I. Introduction

A. Purpose and Scope of report

The purpose of this report is to describe the intent and strategy of the drainage and hydrology design for the Port San Luis Harbor Terrace (PSLHT) Campground project. This report includes discussion of the drainage conditions for the existing site and the proposed development and will present data for both large and small storm events.

This report outlines the design methodologies required by the County of San Luis Obispo and presents hydrology data showing how these requirements were met. In this report it is shown that the proposed project is meeting the county set site design and water quality standards by using Low Impact Design and Development principles.

B. Project Description

The proposed project is a 32 acre hillside camping and RV site that is overlooking Port San Luis. The project will convert the existing harbor storage area into a multi-use campground with harbor related storage. This conversion will create a commercial use building, 5 RV parking / RV cabin areas, 32 hotel/motel units (yurts, cabins, inns, casitas, bungalows, per LCP), a walk in camping area, approximately 3 comfort stations, and the associated roadways and utilities. A harbor storage zone will be retained in the northwest portion of the site.

II. Performance Requirements

The County of San Luis Obispo has developed a Post Construction Requirements Handbook (dated March 2014) with the required standards for post-construction storm water management in new construction and redevelopment. Due to the location of the site in the county, construction must meet performance requirements 1 and 2. The requirements are described below:

A. Performance Requirement 1 (PR1) – Low Impact Development

The intent of PR1 is to mimic predevelopment hydrology to the extent feasible using LID principles. The overall design strategies that PR1 recommends using are to limit disturbance of creeks and natural drainage features; to minimize compaction of highly permeable soils; to limit clearing and grading of native vegetation; and to minimize impervious surfaces by concentrating improvements on the least sensitive portions of the site.

The site design measures listed in PR1, of which at least one (1) must be used, are listed below:

- Roof runoff directed into cisterns or rain barrels.
- Roof runoff directed into vegetated areas.
- Runoff from sidewalks, walkways or patios directed onto vegetated areas.
- Runoff from driveways and/or uncovered parking lots onto vegetated areas.
- Construct bike lanes, driveways, uncovered parking lots, or other paved areas with a permeable surface.

Regarding the Design Strategies, there are no creeks or significant natural drainage features on the site, and any small existing swales and minor ditches disturbed by construction will be fully restored and stabilized. Extensive regrading will be required to implement the proposed plan on the steep site, and the resulting cut and fill slopes will have to be compacted as directed by the project's geotechnical engineer. All areas that do not require disturbance, though, will be protected from unnecessary compaction. Similarly, the site's existing sparse vegetation cover will be retained wherever possible, but it is expected this will primarily be outside the limits of construction. The creation of new impervious surfaces will be limited to the extent feasible, but the proposed camping and vehicle storage uses of the site will require hard surfaced parking areas and all weather roadways. These uses are similar to the site's existing condition, although there will be an increase in total impervious cover. It is noted that permeable pavements were considered for the site, but were ruled out in accordance with the Harbor Terrace Campground Geologic - Geotechnical Hazards Study prepared by Earth Systems Pacific. Another portion of PR1 is the control of storm water. The site has been designed to fully comply with this requirement by sloping all impervious surfaces towards vegetated treatment areas in the form of swales and rain gardens, prior to being discharged from the site via a stormwater pipe system. