results. On August 9, 2019, LACM responded to the museum records search request and indicated that no paleontological resources have been recorded within the bounds of the Project area; however, several fossil localities have been recorded within its immediate vicinity (McLeod, 2019) (Table 3).

From the Puente Formation, several localities have been recorded (McLeod, 2019). Fossil locality LACM 6337, situated approximately 0.25 miles east of the Project area, yielded fossil mackerel (Scombridae), and fossil locality LACM 7503, situated approximately 1 mile southwest of the Project area, yielded a skull and skeleton of a fossil dolphin (*Atocetus*). Additionally, approximately 1 mile northwest of the Project area, LACM 7382-7386 yielded baleen whale (Mysticeti), as well as fish, including croaker (*Lompoquia*), herring (*Ganolytes cameo*), cod (*Eclipes*), snake mackerel (*Thyrsocles*), scad (*Decapterus*), lanternfish (Myctophidae), and deep sea smelt (Bathylagidae). Fossil localities LACM 7490-7492, situated further west-northwest of LACM 7382-7386, yielded fish, including croaker (*Lompoquia*), herring (*Ganolytes cameo*, *Etringus scintillans*), snake mackerel (*Thyrsocles kriegeri*), scad (*Decapterus*), mackerel (*Scomber*), and deep sea smelt (Bathylagidae).

Although Pleistocene-age deposits are not mapped within the Project area, several fossil localities have been recorded nearby from Pleistocene-age older alluvial deposits (Qoa) (McLeod, 2019). From Pleistocene-age older alluvial deposits, fossil locality LACM 1728, situated immediately adjacent to and northwest of the Project area, yielded horse (*Equus*) and camel (*Camelops*) at a depth of 15 to 20 feet below ground surface. Situated approximately 2.5 miles north-northwest of the Project area, fossil locality LACM 8014 yielded fossil bison (*Bison*), and approximately 3 miles southwest of the Project area, fossil locality LACM 7508 yielded fossil ground sloth (*Nothrotheriops*) and horse (*Equus giganteus*).

Table 3. Paleontological Record Search and Literature Review Summary

Institutional Locality Number/Name	Geologic Unit and Age	Taxon	Common Name	Location	Source
LACM 1728	Pleistocene-age older alluvial deposits	*Equus* *Camelops*	Horse Camel	San Bernardino County	McLeod, 2019
LACM 8014	Pleistocene-age older alluvial deposits	*Bison*	Bison	San Bernardino County	McLeod, 2019
LACM 7508	Pleistocene-age older alluvial deposits	*Nothrotheriops* *Equus giganteus*	Ground Sloth Horse	San Bernardino County	McLeod, 2019
LACM 6337	Middle Miocene-age Puente Formation	*Atocetus*	Dolphin	San Bernardino County	McLeod, 2019
LACM 7382 - 7386	Middle Miocene-age Puente Formation	Mysticeti *Lompoquia* *Ganolytes cameo* *Eclipes* *Thyrsocles* *Decapterus* Myctophidae Bathylagidae	Baleen Whale Croaker Herring Cod Snake Mackerel Scad Lanternfish Deep Sea Smelt	San Bernardino County	McLeod, 2019
LACM 7490 – 7492	Middle Miocene-age Puente Formation	*Lompoquia* *Ganolytes cameo* *Etringus scintillans* *Thyroscles kriegeri* *Decapterus*	Croaker Herring Herring Snake Mackerel Scad	San Bernardino County	McLeod, 2019

