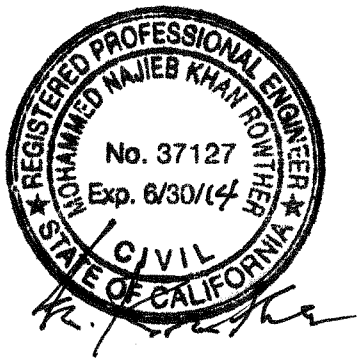
HYDROLOGY STUDY

For

TTM 15353 & 17300

City of Lake Forest
County of Orange



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SECTION 1

INTRODUCTION

A. PROJECT LOCATION

The Portola Center Project (Tentative Tracts 15353 & 17300) is located in the City of Lake Forest, County of Orange. The Project site is approximately 196 acres and is bounded by the Foothill Transportation Corridor and Southern California Edison Transmission Corridor property to the south, El Toro Road to the east, Whiting Ranch and Glenn Ranch Road to the west, and the community of Portola Hills to the north. The Project site is bifurcated by Glenn Ranch Road and Saddleback Ranch Road (please see the vicinity map in Sub-section G).

B. PROJECT BACKGROUND

The Project consists of up to 930 residential units and 18 attached accessory/secondary units, including single family and multifamily homes; 10,000 square feet of neighborhood commercial retail space in a mixed use center; a 5-acre neighborhood park; several smaller pedestrian-oriented neighborhood parks; and approximately 2 miles of new public trails. The Project includes storm water treatment and detention facilities consisting of structural Best Management Practices (BMPs) to meet the Project's post development water quality, hydromodification, and hydrology requirements. Sizes, locations and types of the proposed water quality treatment and detention facilities will be governed by the results of this Hydrology Study, the Project's Hydromodification Analysis, and the Project's Water Quality Management Plans. The design of the proposed facilities will be refined during the final design/final engineering phase of the Project.

The Project also includes the replacement of an existing approximately 12-acre-foot earthen detention basin in the southwest corner of the Project site adjacent to Glenn Ranch Road. This existing basin detains flows from the community of Portola Hills and outlets at the base of the Project site into a natural earthen channel. The Project proposes to replace this existing Portola Hills basin with a new underground detention chamber that would be located in approximately the same area.

C. STUDY PURPOSE

The purpose of this study is to analyze the peak discharges from the 2-, 5-, 10-, 25-, 50-, and 100-year storm events produced from the site in its pre-development state (current state or "existing

condition") and from the site in its post-development state ("proposed condition"). As a result, this study serves as the basis for analyzing and designing onsite stormwater detention facilities, including hydromodification facilities, and conveyance systems.

Function of Detention and Hydromodification.

Detention is the collection and attenuation of stormwater runoff resulting in a controlled release of the runoff to prevent flooding and erosion in downstream areas. Hydromodification Management is one component of detention that is based on a continuous simulation model for a flow duration control between a range of flows extending from 10% of the 2-year peak flow event to the 10-year peak flow event in the pre-developed/natural condition. The purpose of hydromodification management is to control erosion by mimicking the natural flows for a selected range of storms in the post development condition. Hydromodification management is often based on a separate set of flow control requirements. However, this Project's proposed hydromodification detention facilities have been designed to work in conjunction with the Project's flood control facilities which handle much larger storm events out to the 100-year event. Please see the hydromodification report prepared by Geosyntec under separate cover for more information on the design of the Project's hydromodification management facilities.

D. METHODOLOGY

The hydrology calculations and analysis were prepared using the 1986 published version of the *Orange County Hydrology Manual* as incorporated in the Advanced Engineering Software (AES) "RATSC", "FLOODSC", and "CH1" program. The hydrologic soil types were determined from the Hydrologic Soils Group from Orange County Hydrology Manual Maps.

E. DISCUSSION

Existing Condition

The Project site is presently in an undeveloped condition with a mix of native and non-native vegetation covering much of the site. The site has previously undergone rough grading in the north and portions of the south. A review of the Flood Insurance Rate Map (FIRM) (Map #: 06059C0317J) dated December 3, 2009, indicates that no portion of the Project site is in a floodplain (please see a copy of the FIRM map in Section 2 for more detail).

