Appendix C

Sunset Area Plan Storm Drainage Technical Report

SUNSET AREA PLAN
STORM DRAINAGE
TECHNICAL REPORT

September 2017

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I. Introduction

This Sunset Area Storm Drainage Technical Report was prepared by Psomas in support of the Sunset Area Plan. This section summarizes the purpose, background and scope for this Technical Report.

A. Purpose

The purpose of this Storm Drainage Technical Report is to analyze and document the existing conditions hydrologic characteristics within the Sunset Area. Additionally, the report will determine the general plan-level changes associated with the development of the Sunset Area such that receiving waters health and function is maintained as closely as practicable to the existing condition.

B. Background

The Sunset Area is an approximately 8,100 acre area if including the Placer Ranch Specific Plan, approximately 5,900 acres of which comprise the Sunset Area, all located in unincorporated Placer County. The Sunset Area is located north of the Placer Ranch Specific Plan (PRSP), west of State Route (SR) 65 and east of the Amoruso Ranch Specific Plan.

C. Existing Documents

In order to ensure this Technical Report is coordinated with other planning efforts, previous studies were reviewed and utilized in the planning and design of the storm drainage system for the Sunset Area. Each of these studies are listed and described below.

MacKay & Somps, Placer Ranch Specific Plan Storm Drainage Master Plan (2017) -- Placer Ranch is a master-planned community that proposes to develop approximately 2,213 acres consisting of a mix of residential, commercial, recreational amenities, and a university campus. Placer Ranch is located within the unincorporated area of Placer County within the Sunset Industrial Area. The Placer Ranch is east of Industrial Avenue, and is bounded on the north by Sunset Boulevard West and on the west by Amoruso Ranch. The purpose of the Storm Drainage Master Plan was to analyze, identify, and document the Plan Area's existing hydrologic characteristics and determine the required on-site and off-site drainage facilities that are necessary such that the downstream drainage facilities are not impacted by build-out of the project.

The Placer Ranch is within the Pleasant Grove watershed and the Orchard Creek watershed which are both a part of the larger Natomas Cross Canal watershed. The Placer Ranch Specific Plan (PRSP) area is dominated by a gentle grass covered undulating topography that rises from approximately 85-feet in the southwest to 145-feet in the northeast and is bisected diagonally by University Creek, a tributary of Pleasant Grove Creek.

Based on the results of the Storm Drain Master Plan, the PRSP can develop as proposed by constructing storm drainage infrastructure consisting of pipelines, culvert crossings of University Creek and its tributaries, and Low Impact Development features. This infrastructure will function to mitigate the increased storm runoff that will result from the development of the PRSP. The storm runoff impacts on local creeks due to pollutants and hydromodification will be mitigated by proposed Low Impact Development features. Water quality treatment will be constructed for the 85th percentile, 24-hour design event, and hydromodification will be mitigated up to the 2-year, 24-hour design event. Due to potential flooding in the lower portion of Natomas Cross Canal watershed, retention in excess of the existing runoff volume is required for the 100-year, 8-day

event for all upstream development. Retention will occur at an off-site location. The PRSP is in a FEMA unnumbered Zone A area which means that no base flood elevations have been established for the site. The Storm Drain Master Plan will be used as a basis for mapping the limits of inundation within the PRSP.

Kimley-Horn, Amoruso Ranch Specific Plan Area Drainage Master Plan (2016) – The Kimley-Horn report was used by MacKay & Somps in the preparation of the Strom Drain Master Plan, referenced above. Amoruso Ranch is the proposed development adjacent to the PRSP on Placer Ranch's western boundary. The site is entirely within the Pleasant Grove watershed, and is immediately downstream of Placer Ranch. The Amoruso Ranch Specific Plan Area Drainage Master Plan describes and evaluates the drainage system that outfalls to University Creek. The HEC-RAS and HEC-HMS models presented in the Amoruso Ranch study are the basis for the analyses described in the MacKay & Somps report.

II. Land Use Plan Summary

A. Land Use Descriptions

There are ten different land use designations within the Sunset Area boundary as shown in Figure 1. A brief description of each land use designation with types of uses permitted is included below.

General Commercial (GC)

The GC designation provides for retail and service commercial uses along Sunset Boulevard near SR 65. It is intended to provide goods and services to the businesses and the employees working within the Sunset Area as well as travelers using SR 65. Typical uses under the GC designation include retail stores, restaurants, and service commercial uses.

Entertainment Mixed-Use (EMU)

The EMU designation provides for entertainment oriented and visitor-serving uses that would draw customers from beyond South Placer County. It is intended to leverage the excellent transportation access at the future Placer Parkway/Foothills Boulevard interchange, visibility from Placer Parkway and SR 65, and proximity to Thunder Valley Casino. The EMU designation also anticipates the potential need for residential uses to support the workforce employed in the area. Typical uses permitted under the EMU designation include entertainment venues, theme parks, super-regional destination retail, shopping, restaurants, recreational facilities, lodging, healthcare-related services, and residential uses ancillary to or supportive of employment uses.

Business Park (BP)

The BP designation provides for employee-intensive industrial and professional uses, including a campus-like setting. The business Park designation is intended to provide for businesses that involve large numbers of employees and facilities that are attractive and environmentally sensitive. The BP designation is applied to areas with high visibility and good access to major transportation routes. Uses that involve outdoor manufacturing or storage, or that emit any appreciable amount of visible gasses, particulates, steam, heat, odors, vibrations, glare, dust, or excessive noise are discouraged within this designation. Typical uses permitted under the BP designation include professional offices, research and development facilities, light manufacturing and assembly, and retail and service commercial uses necessary to support other allowed uses.

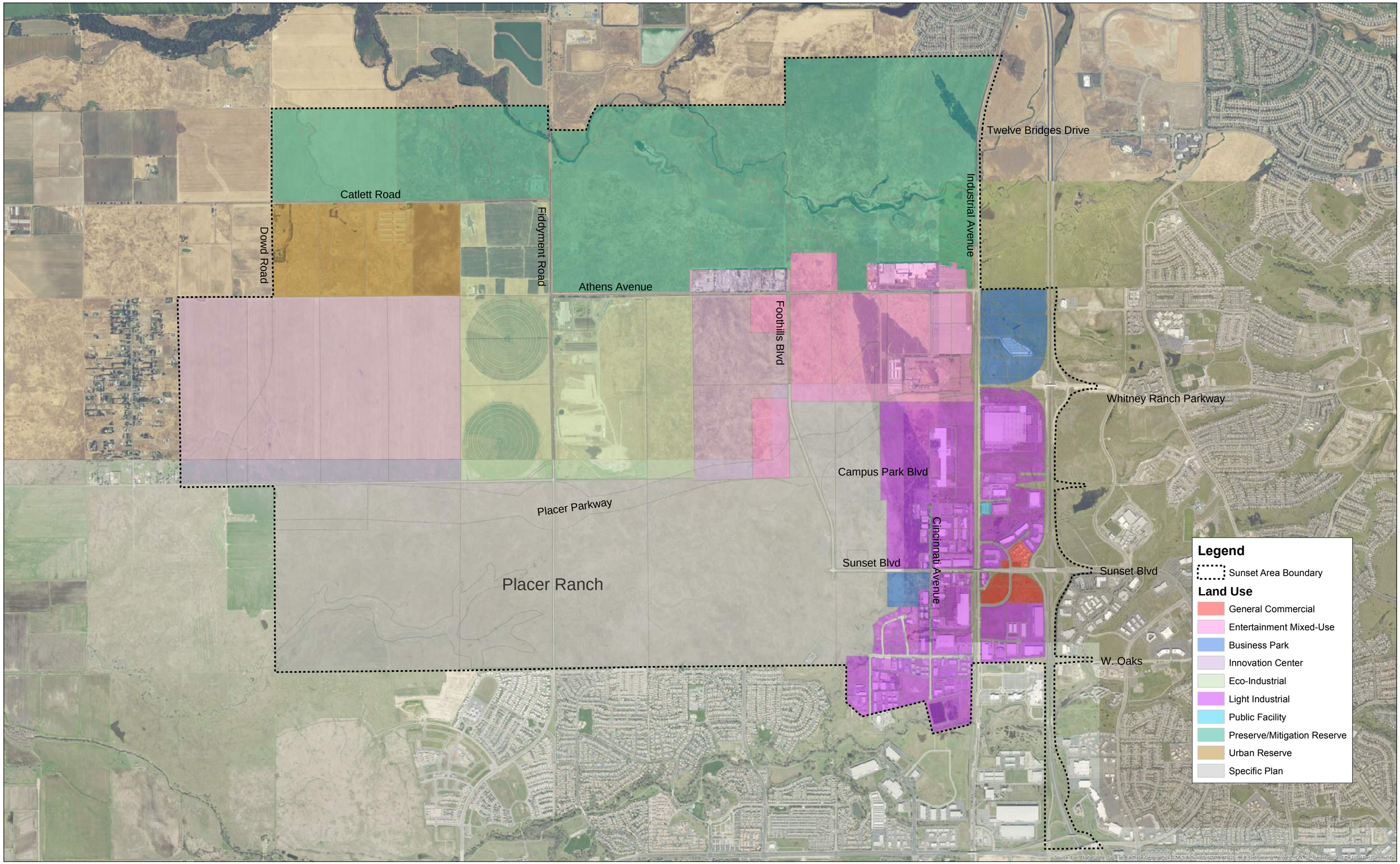

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Figure 1
Sunset Area Land Use Plan

Innovation Center (IC)

The IC designation accommodates a mix of industry clusters (e.g., information technology, life sciences, knowledge-based, creative), with a mix of small and large operations, in an amenity-rich setting with a high level of finish. It also provides the flexibility to integrate innovative residential uses developed in otherwise non-residential projects. The proximity to the CSUS campus in Placer Ranch and Warwick University to the west provides an opportunity to academically-related businesses with the preference for vital and dynamic town center surroundings. Typical uses permitted under the IC designation include light industrial/flex, office, laboratories, research and development, retail and other services catering to other tenants/uses in the area, and residential uses ancillary to or supportive of employment uses.

Eco-Industrial (EI)

The EI designation provides for ongoing operation of the landfill, as well as for industrial and manufacturing uses focused on alternative waste-to-energy technologies, recovery and reuse of materials, solid waste-related research and development, and related advanced manufacturing, perhaps in conjunction with nearby universities. The viability of these uses would be enhanced by reorientation of the West Placer Waste Management Authority (WPWMA) operations within its property to minimize nuisances. Typical uses permitted under the EI designation include manufacturing and remanufacturing including advanced materials, construction and demolition debris recycling, plastics processing (grinding, washing pelletizing, molding), paper conversion, wood salvage and re-milling, glass processing/manufacturing, scrap tire recycling/bailing, electronics repair/de-manufacturing/recycling, non-profit/small industry incubator, and landfill operations.

Light Industrial (LI)

The LI designation provides for a wide variety of uses including office/flex, research and development, light manufacturing, assembly, and distribution activities. This designation is applied to areas with good access to major truck transportation routes and rail lines, located near concentrated residential areas so that employee commute times and distances are minimized. The range of uses within this designation may call for the identification of sub-districts to minimize car/truck conflicts. Typical uses permitted under the LI designation include light manufacturing and assembly, storage and distribution, research and development activities, business support service, retail and service commercial uses necessary to support other allowed uses, and necessary public utility and safety facilities. Much of this area is developed with existing uses. It is assumed that many of the existing uses are considered to be underutilized and will be redeveloped as the area develops.

Public Facility (PF)

The PF designation is applied to government-owned faculties and quasi-public facilities in a variety of rural and urban settings. In the Sunset Area, this designation is applied to areas with existing public or quasi-public facilities and land uses, or to publicly-owned lands intended for development with public facilities. Typical uses permitted under the PF designation include government offices and service centers and other institutional facilities.

Preserve/Mitigation Reserve (P/MR)

The P/MR designation is applied to lands specifically reserved or proposed for watershed preservation, passive outdoor recreation, wilderness or wildlife/environmental preserves; sites or portions of sites with natural features such as unique topography, vegetation, habitat, or stream courses; areas providing buffers between different, potentially incompatible types of land use

such as intensive agricultural operations and residential uses, hazardous areas and/or land uses and areas with concentrations of population, and residential areas and important community facilities that may be viewed as nuisances, such as the Western Regional Sanitary Landfill; and areas intended to preserve community identity by providing separation between communities. Structural development is restricted to accessory structures necessary to support the primary allowed uses. This designation includes three existing reserves—Orchard Creek Conservation Bank, Warm Springs Mitigation Bank, and Moore Ranch Conservancy. Typical uses permitted under the P/MR designation include mitigation banks, natural resurface conservation areas, and necessary public utility and safety facilities.

Urban Reserve (UR)

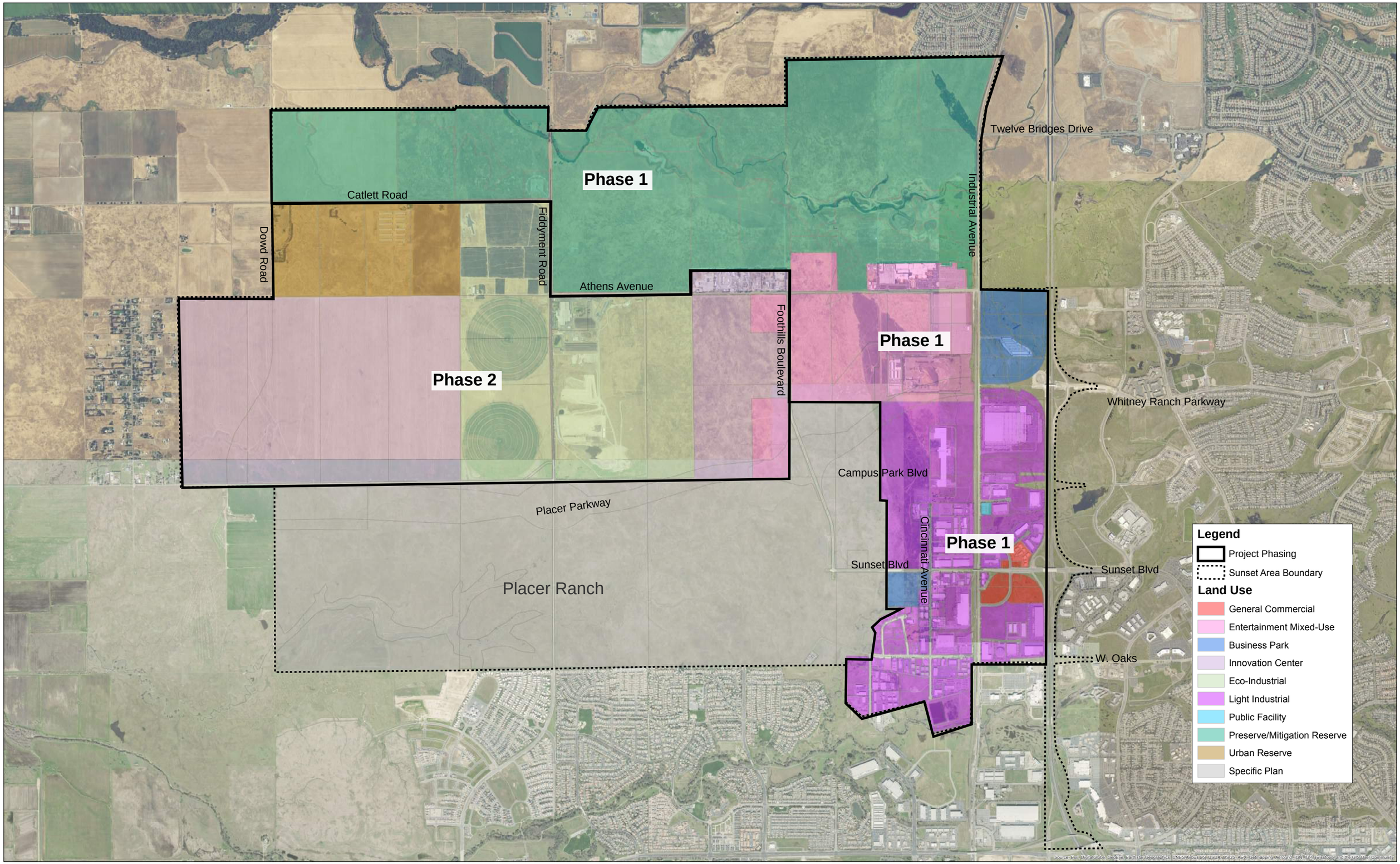
The UR designation is applied to land to be developed beyond the timeframe of the Plan. In the short- and mid-term, these areas will remain in a reserve designation that allows interim agricultural uses. In advance of these areas being planned and developed for urban uses, typical uses permitted in the UR designation include crop production, orchard and vineyards, grazing, pasture and rangeland, necessary public utility and safety facilities, allowable residential development in areas used for agriculture includes one principal dwelling and one secondary dwelling per lot.

Placer Ranch Specific Plan (PRSP)

The PRSP designation applies to Placer Ranch, which covers approximately 2,200 acres in the southern part of the Sunset Area, mostly south of Placer Parkway. Placer Ranch is envisioned to develop with a mixture of residential, commercial, employment, educations, and public uses, with a new CSU Sacramento satellite campus as the centerpiece. At buildout, the area is expected to accommodate approximately 6,000 dwelling units and 14,000 residents. In addition, it has capacity to accommodate over nine million square feet of commercial, employment, and university-related non-residential uses. Development within Placer Ranch will be guided by the Placer Ranch Specific Plan.

B. Phasing

The Sunset Area will likely build out in two major phases, as shown on Figure 2. Phase 1 will include everything east of Foothills Boulevard North plus the entire Preserve/Mitigation Reserve land use designation. This includes the Light Industrial, General Commercial, Business Park, Public Facility, part of the Entertainment Mixed-Use (east of Foothills Boulevard North), and the previously mentioned Preserve/Mitigation Reserve land use designations. Phase 2 will include everything west of Foothills Boulevard North, except for the Preserve/Mitigation Reserve land use designation, which is in Phase 1. This includes the Entertainment Mixed-Use (west of Foothills Boulevard North), Eco-Industrial, Innovation Center, and Urban Reserve land use designations.



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2,300 1,150 0 2,300 Feet

Figure 2
Sunset Area Project Phasing

C. Land Use Statistics

The land use statistics for the Sunset Area are detailed below in Table 1. These statistics include acreage, dwelling units, and building square footage for each land use designation. Placer Parkway acreage has been listed separately from the total Business Park, Entertainment Mixed-Use, Innovation Center, and Light industrial land use designations. Also, there are residential areas within both the Entertainment Mixed-Use and Innovation Center land uses, as shown in Table 1.

Table 1
Sunset Area Land Use Plan Statistics

Land Use Designation	Land Use Area (ac)	Dwelling Units	Building Square Footage
Business Park	131		929,600
Placer Parkway	11		
Eco-Industrial	927		7,916,600
Entertainment Mixed-Use	427		3,061,600
Residential	52	375	
Placer Parkway	38		
General Commercial	34		218,900
Innovation Center	1,042		11,998,500
Residential	187	2,083	
Placer Parkway	17		
Light Industrial	727		3,525,300
Placer Parkway	18		
Public Facility	2		
Preserve/Mitigation Reserve	1,955		
Urban Reserve	320		
Placer Ranch Specific Plan[1]	2,213		
Total	**8,101**	**2,458**	**27,650,500**

1) See Placer Ranch Specific Plan for detailed land use breakdown

III. Existing Conditions

A. Existing Conditions

The Sunset Area spans across three watersheds within the larger Natomas Cross Canal Watershed. The southern portion of the Sunset Area is within the Pleasant Grove watershed. Flows from the southern portion of the Sunset Area flow into University Creek, which is a tributary to Pleasant Grove Creek. The northern portion of the Sunset Area is located within the Orchard Creek and Auburn Ravine Watersheds. A majority of the northern Sunset Area drains to Orchard Creek, which ultimately outlets to the Auburn Ravine Watershed (Figure 3 Watershed Map). The region is dominated by a grassy rolling hills that were previously used for agriculture. The site is dominated by non-native grasses. Elevations within the Sunset Area range in elevation from approximately 83 to 152 feet above mean sea level.

The majority of the Sunset Area is currently undeveloped (Figure 4 Aerial Photography). Existing on-site land use is dominated by open space.

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2,500 1,250 0 2,500 Feet

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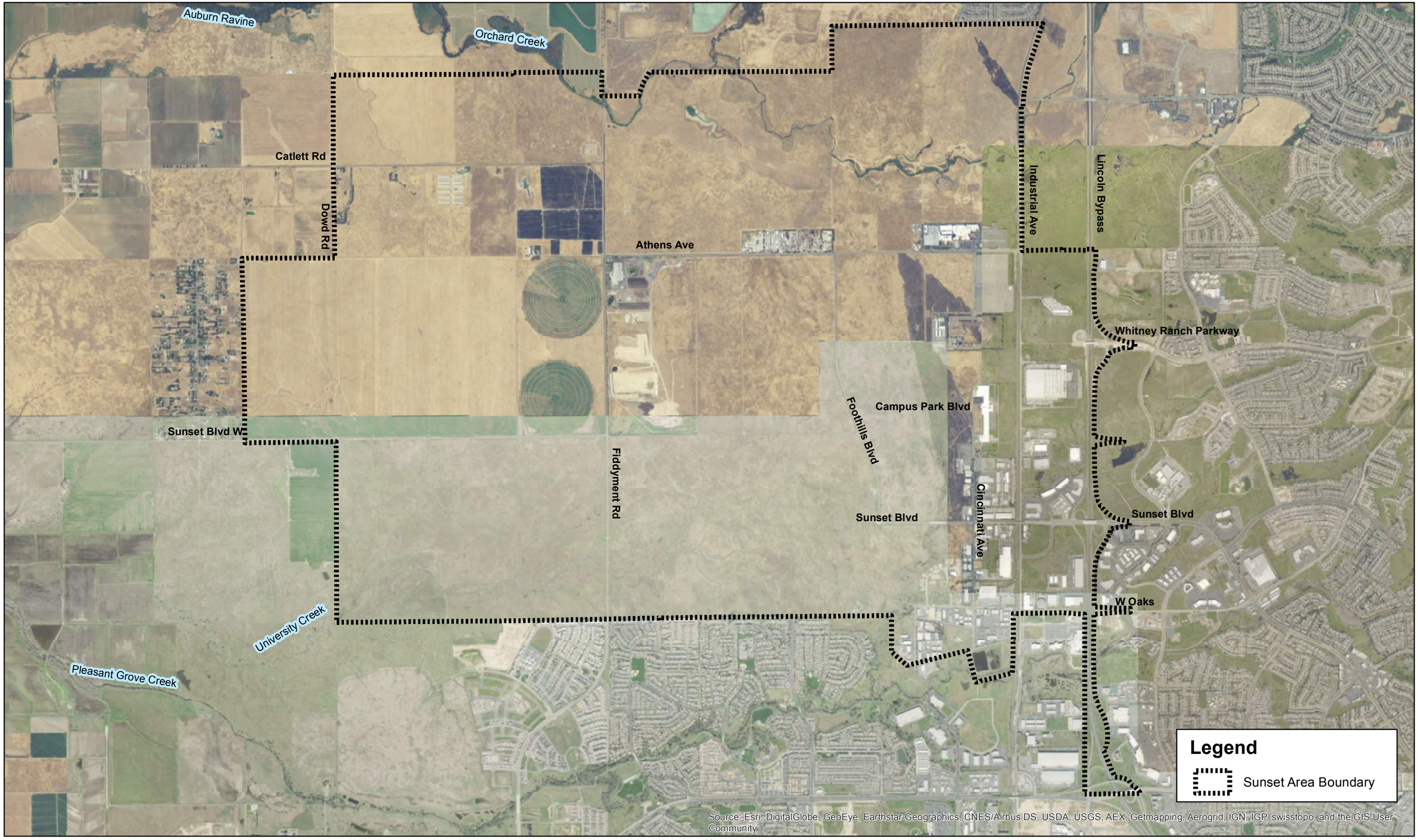
FIGURE 3
SUNSET AREA WATERSHED MAP



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2,500 1,250 0 2,500 Feet

FIGURE 4
SUNSET AREA AERIAL PHOTOGRAPHY

B. FEMA Information/Floodplain Impacts

The Federal Emergency Management Agency's (FEMA) Flood Insurance Study (FIS) Flood Insurance Rate Map (FIRM) encompassing the project area is FIRM 06061C0400F, effective June 8, 1998. The FIRM can be found in the Appendix. No portions of either FIRM identify a mapped floodplain within the Sunset Area project site and no base flood elevations have been determined. The analysis performed herein can be used as the basis for mapping any existing floodplain within the project site. A Letter of Map Revision (LOMR) for the existing conditions floodplain is not required at this time, however, it may be required in the future.

C. Soils Information

The soil type classification for each drainage area was taken from the soil survey of Placer County. The soils classification is identified as either hydrologic Type A, B/D, B, C, or D. These classifications are used in the HEC-HMS model for calculating the hydrology. The tributary watersheds are predominately Type D. The soil distribution for both the tributary watershed and the project site area shown in Table 2. The soils map is shown in Figure 5, Sunset Area Hydrologic Soils Map.

Table 2
Tributary Watershed and Project Site Soils, by Percent

Watershed ID	Area	Length	Δ H	Slope	Soils Data (%)						Impervious
	(sq mi)	(ft)	(ft)	(ft/ft)	Type A	Type B/D	Type B	Type C	Type D	Water	(%)
Pleasant Creek Watershed											
1	0.0784	1691	22	0.0130	0%	0%	0%	59%	41%	0%	50%
2	0.1019	2626	39	0.0149	8%	0%	0%	16%	76%	0%	60%
3	0.0708	2960	25	0.0084	23%	0%	0%	0%	77%	0%	50%
4	0.1547	1946	24	0.0123	6%	0%	0%	89%	0%	5%	80%
5	0.2770	4042	14	0.0035	0%	0%	0%	84%	16%	0%	50%
6	0.2599	5359	14	0.0046	0%	0%	0%	0%	0%	0%	70%
7	0.3557	5707	40	0.0075	0%	0%	0%	79%	21%	0%	20%
8	0.1555	3050	5	0.0055	0%	0%	0%	0%	0%	0%	8%
9	0.1984	5077	39	0.0068	0%	0%	0%	65%	35%	0%	70%
10	0.2511	5124	33	0.0108	0%	0%	0%	25%	75%	0%	10%
11	0.2233	3166	7	0.0016	0%	0%	0%	0%	0%	0%	5%
12a	0.2625	3550	40	0.0079	0%	0%	0%	92%	8%	0%	5%
12b	0.2625	3550	3	0.0025	0%	0%	0%	0%	0%	0%	5%
13	0.3762	6585	41	0.0080	0%	0%	0%	61%	39%	0%	5%
14a	0.2625	3550	28	0.0088	0%	0%	0%	18%	82%	0%	5%
14b	0.2625	3550	25	0.0070	0%	0%	0%	52%	48%	0%	5%
15a	0.2445	4725	9	0.0026	0%	0%	0%	0%	0%	0%	5%
15b	0.2484	4477	34	0.0076	0%	0%	0%	13%	87%	0%	5%
15c	0.2232	4497	32	0.0049	0%	0%	0%	41%	59%	0%	5%
15d	0.2232	4497	14	0.0017	0%	0%	0%	0%	0%	0%	5%
15e	0.3218	5807	36	0.0073	0%	0%	0%	0%	100%	0%	5%
16a	0.2917	5319	7	0.0013	0%	0%	0%	0%	0%	0%	5%

Table 2 (Continued)

Tributary Watershed and project Site Soils, by Percent

Watershed ID	Area	Length	Δ H	Slope	Soils Data (%)						Impervious
	(sq mi)	(ft)	(ft)	(ft/ft)	Type A	Type B/D	Type B	Type C	Type D	Water	(%)
16b	0.2985	5129	23	0.0037	0%	13%	0%	0%	87%	0%	5%
16c	0.2451	3945	17	0.0036	0%	0%	0%	25%	75%	0%	5%
17a	0.2974	3594	27	0.0062	0%	0%	0%	5%	95%	0%	5%
17b	0.2974	3594	25	0.0056	0%	0%	0%	17%	83%	0%	5%
17c	0.3350	4787	10	0.0029	0%	0%	0%	0%	0%	0%	5%
17d	0.2985	5129	30	0.0056	0%	0%	0%	22%	78%	0%	5%
17e	0.2785	3975	5	0.0021	0%	0%	0%	0%	0%	0%	5%
18	0.1863	3495	30	0.0052	0%	2%	0%	25%	73%	0%	5%
Orchard Creek Watershed											
19	0.1367	3814	23	0.0046	0%	0%	0%	21%	79%	0%	10%
20a	0.2985	5129	28	0.0055	0%	18%	0%	4%	78%	0%	15%
20b	0.2889	5776	2	0.0011	0%	0%	0%	0%	0%	0%	60%
21	0.3234	3927	21	0.0053	0%	13%	0%	4%	82%	0%	15%
22	0.2710	5713	28	0.0078	0%	0%	0%	77%	23%	0%	5%
23a	0.2328	4730	7	0.0027	0%	0%	0%	0%	0%	0%	40%
23b	0.3350	4787	25	0.0068	0%	4%	0%	34%	62%	0%	5%
24a	0.3721	5687	26	0.0054	0%	6%	0%	46%	48%	0%	5%
24b	0.2328	4730	4	0.0021	0%	0%	0%	0%	0%	0%	5%
24c	0.3198	5272	24	0.0045	0%	9%	0%	58%	33%	0%	5%
25a	0.2328	4730	5	0.0019	0%	0%	0%	0%	0%	0%	30%
25b	0.2247	4939	20	0.0050	0%	10%	0%	70%	20%	0%	15%
25c	0.2507	5261	24	0.0069	0%	0%	0%	35%	65%	0%	20%
26	0.1632	4425	32	0.0084	0%	0%	0%	39%	61%	0%	8%
27a	0.2507	5261	22	0.0047	0%	0%	0%	81%	19%	0%	5%
27b	0.2940	7449	3	0.0018	0%	0%	0%	0%	0%	0%	5%
28a	0.2889	5776	25	0.0043	0%	0%	0%	87%	13%	0%	35%
28b	0.2803	4971	6	0.0016	0%	0%	0%	0%	0%	0%	8%
28c	0.1472	2460	31	0.0079	0%	0%	25%	19%	56%	0%	5%
Auburn Ravine											
29	0.2348	6144	2	0.0016	0%	0%	0%	0%	0%	0%	5%
30a	0.2247	4939	26	0.0057	0%	0%	0%	100%	0%	0%	5%
30b	0.3091	5263	30	0.0053	0%	0%	0%	98%	2%	0%	5%
30c	0.1472	2460	8	0.0012	0%	0%	0%	0%	0%	0%	5%

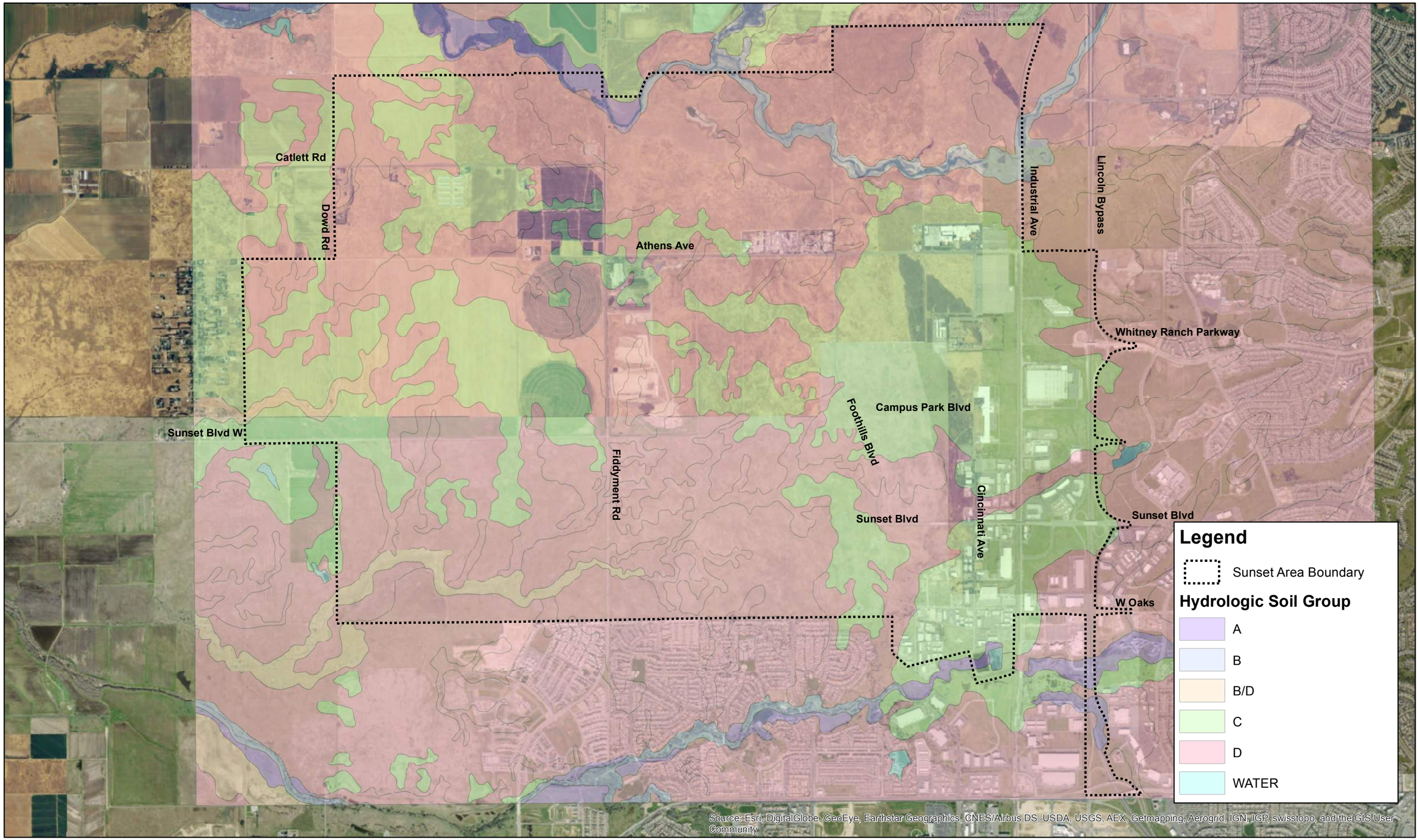

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FIGURE 5
SUNSET AREA HYDROLOGIC SOILS MAP

D. Stormwater Quality

Land development of an area has the potential to increase the volume, velocity, peak discharge, and duration of stormwater runoff compared to the pre-development condition. The California State Water Board developed the Small Municipal Separate Storm Sewer Systems (MS4) Order No. 20130001-DWQ, effective July 1, 2013, to regulate stormwater runoff. Under MS4 a project site is considered a Regulated Project when creating and/or replacing 5,000 square feet or more of impervious surface. Pursuant to the Order, Regulated Projects shall implement Low Impact Development (LID) measures, and hydromodification management is required of Regulated Projects that create and/or replace 1 acre or more of impervious surface. To execute the Order, Placer County developed the West Placer Stormwater Quality Design Manual (WPSWQDM).

The Sunset Area development, a Regulated Project under the order, proposes to implement Stormwater Quality measures outlined in the WPSWQDM. These measures will mitigate to the 85th percentile 24-hour event as required by the Order and defined in the WPSWQDM. Hydromodification management will be mitigated to the 2-year 24-hour peak flow rate. The present General Plan level study does not include sufficient detail, including grading, to analyze proposed conditions Stormwater Quality measures, and these measures will be analyzed and detailed during the Specific Plan level analysis.

IV. Hydrologic Modeling

A. Existing Conditions Model

A HEC-HMS hydraulic model was developed to calculate the existing conditions hydrology of the Sunset Area. The existing conditions analysis is used to establish a baseline from which to determine hydrologic impacts resulting from development of the Sunset Area. Existing conditions are defined by the current land uses within the Sunset Area. Soil type information and impervious coverage for the existing conditions within the project were developed. Subarea data was assembled to create an existing conditions HEC-HMS model and resultant existing conditions hydrology was determined.

Off-site values developed for existing conditions analysis were also used in the proposed conditions model. Off-site upstream drainage areas are assumed to maintain their level of discharge onto the project area at current levels. If these off-site lands develop in the future, the proposed conditions runoff from off-site areas will need to be mitigated such that the resultant runoff onto the Sunset Area does not exceed existing rates.

No storm centering is utilized in modeling the Sunset Area for the 100-year 24-hour and the 200-year 24-hour events since the area is under the 5-square miles as shown in Table 5-1 in the Placer County Flood Control and Water Conservation District Stormwater Management Manual (PCFCWCDSMM).

B. Existing Conditions Peak Flow Rates

Peak flow rates were calculated using the HEC-HMS model and the results at the Confluence Points are shown in Table 3 for the 2-Year, 24-Hour, 10-Year, 24-Hour, 100-Year, 24-Hour, and 200-Year, 24-Hour events. All model input and output HEC-HMS model files are presented in the Appendix.

Table 3
Peak Existing Conditions HEC-HMS Flow Rates by Rainfall Event and Location

2-YR 24-HR Storm			
Confluence Point	HEC-HMS Hydrologic Element	Exst Q (cfs)	Exst Volume (ac/ft)
1	JCT 1	28.4	4.7
2	JCT 2-3	130.1	46.7
3	JCT 4	62.2	13.1
4	JCT 10	210.6	73.4
5	JCT 11	57.4	5.4
6	JCT 16c	140	79.1
7	JCT 17e	131.4	31.9
8	JCT 18	42.1	4.5
9	JCT 27b	161.2	94.9
10	JCT 28c	108.1	27
11	JCT 30c	91.5	24.8

10-YR 24-HR Storm			
Confluence Point	HEC-HMS Hydrologic Element	Exst Q (cfs)	Exst Volume (ac/ft)
1	JCT 1	57.4	8.4
2	JCT 2-3	314.9	98.3
3	JCT 4	116.5	21.3
4	JCT 10	462.7	139.4
5	JCT 11	131.2	14
6	JCT 16c	452.1	213.8
7	JCT 17e	384.7	82.9
8	JCT 18	99.2	11.7
9	JCT 27b	431.4	231.1
10	JCT 28c	251.5	58.9
11	JCT 30c	269.7	64.5

100-YR 24-HR Storm			
Confluence Point	HEC-HMS Hydrologic Element	Exst Q (cfs)	Exst Volume (ac/ft)
1	JCT 1	95.2	13.4
2	JCT 2-3	547.7	174.1
3	JCT 4	191.4	31.5
4	JCT 10	776.9	231.5
5	JCT 11	218.8	27.2
6	JCT 16c	884.2	422.6
7	JCT 17e	682.5	162.6
8	JCT 18	165.3	22.7
9	JCT 27b	830.5	437.5
10	JCT 28c	429.1	106.1
11	JCT 30c	486.6	126.4

200-YR 24-HR Storm			
Confluence Point	HEC-HMS Hydrologic Element	Exst Q (cfs)	Exst Volume (ac/ft)
1	JCT 1	106.1	14.8
2	JCT 2-3	622.1	196.3
3	JCT 4	212.9	34.3
4	JCT 10	876.8	258.3
5	JCT 11	243.6	31.2
6	JCT 16c	1041	488
7	JCT 17e	777	186.3
8	JCT 18	184.1	26
9	JCT 27b	954.5	502.8
10	JCT 28c	485	120
11	JCT 30c	552.9	144.8

C. Proposed Conditions Model

The proposed conditions model is based on the developed Sunset Area. The proposed conditions model updated the existing conditions model with proposed improvements in land use. Impervious percent for the proposed conditions subareas within the project were updated based on proposed land use shown on Table 4. One model was created for this effort that represents the 'unmitigated' proposed conditions scenario which does not include LID features. As noted above, the present General Plan level study does not include sufficient detail, including grading, to analyze proposed conditions mitigation measures, and these measures will be analyzed and detailed in the future during Specific Plan-level or development mapping-level analysis. All model input and output HEC-HMS model files are presented in the Appendix.

Table 4
Proposed Conditions Impervious Percentage

Watershed ID	EI @ 80% Impv	EMU @ 80% Imp	IC @ 65% Imp	P/MR @ 5% Imp	PRSP @ 50% Imp	UR @ 65% Imp	LI @ 80% Imp	BP @ 80% Imp	GC @ 80% Imp	PF @ 50% Imp	PKWY @ 90% Imp	Developed Conditions %Imperv.
	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(%)
Pleasant Creek Watershed												
1	0%	0%	0%	0%	0%	0%	17%	0%	13%	0%	70%	86.97%
2	0%	0%	0%	0%	0%	0%	55%	0%	0%	0%	45%	84.50%
3	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	90.00%
4	0%	0%	0%	0%	0%	0%	91%	0%	0%	0%	9%	80.88%
5	0%	0%	0%	0%	0%	0%	67%	0%	5%	1%	27%	82.32%
6	0%	0%	0%	0%	0%	0%	73%	3%	5%	0%	19%	81.94%
7	0%	0%	32%	1%	0%	0%	59%	3%	0%	0%	6%	75.18%
8	0%	0%	39%	10%	7%	15%	0%	0%	16%	0%	13%	63.45%
9	0%	0%	0%	1%	0%	0%	75%	0%	11%	0%	13%	80.37%
10	0%	0%	6%	13%	24%	9%	32%	7%	0%	0%	9%	61.20%
11	0%	0%	0%	11%	71%	9%	0%	0%	0%	1%	8%	49.39%
12a	0%	18%	43%	3%	0%	0%	0%	5%	3%	0%	29%	74.29%
12b	0%	0%	13%	4%	0%	0%	0%	12%	18%	43%	10%	63.45%
13	34%	6%	43%	3%	0%	0%	0%	0%	0%	4%	10%	71.06%
14a	0%	0%	3%	3%	20%	4%	0%	0%	0%	63%	7%	52.88%
14b	0%	0%	1%	20%	44%	0%	0%	0%	0%	26%	9%	44.75%
15a	97%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%	80.27%
15b	99%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	80.14%
15c	85%	0%	5%	0%	0%	0%	0%	0%	0%	0%	10%	80.31%
15d	16%	0%	41%	10%	0%	0%	0%	0%	7%	7%	20%	66.12%
15e	8%	0%	12%	32%	18%	5%	0%	0%	6%	6%	12%	47.22%
16a	0%	0%	5%	19%	53%	0%	0%	0%	0%	6%	18%	49.32%
16b	0%	0%	0%	25%	65%	0%	0%	0%	0%	4%	6%	41.20%
16c	0%	0%	0%	15%	81%	0%	0%	0%	0%	0%	3%	44.54%
17a	25%	0%	75%	0%	0%	0%	0%	0%	0%	0%	0%	68.79%
17b	0%	0%	93%	1%	0%	0%	0%	0%	0%	0%	6%	66.07%
17c	0%	0%	99%	0%	0%	1%	0%	0%	0%	0%	0%	65.00%
17d	0%	0%	94%	1%	1%	0%	0%	0%	0%	0%	5%	65.73%
17e	0%	0%	80%	0%	9%	5%	0%	0%	0%	0%	7%	65.37%
18	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	65.00%
Orchard Creek Watershed												
19	0%	0%	0%	0%	0%	0%	0%	73%	0%	0%	27%	82.69%
20a	0%	4%	0%	0%	0%	0%	31%	31%	0%	0%	35%	83.49%
20b	0%	16%	0%	60%	0%	0%	16%	0%	0%	0%	8%	35.42%
21	0%	5%	0%	92%	0%	0%	0%	0%	0%	0%	3%	11.44%

Table 4 (Continued)

Proposed Conditions Impervious Percentage

Watershed ID	EI @ 80% Impv	EMU @ 80% Imp	IC @ 65% Imp	P/MR @ 5% Imp	PRSP @ 50% Imp	UR @ 65% Imp	LI @ 80% Imp	BP @ 80% Imp	GC @ 80% Imp	PF @ 50% Imp	PKWY @ 90% Imp	Developed Conditions %Imperv.
	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(% of WS)	(%)
22	0%	0%	0%	99%	0%	0%	0%	0%	0%	0%	1%	5.72%
23a	0%	83%	0%	11%	0%	0%	3%	0%	0%	0%	3%	72.31%
23b	0%	67%	0%	2%	23%	0%	7%	0%	0%	0%	1%	71.45%
24a	0%	10%	0%	90%	0%	0%	0%	0%	0%	0%	0%	12.60%
24b	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	5.00%
24c	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	5.00%
25a	0%	45%	22%	26%	0%	0%	0%	0%	0%	0%	7%	57.78%
25b	0%	12%	83%	1%	0%	0%	0%	0%	0%	0%	3%	66.62%
25c	49%	0%	33%	17%	0%	0%	0%	0%	0%	0%	2%	62.82%
26	37%	0%	0%	59%	0%	0%	0%	0%	0%	0%	4%	36.14%
27a	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	5.00%
27b	0%	0%	0%	99%	0%	0%	0%	0%	0%	0%	1%	6.05%
28a	69%	0%	0%	26%	0%	0%	0%	0%	0%	0%	5%	61.00%
28b	37%	0%	0%	58%	0%	0%	0%	0%	0%	0%	5%	37.32%
28c	0%	0%	0%	97%	0%	3%	0%	0%	0%	0%	1%	7.04%
Auburn Ravine												
29	0%	0%	0%	31%	0%	67%	0%	0%	0%	0%	2%	47.02%
30a	36%	0%	32%	0%	0%	32%	0%	0%	0%	0%	0%	70.40%
30b	0%	0%	0%	16%	0%	80%	0%	0%	0%	0%	4%	56.62%
30c	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	5.00%

D. Unmitigated Proposed Conditions Peak Flow Rates

The proposed conditions unmitigated peak discharges for the 100-year, 24-hour event are summarized in Table 5. Table 5 indicates that most confluence points will experience at least a moderate increase in peak flow rates compared to existing conditions without mitigation.

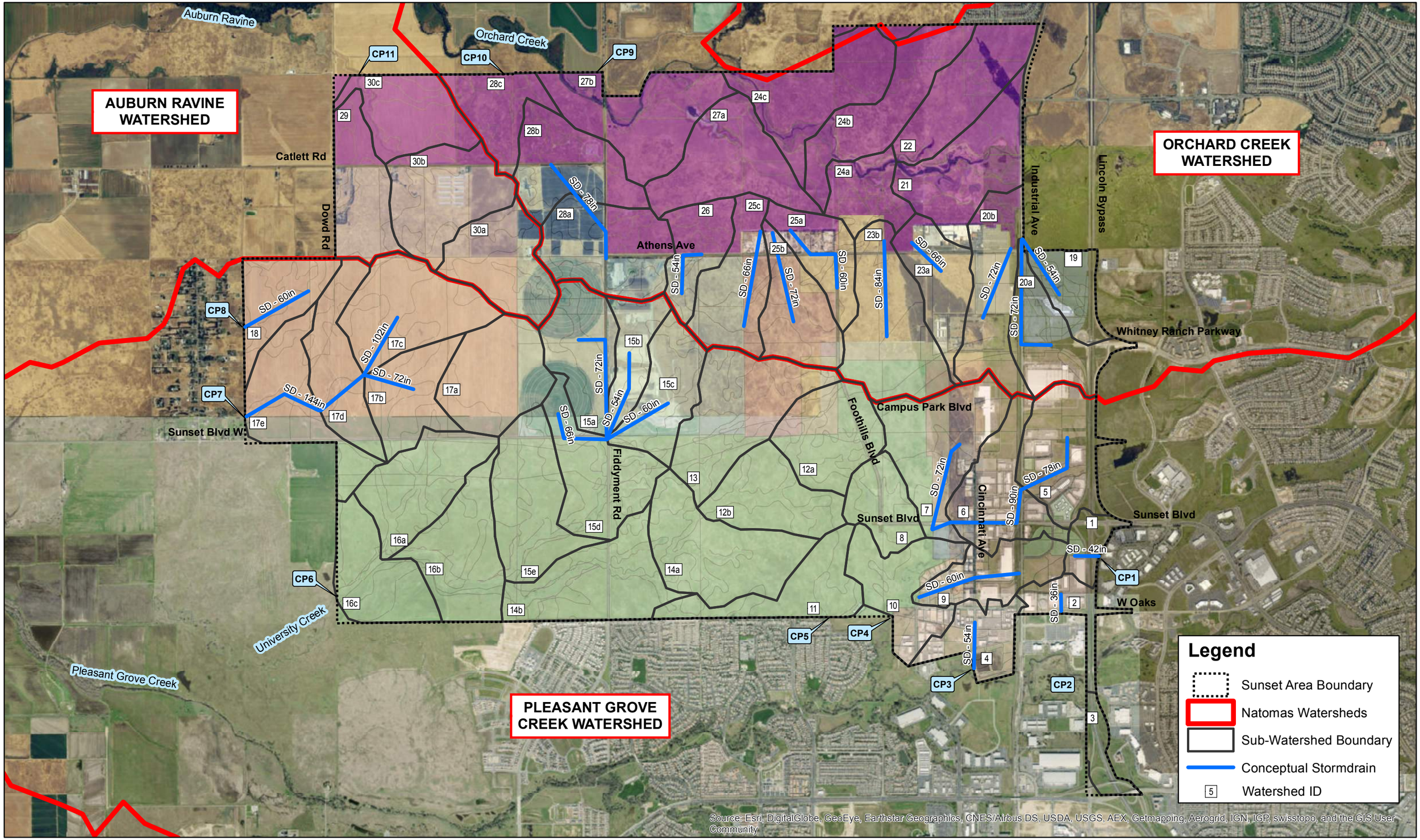
Table 5
Existing and Proposed Conditions Attenuated Peak Discharges

100-YR 24-HR Storm					
Confluence Point	Hydrologic Element	Exst Q	Exst Volume	Pro Q	Pro Volume
		(cfs)	(ac/ft)	(cfs)	(ac/ft)
1	JCT 1	95.2	13.4	95.3	13.1
2	JCT 2-3	547.7	174.1	600	263.9
3	JCT 4	191.4	31.5	191.3	30.7
4	JCT 10	776.9	231.5	817.3	298.6
5	JCT 11	218.8	27.2	226.1	41.7
6	JCT 16c	884.2	422.6	1102.7	676.4
7	JCT 17e	682.5	162.6	730.9	239.9
8	JCT 18	165.3	22.7	170	31.3
9	JCT 27b	830.5	437.5	1061.1	685.1
10	JCT 28c	429.1	106.1	452.6	145.8
11	JCT 30c	486.6	126.4	523.4	187.5

As noted elsewhere, the present General Plan-level study does not include sufficient detail, including grading, to analyze proposed conditions mitigation measures and mitigated peak flow rates, and these measures and rates will be analyzed and detailed in the future during Specific Plan-level or development mapping-level analysis.

V. Stormwater Infrastructure

The conceptual stormwater infrastructure trunk lines for the Sunset Area was developed based on hydrology developed in proposed conditions HEC-HMS analysis, as described above. The analysis was performed using FlowMaster, which is a calculator for the design and analysis of a wide range of hydraulic elements, including pipes. For the purposes of the present analysis the Manning's value was assumed to be n=0.015 as per Placer County Flood Control and Water Conservation District Stormwater Management Manual, the discharge was taken from the HEC-HMS modeling, and the pipe slope was set at the average of existing grade for the drainage area. Interior pipe diameter is assigned sufficient to convey the 100-year, 24-hour discharge, or the next largest common RCP pipe schedule. Backwater from receiving water is not considered in the present analysis and no freeboard criteria is considered since proposed grading from which to develop top-of-grate or top-of-cover elevations is not available. The Conceptual Storm Drain Infrastructure at buildout is depicted on Figure 6. FlowMaster results for pipeline sizing are shown in Table 6 and the model files can be found in the Appendix.



PSOMAS

N

2,400 1,200 0 2,400 Feet

FIGURE 6
SUNSET AREA CONCEPTUAL STORMDRAIN MAP

Table 6
Conceptual Stormdrain Sizing Parameters

Watershed	Length	Slope	Q100	Contributing Watersheds	Combined Flow in SD	Proposed Stormdrain Size
	(ft)	(ft/ft)	(cfs)			(in)
1	700	0.0186	93.40		93.40	42
2	479	0.0417	107.20		107.20	36
4	1340	0.0134	189.60		189.60	54
5	2364	0.0030	228.60		228.60	78
6	3454	0.0046	206.70	5	435.30	90
7	2637	0.0064	284.00		284.00	72
9	3010	0.0073	153.10		153.10	60
15a	3673	0.0027	187.20		187.20	72
15b	2644	0.0057	109.40		109.40	54
15c	2067	0.0073	181.60		181.60	60
15d	1970	0.0096	225.00		225.00	66
17b	1470	0.0034	182.30	17a	464.90	72
17c	1827	0.0049	270.50		270.50	102
17d	1531	0.0026	173.60	17a-c	909.00	132
17e	2395	0.0025	236.50	17a-d	1145.50	144
18	2109	0.0081	165.50		165.50	60
19	1924	0.0052	119.10		119.10	54
20a	3906	0.0038	183.40		183.40	72
20b	2157	0.0046	212.60		212.60	72
23a	1183	0.0042	161.70		161.70	66
23b	2770	0.0032	292.60		292.60	84
25a	2611	0.0042	135.60		135.60	60
25b	2651	0.0030	164.90		164.90	72
25c	2972	0.0050	185.60		185.60	66
26	1652	0.0061	124.80		124.80	54
28a	3289	0.0052	299.00		299.00	78

As noted elsewhere, the present general plan-level study does not include sufficient detail, including grading, to analyze a more comprehensive proposed conditions storm sewer layout.

VI. Retention Volume

As noted above, the Sunset Area drains to the Auburn Ravine/Orchard Creek and the Pleasant Grove Creek watersheds as shown on Figure 3. These watersheds are part of the larger Natomas Cross Canal watershed. It has been previously identified by the Auburn Ravine, Coon, and Pleasant Grove Creek Flood Mitigation study (CH2MHILL 1993), that upstream development will increase the potential for flooding in the lower portion of Natomas Cross Canal watershed. In order to mitigate the increase in runoff volume, the use of regional retention facilities is proposed.

The required retention volume for the Sunset Area was determined by calculating the difference between pre- and post-development runoff based on soil type classifications and existing versus proposed land use. As directed by the County, it was assumed that the existing condition (including existing developed property) goes back to the natural, pre-developed state. The following equations were used to compute the runoff for existing and proposed conditions and the resulting impact. These equations were taken from the Pleasant Grove/Curry Creek Watershed Mitigation Fee report updated by Civil Engineering Solutions, Inc. in 2017 for the City of Roseville.

Volumetric Retention Equations:

Runoff Existing =0.09920478+(0.697025/(1+(PreInf/0.07704916)^1.44835)
*Runoff Proposed=(PostImpFrac*0.896167)+(1-PostImpFrac)*(0.09920478+0.697025/(1+(PostInf/0.07704916)^1.44835)*
Impact = Runoff Proposed - Runoff Existing

Inf (in/hr) = pre-developed infiltration rate in inches/hour
PostInf (in/hr) = post-developed infiltration rate in inches/hour
Impact (AF/ac) = acre-feet of volumetric retention required per acre of land use
PostImpFrac = post-development fraction of impervious area

The runoff volume calculations are dependent on infiltration rate and the amount of post-development impervious area. The existing and proposed infiltration rates in the runoff equations above are based on soil type and land use. Soil type within the Plan Area was downloaded as GIS shapefiles from the U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS) Web Soil Survey and are designated as Soil Groups A, B, B/D, C, and D. The infiltration rate for each Soil Group by land use cover are included in Table 5-3 of the Placer County Flood Control and Water conservation District Stormwater Management Manual (SWMM).