Institutional Locality Number/Name	Geologic Unit and Age	Taxon	Common Name	Location	Source
		Scomber Bathylagidae	Mackerel Deep Sea Smelt		
Unlisted	Pleistocene-age older alluvial deposits	*Peromyscus* sp. *Dipodomys ordii* *Neotoma* sp. *Thomomys* sp. *Lepus* sp. *Equus conversidens* *Taxidea taxus* *Smilodon* sp. *Puma concolor* *Mammuthus* sp. *Camelops* sp. *Hemiauchenia* sp. *Nothrotheriops* sp. *Megalonyx* sp. *Opherus agassizi*	Rodent Rodent Rodent Rodent Rabbit Horse Badger Saber-toothed Cat Mountain Lion Mammoth Camel Llama Ground Sloth Ground Sloth Tortoise	San Bernardino County	Jefferson, 1991; Reynolds, 1991; Brattstrom, 1961
Numerous UCMP Localities	Pleistocene-age older alluvial deposits	*Juniperus* sp. *Canis* sp. *Canis dirus* *Lynx rufus* *Urocyon cinereoargenteus* *Equus* sp. *Camelops* sp. *Camelops hesternus* *Camelus* sp. *Tanupolama stevensi* *Ovis canadensis* *Spilogale* sp. *Lepus californicus* *Ochotona* sp. *Bassariscus astutus* *Marmota flaviventris* *Microtus* sp. *Lemmiscus curtatus* *Neotoma cinerea* *Dipodomys* sp. *Chaetodipus* sp. *Baiomys* sp. *Sciurus* sp. *Spermophilus* sp. *Otospermophilus* sp. *Thomomys* sp. *Buteo* sp. *Crotaphytus* sp. *Cnemidophorus tigris* *Sceloporus occidentalis* *Hesperotestudo* sp. *Gopherus agassizii* Amphibia	Plant Wolf Dire Wolf Bobcat Fox Horse Camel Camel Camel Llama Bighorn Sheep Skunk Rabbit Pika Ring-tailed Cat Rodent Rodent Rodent Rodent Rodent Rodent Rodent Rodent Rodent Rodent Rodent Bird Lizard Lizard Lizard Tortoise Tortoise Amphibian	San Bernardino County	UCMP, 2019
UCMP PA948	Middle Miocene-age Puente Formation, Soquel Member	-	Plant	San Bernardino County	UCMP, 2019
UCMP PB02004, PB02006 - PB02014,	Middle Miocene-age Monterey (Puente) Formation	-	Plant	San Bernardino County,	UCMP, 2019

Institutional Locality Number/Name	Geologic Unit and Age	Taxon	Common Name	Location	Source
PB99050 – PB99053				Riverside County	
UCMP 4046	Middle Miocene-age Puente Formation	-	Invertebrate	Los Angeles County	UCMP, 2019
UCMP 9041	Middle Miocene-age Puente Formation	-	Invertebrate	Los Angeles County	UCMP, 2019
UCMP 12678	Middle Miocene-age Puente Formation	-	Foraminifera	Los Angeles County	UCMP, 2019
UCMP MF7452	Middle Miocene-age Puente Formation	-	Foraminifera	Los Angeles County	UCMP, 2019
UCMP PA1195	Middle Miocene-age Puente Formation, La Vida Member	-	Plant	Los Angeles County	UCMP, 2019
UCMP PA1327	Middle Miocene-age Puente Formation, Sycamore Canyon Member	-	Plant	Los Angeles County	UCMP, 2019
UCMP PB01005	Middle Miocene-age Puente Formation	-	Plant	Los Angeles County	UCMP, 2019
UCMP PB99003	Middle Miocene-age Puente Formation	-	Plant	Los Angeles County	UCMP, 2019
UCMP V3637	Middle Miocene-age Puente Formation	-	Vertebrate	Los Angeles County	UCMP, 2019
UCMP MF3653	Middle Miocene-age Puente Formation	-	Foraminifera	Orange County	UCMP, 2019
UCMP PA947	Middle Miocene-age Puente Formation, La Vida Member	-	Plant	Orange County	UCMP, 2019
UCMP V68103	Middle Miocene-age Puente Formation	Osteichthyes	Fish	Orange County	UCMP, 2019
Multiple Unlisted Localities	Middle Miocene-age Puente Formation (listed as Monterey Formation and Sycamore Canyon Formation, both coeval to Puente Formation)	*Atocetus angulii* Balaenopteridae Cetacea Delphinidae Mysticeti Otariid Physeteridae Pinnipedia *Pithanotaria starri* Aves Acanthopterygii Alepocephalidae *Anarrhichthys* *Araeosteus* (cf.)	Chino Hills Dolphin, Extinct Rorqual Whale Whale Dolphin Baleen Whale Eared Seal Sperm Whale Seals and Sea Lions Fur Seal Bird Spiny-Finned Fish Slickhead Wolf-eel Bony Fish	City of Chino Hills, San Bernardino County	Cogstone, 2011; City of Chino Hills, 2013

Institutional Locality Number/Name	Geologic Unit and Age	Taxon	Common Name	Location	Source
		Araeosteus rothi	Prow Fish, Extinct		
		Argentinoidei	Smelt		
		Argyropelecus bullockii	Hatchetfish, Extinct		
		Atherinidae	Silverside/Grunion		
		Bathylagidae	Deep Sea Smelt		
		Belonidae	Needlefish		
		Carangidae	Jack		
		Chauliodus eximius	Viperfish, Extinct		
		Clupeidae	Herring/Sardine		
		Cyclothone	Bristlemouth		
		Decapterus	Scad, Extinct		
		Eclipes	Hake		
		Etringus	Herring		
		Gadiformes	Cod		
		Ganoessus	Sardine, Extinct		
		Ganoessus clepsydra	Sardine		
		Ganolytes	Sardine		
		Hemirhamphid or Exocetid	Gliding or Flying Fish		
		Hipposyngnathus impocitor	Pipefish, Extinct		
		Lompoquia	Croacker		
		Myctophidae	Lantern Fish		
		Oncorhymus rastrosus	Saber-toothed Salmon, Extinct		
		Perciformes	Perch-like Fish		
		Pleuronectiformes	Flat Fishes, Halibut		
		Pseudoseriola	Bluefish		
		Sarda	Bonito		
		Scomber	Mackerel		
		Scomberesox	Needle-nose Gar		
		Scombridae	Mackerel		
		Scorpenidae	Rockfish		
		Serranidae	Sea Bass		
		Sparidae	Porgies		
		Sphyraena	Barracuda		
		Stomias	Scaly Dragonfish		
		Syngnathus	Pipefish		
		Thyrsocles	Knife Fish, Extinct		
		Xyne grex	Herring		
		Zaphlegidae	Snake Mackerel		
		Carcharocles	White Shark, Extinct		
		Cetorhinus	Basking Shark		
		Elasmobranchii	Shark		
		Isurus	Mako Shark		
		-	Marine invertebrates, including brachiopods, bivalves, gastropods, and crustaceans		
		-	Marine plants, including seaweed, kelp, red algae, brown algae, and green algae		
		-	Terrestrial plants, including trees, grasses, and flowering plants		
PBDB 124524	Middle Miocene-age Puente	*Protohepialus comstocki* *Aphelophlebodes stocki*	Moth, Extinct Mayfly	Orange County	Pierce, 1945;

Institutional Locality Number/Name	Geologic Unit and Age	Taxon	Common Name	Location	Source
	Formation (marine shale unit)				PBDB, 2019
PBDB 91023	Middle Miocene-age Puente Formation, Yorba Member (siltstone unit)	*Farrea rugosa* *Delectopecten peckhami* *Syngnathus avus* *Scopelogadus mizolepis* *Eclipes veternus* Foraminifera	Glass Sponge Scallop Pipefish Ray-finned Fish Ray-finned Fish Foraminifera	Orange County	Rigby and Albi, 1996; PBDB, 2019
PBDB 162458 – PBDB 162460	Middle Miocene-age Puente Formation, La Vida Member	*Otodus megalodon* *Cosmopolitodus hastalis* *Oxyrhina plana* Teleostei *Desmostylus* sp. Teleostei *Otodus megalodon* Cetacea Otaridae *Otodous megalodon*	Great White Shark, Extinct Mackerel Shark Mackerel Shark Teleost Fish Hippo-like Mammal, Extinct Teleost Fish Great White Shark, Extinct Whale Eared Seal Great White Shark, Extinct	Orange County	Pimiento, 2014; PBDB, 2019
PBDB 184471	Middle Miocene-age Puente Formation, Yorba Member	Physeteroidea	Whale	Orange County	Sherzer, 2017; PBDB 2019

7.0 FIELD SURVEY

The survey area is located between Peyton Drive and Pipeline Avenue in the City of Chino Hills, County of San Bernardino. The terrain and existing ground disturbances consists of a man-made drainage with steep sides, level asphalt or gravel road running parallel, with dirt or vegetated laydown yards (Figures 4-6). The drainage runs between the backyards of a neighborhood (Figures 4-6).

Paleo Solutions conducted a paleontology survey of the Project area on August 7, 2019. The results of the field survey are incorporated into the following Geology and Paleontology subsections (Sections 7.1 and 7.2, respectively).

7.1 GEOLOGY

The middle Miocene-age Puente Formation, Yorba Member (Tpy) is mapped south and southwest of the Project area, with one portion intersecting the drainage in its western half. However, the Puente Formation, Yorba Member (Tpy) was not observed by field staff. Holocene-age alluvial gravel, sand, and silt of valleys and floodplains (Qa) is mapped north and southeast of the Project area and is mapped throughout the majority of the Project area. However, the Holocene-age alluvial gravel, sand, and silt of valleys and floodplains (Qa) was not observed by field staff. Moreover, geologic units mapped within a half-mile of the Project area, including Puente Formation, Soquel Member (Tpss), Puente Formation, unassigned sandstone (Tps), and gravel/sand of Santa Ana River (Qg), were also not observed within the Project area during the survey. The Project area was entirely covered by man-made structures or unmapped Recent previously disturbed sediments and artificial fill (af).

Due to the level of previous disturbance and hardscaping, the depth to sensitive geologic units could not be ascertained during the field survey.

7.2 PALEONTOLOGY

No paleontological resources were discovered during the survey, although sediments conducive to fossil preservation, including the middle Miocene-age Puente Formation, Yorba Member (Tpy), are mapped along a portion of the Project area and may be present at shallow or unknown depth within the entire Project area.

Figure 4. Overview of Project area. View east.

Figure 5. Overview of western laydown yard. View southwest.

Figure 6. Overview of eastern laydown yard. View south.

8.0 IMPACTS TO PALEONTOLOGICAL RESOURCES

Impacts on paleontological resources can generally be classified as either direct, indirect or cumulative. Direct adverse impacts on surface or subsurface paleontological resources are the result of destruction by breakage and crushing as the result of surface disturbing actions including construction excavations. In areas that contain paleontologically sensitive geologic units, ground disturbance has the potential to adversely impact surface and subsurface paleontological resources of scientific importance. Without mitigation, these fossils and the paleontological data they could provide if properly recovered and documented, could be adversely impacted (damaged or destroyed), rendering them permanently unavailable to science and society.

Indirect impacts typically include those effects which result from the continuing implementation of management decisions and resulting activities, including normal ongoing operations of facilities constructed within a given project area. They also occur as the result of the construction of new roads and trails in areas that were previously less accessible. This increases public access and therefore increases the likelihood of the loss of paleontological resources through vandalism and unlawful collecting. Human activities that increase erosion also cause indirect impacts to surface and subsurface fossils as the result of exposure, transport, weathering, and reburial.

Cumulative impacts can result from incrementally minor but collectively significant actions taking place over a period of time. The incremental loss of paleontological resources over time as a result of construction-related surface disturbance or vandalism and unlawful collection would represent a significant cumulative adverse impact because it would result in the destruction of non-renewable paleontological resources and the associated irretrievable loss of scientific information.

Excavations for the Project area are anticipated to extend 12 feet below existing grade, with a width of 160 feet over a total length of 4,860 feet, and may potentially impact middle Miocene-age Puente Formation, Yorba Member (Tpy), which may result in significant impacts and/or adverse effects to paleontological resources. Although the Puente Formation, Yorba Member (Tpy) was not observed during the survey, this geologic unit may be encountered in the subsurface of the Project area at shallow depth, especially since previous excavations during construction of the existing Carbon Canyon Channel may have already removed overlying native Holocene-age alluvial deposits. Additionally, ground-disturbing activities may impact the Puente Formation, Soquel Member (Tpss), Puente Formation, unassigned sandstone (Tps), or Pleistocene-age older alluvial deposits (Qoa) at shallow or unknown depths. Surface grading or shallow excavations entirely within Holocene-age gravel/sand of Santa Ana River, Holocene-age alluvial gravel, sand, and silt of valleys and floodplains (Qa), and Recent previously disturbed sediments and artificial fill (af) are unlikely to uncover significant fossil vertebrate remains; however, they may shallowly overlie older *in-situ* sedimentary deposits of Miocene- to Pleistocene-age. Therefore, grading and other earthmoving activities may potentially result in significant adverse direct impacts to paleontological resources within the subsurface of the Project area. Spot-checking of excavations are necessary to determine if sensitive sediments occur beneath the surface.

9.0 RESEARCH GOALS

Miocene- to Pleistocene-age deposits in the Project area have the potential to contain scientifically important fossil remains that could be unearthed during construction in areas where native sediments are disturbed. The fossils found in California provide critically important paleoecological and paleoenvironmental data. They provide direct evidence of the composition and phylogenetic diversity of the paleobiota, paleobiologic features of individual taxa, and evolutionary relationships of the fauna and flora through time. In combination, the fossil assemblages at individual localities, together with the sediments in which they are preserved, also provide indirect evidence of the nature of paleoclimates and environments, and importantly, the geographic distributions of different paleoenvironment types such as the fluctuating ocean shorelines, locations of inland lakes and swamps, upland habitats, and lowland habitats such as basin floors. It is important to bear in mind that the type and scope of research that can be accomplished, is entirely dependent upon the types and numbers of fossils that are discovered and their sedimentological context. If no fossils are discovered, then no paleontological research will be possible.

The recovery of fossils from Project excavations as the result of paleontological monitoring, together with the implementation of the additional mitigation measures outlined below, would add to existing paleontological data and help better document the prehistory of southern California. The recovered fossils will provide information that may be useful in more accurately and precisely determining the ages of the sedimentary units in which they were preserved depending upon the biostratigraphic utility of the fossil specimens. Depending upon the types of fossils that are recovered from Project excavations and the quality of their preservation, the existing fossil record of southern California during the Miocene to Pleistocene will be enhanced by the addition of new specimens of known taxa, the discovery of taxa that have not been previously reported from the general area, and possibly the discovery of previously unknown taxa. In combination, the fossil assemblage from the Project site would have the potential to add new paleoecologic and paleoenvironmental information to our existing knowledge of southern California.

10.0 PALEONTOLOGICAL RESOURCES MITIGATION AND FOSSIL RECOVERY PLAN

The mitigation and fossil recovery plan is designed to reduce potential impacts or adverse effects on paleontological resources to below the level of significance pursuant to CEQA and NEPA. The proposed mitigation and fossil recovery plan consists of the following nine components that will be more fully described below:

1) Construction Monitoring
2) Fossil Recovery
3) Screenwashing of Bulk Matrix Sampling
4) Laboratory Preparation, Analysis, and Pre-Curation
5) Reporting
6) Significance Criteria
7) Unanticipated Discoveries
8) Staffing and Schedule
9) Curation

10.1 CONSTRUCTION MONITORING

A Qualified Paleontologist shall be retained to oversee all paleontological mitigation. Prior to the start of construction, the Qualified Paleontologist will ensure that a curation agreement with the appropriate designated repository is obtained. Prior to the start of ground-disturbance, the Qualified Paleontologist or Paleontological Monitor will present a worker environmental awareness training. This can be presented in conjunction with the safety tailboard meeting. The training will include a discussion on mitigation concerns, field procedures for paleontology, and discovery notification protocols. Verification of training will be provided to the District in the form of a signature sheet. The District will, in turn, provide the verification of training to the USACE. A site-specific health and safety plan (HASP) with emergency contact information should also be prepared by the paleontological consultant prior to any ground-disturbance. All monitoring personnel will be required to review the HASP prior to entry to the site and shall have a copy in their vehicle at all times.

Monitoring is recommended during excavations impacting middle Miocene-age Puente Formation, Yorba Member (Tpy), Soquel Member (Tpss), unassigned sandstone (Tps), and unmapped Pleistocene-age older alluvial deposits (Qoa), if encountered in the subsurface. These sensitive geologic units were not observed at the surface during the pedestrian field survey; however, they are likely present at shallow or unknown depth. Therefore, it is recommended that construction excavations, including trenching, grading, cutting, and drilling that is 36-inches in diameter or greater in all areas of the Project be initially spot-checked in order to determine if paleontologically sensitive sediments are being impacted beneath the ground surface. The field observations will be communicated to the Qualified Paleontologist who, in turn, will notify the District. In the event that geologic units with very high (PFYC 5) or moderate (PFYC 3) paleontological potentials are observed, the District will be notified immediately, and updated sediment observations will subsequently be provided on a weekly basis by the Qualified Paleontologist. Based on the sediment types, depths, and distributions observed during spot-checking, the District will determine where monitoring should occur within the Project area. Any modifications to monitoring decisions should be communicated from the District to the USACE. It is recommended that monitoring be implemented in areas where sensitive sediments, including middle Miocene-age Puente Formation, Yorba Member (Tpy), Soquel Member (Tpss), unassigned sandstone (Tps), or unmapped Pleistocene-age older alluvial deposits (Qoa) are impacted at depth. It is recommended that spot-checking efforts be reduced if it is determined that only Recent previously disturbed sediments and artificial fill (Qf) and/or Holocene-age deposits (Qa, Qg) are being impacted, or if sediments are deemed to be non-conducive to fossil preservation.

Spot-checking and/or monitoring are not recommended for pile driving or hydro-excavation regardless of depth or mapped paleontological potential since any recovered fossil resources would likely be heavily damaged due to the excavation methods. Monitoring and spot-checking of drilling that is less than 36 inches in diameter is also not recommended since small augers tend to pulverize the sediments and any fossils contained within, making it unlikely that any scientifically significant fossils will be recovered. Significant fossils are more likely to be recovered from larger diameter augers (greater than 36 inches in diameter), which often bring up large chunks of rock/sediment that can contain intact fossils. Therefore, large diameter drilling will be spot-checked and monitored as described above. Shallow ground disturbance associated with grubbing activities will take place entirely within previously disturbed sediments and artificial fill and are not recommended for spot-checking or monitoring.

Paleontological resource monitoring of construction excavations involves field inspections of cut slopes, trenches, spoils piles, and all graded surfaces in accordance with project safety requirements for occurrences of freshly exposed fossil remains. The primary responsibility of paleontological monitors should always be to adhere to all project safety requirements, and to only inspect and evaluate fossil discoveries when conditions are safe to do so. If a fossil is discovered by a monitor in a construction excavation, the monitor must immediately notify the equipment operator and/or site project manager to stop work within a 25-foot radius of the discovery, and then mark the area surrounding the site with flagging until the discovery can be fully explored and evaluated. The paleontological monitor shall notify the Qualified Paleontologist, who will in turn notify the District. The District will then notify the USACE. If a concentration of fossils is found, the area will be flagged and the site project manager, Qualified Paleontologist, and District will be notified to determine necessary action. The District will notify the USACE in the event of any discoveries. Ground-disturbing construction activities should not resume in the immediate area of the paleontological resources until authorized by the Qualified Paleontologist in consultation with the District. Any actions will be communicated from the District to the USACE.

All paleontological monitors will be trained in commercially reasonable construction site safety protocols by the paleontological consultant prior to entering any construction site. Additional safety training may be provided to paleontological monitors by the contractor and required prior to entry to the Project site. Paleontological monitors should always wear hard hats and safety vests, review and retain a copy of a site-specific health and safety plan, and attend any required safety meetings. Monitors should be equipped with flagging, survey stakes, and tools for fossil exploration and recovery including x-acto knives, awls, brushes, picks, chisels and shovels. Other essential tools for monitors include chemical preservatives such as vinac or butvar, cyanoacrylate glue, specimen containers such as vials and plastic bags, a GPS receiver, a field notebook, data recording forms, a digital camera, and a plaster kit. All paleontological monitors will have sufficient paleontological training and field experience to demonstrate acceptable knowledge of fossil identification, collection methods, paleontological techniques, and stratigraphy.

10.2 FOSSIL RECOVERY

When scientifically significant fossil discoveries are made during monitoring of construction excavations, either by paleontological monitors or construction personnel, they will be quickly and professionally explored and evaluated in order to minimize construction delays. Additional paleontologists should be brought to assist with the recovery as needed. Recoveries may consist of the relatively rapid removal of small isolated fossils from an active cut, to hand-quarrying of larger fossils over several hours, to excavations of large fossils or large numbers of smaller fossils from a bone bed over several days. The duration of each excavation is determined by the size, preservation, and number of fossils at each locality. Depending on the size and fragility of each fossil recovered, chemical adhesives and hardeners/consolidants should be applied to fossils as matrix is removed in the field to prevent further breakage during removal and transport. Larger fossils should be jacketed using burlap and plaster, and jackets should be reinforced with cribbing as deemed necessary by the Qualified Paleontologist. Large fossil excavations are often undertaken in consultation with the construction foreman. Heavy equipment provided by the contractor can be used to assist with removing rock surrounding quarry sites to expedite fossil recovery and can also hoist large jackets onto flat-bed trucks for removal from the Project area and transport to the paleontological laboratory. All excavations must be carried out in consultation with the site project manager and the District. Additionally, the District will consult with the USACE, as needed.

Data recorded at each paleontological collecting locality should include, but not be limited to: field number, date of discovery, date of collection (if applicable), geographic coordinates, elevation, formation, stratigraphic position, lithologic description of sediment in which the specimen(s) was preserved, type(s) of fossils and elements(s), taphonomic and paleoenvironmental interpretations, associations with other fossils, photograph(s), and collectors(s).

10.3 SCREENWASHING OF BULK MATRIX SAMPLES

Scientifically significant fossils of small or even microscopic size consisting of vertebrates, invertebrates, plants, or trace fossils, may be discovered during the monitoring program. At the discretion of the Qualified Paleontologist in consultation with the District, bulk matrix samples should be collected from such localities if it is determined that the fossils could yield scientifically important information. The District will consult with the USACE regarding the collection of samples, as needed. Such samples would be transported to a paleontological laboratory for soaking, re-drying, washing, and picking/sorting in order to fully document the microfaunal and microfloral diversity. SVP (2010) guidelines recommend a minimum sample size of 2,000 pounds. However, in practice, the amount of matrix sampled should depend on the abundance or lack thereof of fossils preserved within the matrix (Murphey et al., 2019), which is typically ascertained by wet-screening of 20-pound test samples in the field. Sampling should be done in such a way as to prevent or minimize interference with construction. For example, construction equipment can often expedite the sampling process by assisting with the removal of matrix from the excavation and establishment of a stockpile in an area removed from construction equipment in order to permit the paleontological monitor to transfer the matrix from the stockpile to buckets and remove them from the site.

10.4 LABORATORY PREPARATION, ANALYSIS, AND PRE-CURATION

All fossils and bulk matrix samples collected at the Project will be removed to a secure paleontological laboratory for preparation to the point of identification and curation. Fossil preparation involves the removal of sedimentary rock matrix or sediment from the fossil remains, treatment with archival chemical stabilizers, gluing and repair of broken fragments using archival adhesives, and construction of a supporting storage cradle as appropriate (mostly for larger specimens). Preparation of small fossils may require the use of a binocular microscope. Fossil-rich concentrate from bulk matrix samples may require heavy liquid separation prior to picking under a microscope.

Following preparation, all fossils should be inventoried as part of the pre-curation process and then identified to taxon and element by a technical specialist, as necessary. Pre-curation involves the assignment of locality numbers and preparation of fossil locality forms, the assignment of unique catalogue numbers to each specimen, the application of specimen numbers to each fossil specimen, entry of specimen data into a computerized database, and the placement of each fossil into archival vials, trays or cradles, depending upon its size. The inventoried collection should be transferred to a paleontological repository along with all associated data. Fossil identification should be to the lowest taxonomic possible level (ideally Family or lower). All fossils should be labeled with their field locality number, which is traceable to the metadata including collector, date of collection, UTM coordinates (NAD83 datum), elevation, lithologic description, taxon, and element description at a minimum. The properly inventoried fossil collection should then be analyzed taxonomically, taphonomically, and/or biostratigraphically. The types of analyses that can be performed will be dependent upon the nature of the fossil collection. All data, including the results of the analysis, should be compiled along with the fossil specimen inventory and detailed paleontological locality forms, maps and photos for inclusion in the paleontological monitoring report. All scientifically significant fossils collected during the monitoring program will be transferred to the SBCM or other accredited public curation facility so they will be available for scientific research, education and display. Upon receipt of the fossil collection, a signed repository receipt form will be issued, and a copy will be appended in the final mitigation report.

10.5 REPORT

A confidential paleontological mitigation report will be prepared and submitted to the District within 30 days of completion of field work. The District will submit the report to USACE. The report shall include dates of field work, results of monitoring, fossil analysis, significance evaluation, conclusions, locality forms, and an itemized list of specimens. Additionally, if construction monitoring results in the discovery and recovery of paleontological resources, a copy of the report will be submitted along with the recovered fossils to the SBCM (or another appropriate fossil repository). The report will meet or exceed all federal and state standards. The report will be provided in electronic (PDF) format. The District and USACE approval of this report will signify the completion of the paleontological mitigation program.

10.6 SIGNIFICANCE CRITERIA

For the purpose of this Project, scientifically significant fossils are generally defined as those that are identifiable to taxon and/or element, and thus are potentially useful for scientific research purposes. However, unidentifiable fossils may also be collected if they are potentially useful to the overall analysis (see Section 3). For example, an unidentifiable bone fragment may be suitable for radiocarbon dating depending upon the preservation state of the bone. Rock or sediment samples may also be collected if they provide information necessary for depositional and paleoenvironmental interpretations.

Paleontological monitors should always use caution when making decisions about significance in the field, and collect fossils if they are unsure of their significance. For example, when monitoring construction sites, it is often difficult to see the full extent of a fossil being recovered because it is collected partially encased in sedimentary matrix and as a result it may not be possible to determine the significance of a fossil specimen until it has been partially prepared. Generally, bone fragments with no articular surfaces that are not associated with other fragments to which they might be re-assembled in the laboratory should not be collected, or should be discarded if they are found to be non-significant once they have been partially prepared in the laboratory.

10.7 UNANTICIPATED DISCOVERIES

Prior to earthmoving activities, the paleontological monitor shall inform construction personnel of the possibility for fossil discoveries, and will instruct personnel to immediately inform their supervisor if any bones or other potential fossils are unearthed at the Project site and a paleontological monitor is not present. In such a case, workers should immediately cease all activity within a 25-foot radius of the discovery site until a paleontological monitor can be mobilized to the Project site to examine and evaluate the find. Work may not resume in the discovery area until it has been authorized by the Qualified Paleontologist, the District, and the USACE. Authorization from the USACE will be communicated through the District in the event of discoveries.

10.8 STAFFING AND SCHEDULING

A construction schedule has not been determined at this time. The construction manager will notify the paleontological consultant at least 24 hours in advance (and up to 48 hours in advance when possible), when a monitor is needed on the construction site. It is not possible to predict the number and type(s) of fossils that may be discovered and recovered during construction.

All paleontological work will be overseen by a Qualified Paleontologist, and construction monitoring will be completed by a qualified paleontological monitor. All monitoring personnel will have a minimum of a Bachelor's degree in geology, paleontology, or related field.

10.9 CURATION

If paleontological resources are recovered during monitoring, SBCM will be given the right of first refusal for any recovered significant or potentially significant fossils. Storage fees will be paid for by the Project owner.

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APPENDIX A: MUSEUM RECORD SEARCH RESULTS

CONFIDENTIAL APPENDIX REMOVED