The Project is comprised of six (6) major drainage areas (Drainage Areas "A" through "F") that exit the Project site at thirteen (13) concentration nodes (outlets) located around the perimeter of the Project, as shown on the existing and proposed condition hydrology maps. Drainage Area "A" is comprised of approximately 213.9 acres, including off-site area of approximately 151.4 acres of Portola Hills Community. Drainage Areas "B, "C", "D", "E" & "F" are comprised of a total acreage of approximately 137.5 acres. All the drainage runoff discharging from the 13 outlets are tributary to existing earthen channels that drain to the existing Serrano Creek and Aliso Creek.

There is an existing 60-inch R.C.P. storm drain (Facility #: J01P06) that extends underneath Saddleback Ranch Road carrying flows from the Portola Hills Community (located to the north of the Project site) into to an existing approximately 12 acre-foot detention basin located approximately 500 feet southwest of the Saddleback Ranch/Glenn Ranch Road intersection, in the southwest corner of the Project site. This existing Portola Hills basin outlets at the bottom of Drainage Area "A" at Node 377 in the southwest corner of the Project site. The outlet of the existing detention basin (at Node 377) was designed for Expected Value (EV) peak discharges of 264 cubic feet per second (cfs), 195 cfs, and 151 cfs for the 100-, 25-, and 10-year storm events, respectively (per Portola Hills Retarding Basin Study by J.P Kapp & Associates, Inc. dated November 1989, included Section 8).

Proposed Condition

The post-development condition includes the six drainage areas (Drainage Areas "A" through "F") discharging across the southern and eastern boundary of the Project site, similar to existing condition. The 2-Yr, 5-Yr, 10-Yr, 25-Yr, 50-Yr and 100-Yr expected value (EV) with high confidence (HC) for Drainage Areas "A through F" is shown on the summary table titled: "Tentative Tract 15353 & 17300 Areas "A", "B", "C", "D", "E" & "F" Summary of Hydrology Analysis Existing Condition vs. Proposed Condition" (included in Sub-section I).

Drainage Area "A" includes 151.4 acres of the Portola Hills Community to the North of the Project site. Runoff from the existing Portola Hills Community and a portion of the runoff from the existing Glenn Ranch Road and Saddleback Ranch Road, account for approximately 72% of the total runoff in this Drainage Area. The remaining 28% of these flows are coming from portions of Drainage Area "A" that are part of the Project site. The existing flows from Portola Hills and portions of Glenn Ranch Road and Saddleback Ranch Road will not be comingled with

the Project's flows. Instead, these existing flows will be confined to a separate bypass storm drain system and diverted into a new underground 5.4 acre-foot flow-by underground detention chamber at node 336.11, (Basin #2). Flows from those portions of Drainage Area "A" that are part of the Project site will be captured and routed through a separate storm water detention and conveyance system that treats and detains these flows in compliance with water quality and hydromodification requirements. After accounting for the project flows discharging at Node 377, Basin #2 is sized to limit the peak discharge at Node 377 to 263.9 cfs, 178.8 cfs and 150.9 cfs, for 100-year, 25-year and 10-year EV storm events, respectively.

Hydromodification

As shown on the map titled "Preliminary Design Detention-Hydromodification & Water Quality Volume Exhibit" (included in Section 3), in addition to Basin #2, the Project includes 8 underground flow-through hydromodification/water quality (HYD/WQ) chambers, and one flow-through open-basin for detention, hydromodification, and water quality (Basin #9).

Nuisance runoff, and runoff during minor storms of up to 10-year frequencies, will be diverted and routed through the underground HYD/WQ chambers for treatment and flow-retardation (to meet hydromodification requirements) prior to being released to the downstream storm drain system.

Onsite portion of Drainage Area "A" has been divided into Subareas A1, A3, A4 & A5. Runoff from Subareas A1 & A3 will be routed into Basin #3; Subarea A4 will be routed through HYD/WQ Basin #4; and Subarea A5 will be routed through Basin #1.

Drainage Area "B" has been divided into Subareas B1, B2 & B3. Subareas B1 & B2 will be routed through HYD/WQ Basin #5; and Subarea B3 will be routed through two interconnected underground chambers, i.e. HYD/WQ Basins #7A and HYD/WQ Basin 7B.

Drainage Area "C" has been divided into Subareas C1 & C2. Runoff from Subarea C1 will be routed through HYD/WQ Basin #8A; and Subarea C2 will be routed through HYD/WQ Basin #8B.

Drainage Area "D" consists of two Subareas D1 & D2. Runoff from both the subareas will be routed through a water quality/hydromodification/detention basin, Basin #9.

The Project's discharges in the proposed condition must also meet Regional Water Quality Control Board water quality and the Interim Hydromodification standards. Water Quality Management Plans (WQMPs) outlining these elements of the Project's stormwater conveyance system have been prepared for the Project's two Tentative Tract Maps (TTM15353 and TTM17300) as separate reports.

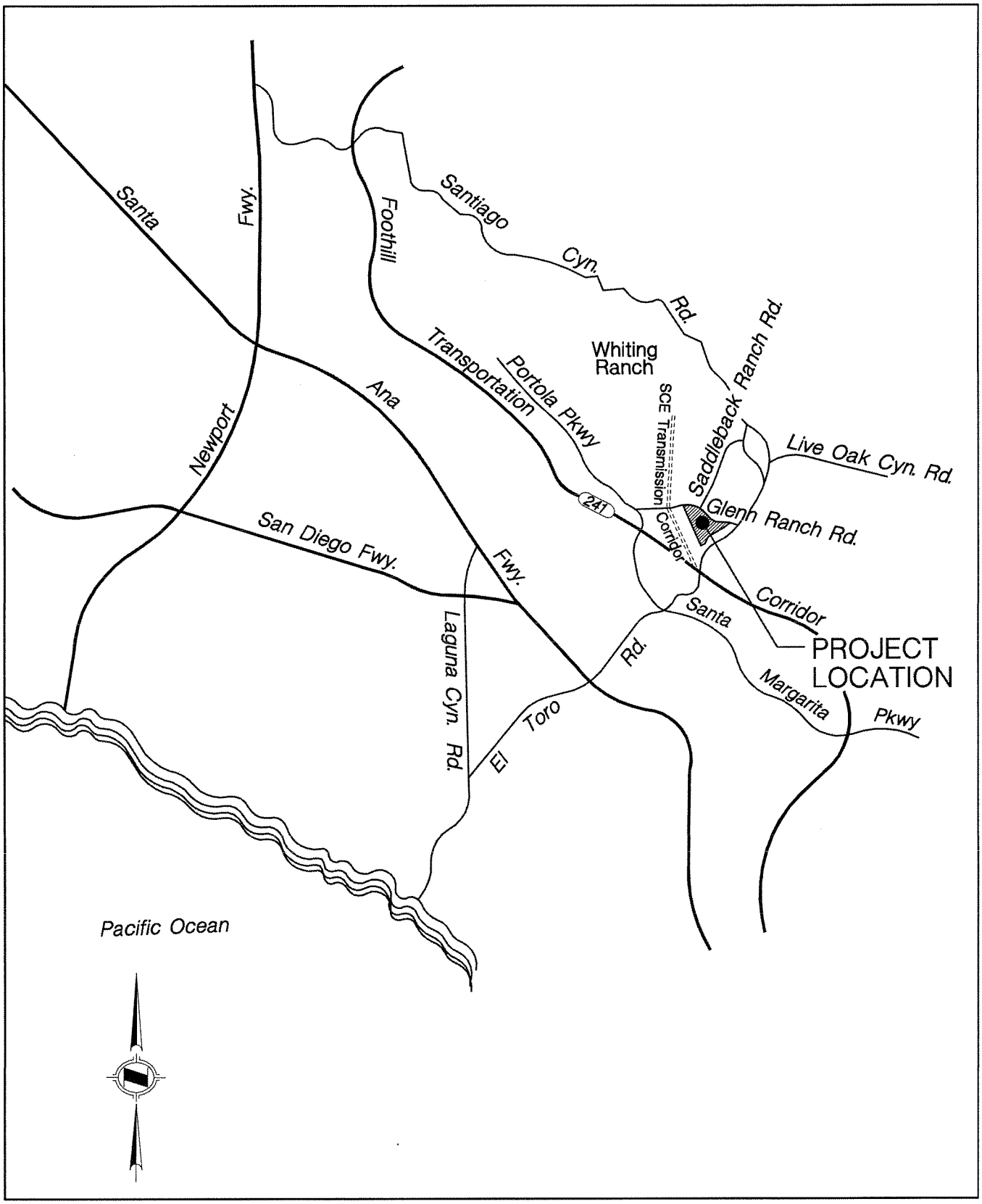
F. CONCLUSIONS

The onsite storm water detention and conveyance system in Drainage Area "A" will be designed as a separate system to ensure no commingle of flows originating in Portola Hills and portions of Glenn Ranch and Saddleback Ranch Roads and flows originating onsite before the onsite flows undergo treatment and detention for water quality and hydromodification purposes.

Thirteen (13) discharges locations (nodes) around the perimeter of the Project site are proposed in the Proposed Condition. The study indicates that, with the proposed detention and hydromodification basins, the individual post-development (Proposed Condition) peak discharges at the 13 discharge locations are less than the individual pre-developed (Existing Condition) peak discharges at these 13 different discharge locations, thereby preventing any new contribution to a localized flooding condition. The outlets will be designed with riprap and/or energy dissipaters to ensure post-development discharge velocities do not exceed discharge velocities in the Existing Condition. Therefore, the proposed Project has no impact on erosion and scour at outlet locations.

Per the FIRM Map #06059C0317J dated December 3, 2009, no portion of the Project site is in a floodplain in the site's Existing Condition nor would any portion of the site be in a floodplain in the Proposed Condition. Please see the summary table entitled "Summary of Hydrology Analysis, Existing Condition vs. Proposed Condition" in Section 1 for more detail on Project flows in the Existing and Proposed Conditions. Finally, all of the Project's proposed storm water facilities will be protected and designed for the 100-year storm event per the requirements of the current Orange County Local Drainage Manual and the Project's discharges in the proposed condition have been designed to meet applicable water quality and the Interim Hydromodification standards.