Land use cover for existing condition was assumed to be Fair Grassland in Table 5-3 of the SWMM. For developed land, the post-infiltration rate used Urban Covers for residential or commercial land use (landscaping with lawn, shrubs, etc.). Placer Parkway infiltration was calculated separately where it cut through the project. For the Landfill, future development was provided by County staff and is based on the Landfill site plan (Eco-Industrial). Portions of the Landfill were assumed commercial use and for all remaining parcels it was assumed no runoff could leave the site resulting in no retention impact from those portions of the Landfill. Also, the Urban Reserve and Preserve land uses were assumed to remain unchanged and therefore generate no retention volume requirement.

Table 7 shows the calculated infiltration rates by development land use area for both existing and proposed conditions using NRCS Soil Group data and SWMM infiltration rates. Soil classifications downloaded from the NRCS Web Soil Survey are shown on Figure 5 with project land use shown on Figure 1.

Table 7
Pre- and Post- Development Infiltration Rates by Land Use and Watershed

Land Use	Soil Group Area (ac)				Total Area (ac)	*Res Sub-Area* [1]	Pre-Inf (in/hr)	Post-Inf (in/hr)
	A	B	C	D				
Auburn Ravine Watershed								
Business Park	-	-	68.4	29.7	98.0	-	0.084	0.148
Placer Parkway	-	-	3.2	8.1	-	-		
Eco-Industrial	-	-	82.3	160.3	242.5	-	0.077	0.134
Non-Landfill Ops			31.7	121.4	153.2		0.074	0.128
Entertainment Mixed-Use	-	-	397.9	55.6	453.5	*48.5*	0.088	0.155
Placer Parkway	-	-	22.5	-	-	-		
General Commercial	-	-	-	-	-	-	-	-
Innovation Center	-	-	61.0	202.1	263.1	*40.1*	0.075	0.129
Light Industrial	-	-	106.4	0.0	106.4	-	0.090	0.160
Placer Parkway	-	-	16.4	0.8	-	-		
Public Facility	-	-	-	-	-	-	-	-
Placer Parkway Total	-	-	42.1	8.9	51.1	-	0.086	0.153
Pleasant Grove Creek Watershed								
Business Park	-	-	10.6	12.5	23.1	-	0.079	0.138
Eco-Industrial	-	-	67.9	260.0	328.0	-	0.074	0.128
Non-Landfill Ops			112.2	89.3	201.6	-	0.081	0.142
Placer Parkway	-	-	1.1	1.0	-	-		
Entertainment Mixed-Use	-	-	9.1	20.5	29.6	*3.2*	0.076	0.132
Placer Parkway	-	-	8.5	6.7	-	-		
General Commercial	-	-	35.9	2.0	37.9	-	0.089	0.158
Innovation Center	-	49.6	537.0	374.6	961.1	*146.6*	0.086	0.149
Placer Parkway	-	-	8.8	7.6	-	-		
Light Industrial	5.7	-	472.3	152.9	630.9	-	0.087	0.153
Public Facility	-	-	2.4	-	2.4	-	0.090	0.160
Placer Parkway Total	-	-	18.5	15.4	33.9	-	0.081	0.142
Pre-Infiltration Rates [2]	***0.31***	***0.16***	***0.09***	***0.07***				
Post-Infiltration Rates [3]	***0.48***	***0.25***	***0.16***	***0.12***				

(1) Residential Sub-Area is included in the Total Area

(2) Rate for Fair Grasslands per Placer County Flood Control and Water Conservation District Stormwater Management Manual

(3) Rate for Urban Covers per Placer County Flood Control and Water Conservation District Stormwater Management Manual

The retention volume calculations for the Plan Area are shown in Table 8 utilizing the equations above and the infiltrations rates calculated in Table 7. Percent impervious for the developed condition is estimated based on the proposed land use plan. Retention was calculated separately for the two drainage areas, Auburn Ravine/Orchard Creek Watershed and Pleasant Grove Creek Watershed. The resulting calculations show a need for approximately 375 acre-feet of retention volume in the Auburn Ravine Watershed and 655 acre-feet in the Pleasant Grove Creek Watershed.

Table 8
Retention Volume Impact Calculation

Land Use	Pre Inf(1) (in/hr)	Post Inf(1) (in/hr)	Post Imp Fraction	Existing Runoff (ft)	Proposed Runoff (ft)	Impact Rate (ft)	Land Use Area (ac)	Impact (ac-ft)
Auburn Ravine Watershed								
Business Park	0.084	0.148	0.80	0.426	0.776	0.350	98.0	34.3
Eco-Industrial/Landfill Ops	0.077	0.077	0.00	0.449	0.449	0.000	242.5	0.0
Eco-Industrial/Comm'l	0.074	0.128	0.80	0.457	0.782	0.324	153.2	49.7
Entertainment Mixed-Use	0.088	0.155	0.80	0.416	0.774	0.358	404.9	145.1
Ent Mixed-Use/Res	0.088	0.155	0.50	0.416	0.591	0.175	48.5	8.5
General Commercial	-	-						0.0
Innovation Center	0.075	0.129	0.80	0.456	0.782	0.326	223.0	72.6
Innov Cntr/Res	0.075	0.129	0.50	0.456	0.610	0.154	40.1	6.2
Light Industrial	0.090	0.160	0.80	0.409	0.773	0.364	106.4	38.7
Public Facility	-	-						0.0
Placer Parkway	0.086	0.153	0.85	0.419	0.805	0.386	51.1	19.7
AUBURN RAVINE TOTAL							**1,367.8**	**374.8**
Pleasant Grove Creek Watershed								
Business Park	0.079	0.138	0.80	0.441	0.779	0.338	23.1	7.8
Eco-Industrial/Landfill Ops	0.074	0.074	0.00	0.457	0.457	0.000	328.0	0.0
Eco-Industrial/Comm'l	0.081	0.142	0.80	0.435	0.777	0.343	201.6	69.1
Entertainment Mixed-Use	0.076	0.132	0.80	0.451	0.780	0.330	26.4	8.7
Ent Mixed-Use/Res	0.076	0.132	0.50	0.451	0.607	0.156	3.2	0.5
General Commercial	0.089	0.074	0.80	0.412	0.808	0.397	37.9	15.0
Innovation Center	0.086	0.149	0.80	0.421	0.775	0.355	814.5	289.1
Innov Cntr/Res	0.086	0.149	0.50	0.421	0.594	0.174	146.6	25.5
Light Industrial	0.087	0.153	0.80	0.417	0.774	0.358	630.9	225.7
Public Facility	0.090	0.160	0.80	0.409	0.773	0.364	2.4	0.9
Placer Parkway	0.081	0.142	0.85	0.435	0.807	0.372	33.9	12.6
PLEASANT GROVE CREEK TOTAL							**2,248.4**	**654.8**

(1) Existing and Proposed Infiltration Rates from Table 6.

The specific location for retention has not yet been determined, however, regional retention facilities within the Natomas Cross Canal watershed are planned to be utilized. The City of Roseville's Reasons Farms regional retention basin is currently being analyzed for proposed off-site retention in the Pleasant Grove Creek Watershed and two alternative regional locations are being proposed in the Auburn Ravine Watershed. Should the Sunset Area develop prior to regional facilities becoming available, interim retention facilities will be utilized.

VII. Stormwater Quality

Sunset Area will maintain stormwater quality using a variety of source control and Low Impact Development (LID) measures. These measures are intended to maintain clean water, recharge groundwater, protect and enhance habitat, and add value to Sunset Area.

The present general plan-level study does not include sufficient detail, including grading, to analyze a more detailed stormwater quality design, including hydromodification, and the specific plan-level analysis of the stormwater quality and hydromodification will be analyzed and detailed in the future. Future analysis will comply with the requirements outlined in the West Placer Stormwater Quality Design Manual.