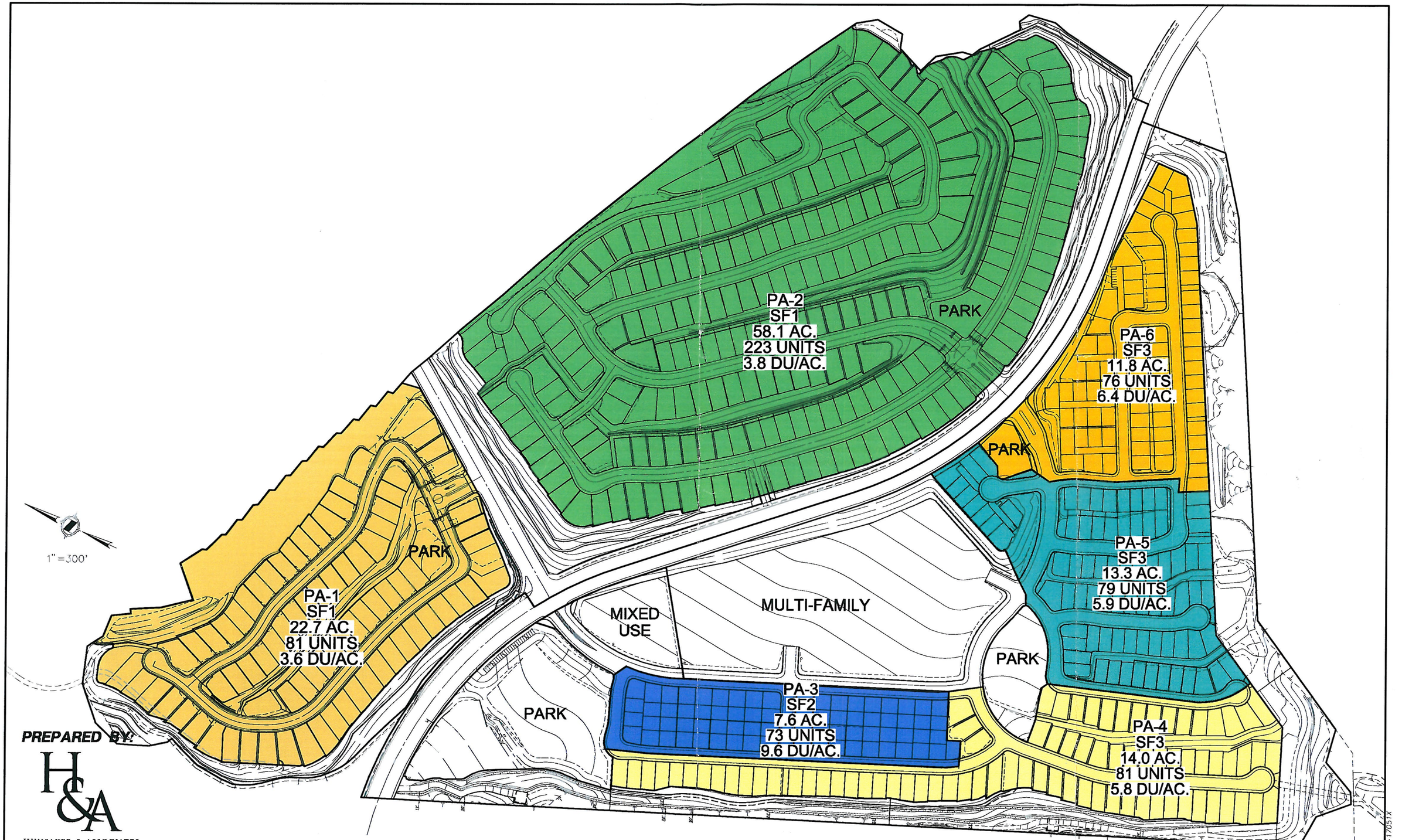
G. VICINITY MAP



VICINITY MAP

N.T.S.

H. LAND USE MAP



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PORTOLA CENTER DENSITY STUDY

W.O.: 0061-1765.1X

PLOTTED BY: Kathy Burns DATE: Feb. 14, 2013 08:27:43 AM FILE: F:\0334\Planning\OA_Project\EXHIBITS\PARCELS FROM SCOTT.dwg

I. SUMMARY OF HYDROLOGY ANALYSIS – EXISTING CONDITION VS. PROPOSED CONDITION

TENTATIVE TRACTS 15353 & 17300
AREAS "A", "B", "C", "D", "E" & "F"
SUMMARY OF HYDROLOGY ANALYSIS
EXISTING CONDITION VS. PROPOSED CONDITION

DRAINAGE AREA	OUTLET		LAND USE	AREA (AC)		PEAK FLOW RATE (CFS)																				Remarks
						2-Year Storm				5-Year Storm				10-Year Storm				25-Year Storm				50-Year Storm				100-Year Storm				
						Rational Method				Rational Method				Rational Method				Rational Method				Rational Method				Rational Method				
						(EV)	(HC)	With Detention		(EV)	(HC)	With Detention		(EV)	(HC)	With Detention		(EV)	(HC)	With Detention		(EV)	(HC)	With Detention		(EV)	(HC)	With Detention		
	NUMBER	NODE		PROP.	EXIST.			(EV)	(HC)			(EV)	(HC)			(EV)	(HC)			(EV)	(HC)			(EV)	(HC)			(EV)	(HC)	
A	1	377	**Design Peak Runoff Per J.P. Kapp**													**151.0**				**195.0**						**264.0**		
			Existing Condition		213.9	187.9	224.0	N/A	N/A	247.8	290.1	N/A	N/A	285.2	348.5	N/A	N/A	343.6	426.6	N/A	N/A	379.7	494.2	N/A	N/A	421.7	572.4	N/A	N/A	
			Proposed Condition	217.2		204.9	236.9	105.0	*123.1*	267.9	306.3	120.8	*151.5*	303.7	367.8	**150.9**	*182.3*	365.2	448.4	**178.8**	*221.5*	403.3	518.0	198.4	*260.0*	445.9	598.7	**263.9**	*305.6*	Onsite upto 10-Yr (EV) Peak, $V_{REQUIRED}$ = 2.5ac-ft (Basin #3), Provided $V_{HYDROMOD}$ = 2.8ac-ft; $V_{REQUIRED}$ = 1.1ac-ft (Basin #4), Provided $V_{HYDROMOD}$ = 1.2ac-ft; Offsite With Flowby of 101.7cfs, $V_{REQUIRED}$ = 5.4ac-ft (Basin #2)
	2	382	Existing Condition		1.3	0.7	1.6	N/A	N/A	1.3	2.4	N/A	N/A	2.3	3.1	N/A	N/A	3.0	3.8	N/A	N/A	3.5	4.3	N/A	N/A	3.7	4.9	N/A	N/A	Proposed Condition Peak Discharges Less Than Existing Condition Peak Discharges
			Proposed Condition	0.4		0.4	0.7	N/A	N/A	0.6	1.0	N/A	N/A	1.0	1.3	N/A	N/A	1.3	1.6	N/A	N/A	1.4	1.8	N/A	N/A	1.5	2.0	N/A	N/A	
	3	383	Existing Condition		4.9	2.6	6.1	N/A	N/A	5.1	9.1	N/A	N/A	8.8	11.7	N/A	N/A	11.4	14.2	N/A	N/A	13.1	16.1	N/A	N/A	13.9	18.4	N/A	N/A	Proposed Condition Peak Discharges Less Than Existing Condition Peak Discharges
			Proposed Condition	2.3		1.2	2.9	N/A	N/A	2.4	4.2	N/A	N/A	4.1	5.5	N/A	N/A	5.3	6.6	N/A	N/A	6.1	7.5	N/A	N/A	6.5	8.6	N/A	N/A	
	4	384	Existing Condition		0.6	0.2	0.7	N/A	N/A	0.5	1.0	N/A	N/A	1.0	1.3	N/A	N/A	1.3	1.6	N/A	N/A	1.4	1.8	N/A	N/A	1.5	2.0	N/A	N/A	Proposed Condition Peak Discharges Less Than Existing Condition Peak Discharges
			Proposed Condition	0.1		0.1	0.2	N/A	N/A	0.1	0.2	N/A	N/A	0.2	0.3	N/A	N/A	0.3	0.3	N/A	N/A	0.3	0.4	N/A	N/A	0.3	0.4	N/A	N/A	
	5	385	Existing Condition		3.6	1.4	4.1	N/A	N/A	3.1	6.1	N/A	N/A	5.8	8.0	N/A	N/A	7.7	9.7	N/A	N/A	8.6	11.1	N/A	N/A	9.4	12.7	N/A	N/A	Proposed Condition Peak Discharges Less Than Existing Condition Peak Discharges
			Proposed Condition	2.4		1.0	2.7	N/A	N/A	2.1	4.1	N/A	N/A	3.9	5.3	N/A	N/A	5.1	6.4	N/A	N/A	5.8	7.3	N/A	N/A	6.2	8.4	N/A	N/A	
B	6	82	Existing Condition		77.1	7.3	58.0	N/A	N/A	38.5	91.8	N/A	N/A	86.5	121.4	N/A	N/A	116.2	150.4	N/A	N/A	132.9	172.9	N/A	N/A	145.1	198.7	N/A	N/A	Onsite upto 10-Yr (EV) Peak, $V_{REQUIRED}$ = 5.7ac-ft (Basin #5), Provided $V_{HYDROMOD}$ = 6.4ac-ft; $V_{REQUIRED}$ = 0.7ac-ft (Basins #7A & #7B), Provided $V_{HYDROMOD}$ = 0.9ac-ft
			Proposed Condition	94.8		47.3	87.4	4.2	12.2	78.3	129.7	9.1	53.0	127.1	167.8	56.9	94.9	165.2	203.6	91.2	130.0	187.5	231.8	110.1	157.7	201.1	264.9	127.6	187.4	
C	7	116	Existing Condition		17.2	4.7	17.2	N/A	N/A	12.8	26.2	N/A	N/A	24.7	34.2	N/A	N/A	32.7	41.9	N/A	N/A	37.6	47.8	N/A	N/A	40.4	54.8	N/A	N/A	Onsite upto 10-Yr (EV) Peak, $V_{REQUIRED}$ = 0.06ac-ft (Basin #8); $V_{REQUIRED}$ = 0.4ac-ft (Basin #8A), Provided $V_{HYDROMOD}$ = 0.4ac-ft; $V_{REQUIRED}$ = 0.6ac-ft (Basin #8B), Provided $V_{HYDROMOD}$ = 0.6ac-ft
			Proposed Condition	17.7		9.0	20.3	2.9	8.4	17.1	30.3	6.6	16.4	29.2	39.3	16.0	25.5	38.2	47.8	23.4	35.3	43.1	54.4	29.6	43.0	46.6	62.2	33.5	50.9	
D	8	200.5	Existing Condition		13.4	4.0	12.8	N/A	N/A	10.1	19.6	N/A	N/A	19.0	25.6	N/A	N/A	25.1	31.3	N/A	N/A	28.5	35.8	N/A	N/A	30.8	41.1	N/A	N/A	$V_{REQUIRED}$ = 1.9ac-ft (Basin #9), Provided $V_{HYDROMOD}$ = 3.3ac-ft
			Proposed Condition	14.6		7.7	14.5	1.7	3.2	13.0	21.7	2.9	4.6	21.4	28.2	4.5	6.2	27.8	34.3	5.9	13.9	31.7	39.1	9.4	24.4	34.0	44.6	13.2	33.0	
	9	202.1	Existing Condition		5.8	2.3	6.5	N/A	N/A	5.2	9.9	N/A	N/A	9.6	12.9	N/A	N/A	12.6	15.7	N/A	N/A	14.1	17.9	N/A	N/A	15.4	20.5	N/A	N/A	Proposed Condition Peak Discharges Less Than Existing Condition Peak Discharges
			Proposed Condition	1.8		1.5	2.9	N/A	N/A	2.5	4.3	N/A	N/A	4.2	5.6	N/A	N/A	5.5	6.7	N/A	N/A	6.3	7.6	N/A	N/A	6.6	8.7	N/A	N/A	
	10	204.2	Existing Condition		3.1	1.2	3.3	N/A	N/A	2.7	5.0	N/A	N/A	4.9	6.6	N/A	N/A	6.5	8.0	N/A	N/A	7.3	9.2	N/A	N/A	7.9	10.5	N/A	N/A	Proposed Condition Peak Discharges Less Than Existing Condition Peak Discharges
			Proposed Condition	1.7		0.8	2.0	N/A	N/A	1.7	3.0	N/A	N/A	3.0	3.9	N/A	N/A	3.9	4.7	N/A	N/A	4.4	5.4	N/A	N/A	4.7	6.2	N/A	N/A	
	11	207	Existing Condition		3.2	1.1	3.3	N/A	N/A	2.6	5.0	N/A	N/A	4.9	6.6	N/A	N/A	6.5	8.1	N/A	N/A	7.4	9.2	N/A	N/A	8.0	10.5	N/A	N/A	Proposed Condition Peak Discharges Less Than Existing Condition Peak Discharges
			Proposed Condition	1.5		0.7	1.7	N/A	N/A	1.4	2.6	N/A	N/A	2.5	3.3	N/A	N/A	3.3	4.1	N/A	N/A	3.8	4.6	N/A	N/A	4.1	5.3	N/A	N/A	
E	12	402	Existing Condition		14.6	7.1	17.6	N/A	N/A	14.3	26.5	N/A	N/A	25.5	34.5	N/A	N/A	33.6	42.0	N/A	N/A	38.4	47.9	N/A	N/A	41.1	54.9	N/A	N/A	Proposed Condition Peak Discharges Less Than Existing Condition Peak Discharges
			Proposed Condition	4.8		3.8	6.7	N/A	N/A	6.1	9.8	N/A	N/A	9.5	12.6	N/A	N/A	12.4	15.3	N/A	N/A	14.5	17.4	N/A	N/A	15.0	19.9	N/A	N/A	
F	13	501	Existing Condition		3.1	1.2	3.4	N/A	N/A	2.7	5.2	N/A	N/A	5.0	6.7	N/A	N/A	6.5	8.2	N/A	N/A	7.4	9.3	N/A	N/A	8.0	10.6	N/A	N/A	Proposed Condition Peak Discharges Less Than Existing Condition Peak Discharges
			Proposed Condition	2.5		1.0	2.7	N/A	N/A	2.2	4.1	N/A	N/A	4.0	5.4	N/A	N/A	5.3	6.5	N/A	N/A	5.9	7.5	N/A	N/A	6.4	8.5	N/A	N/A	
			Total	361.8	361.8																									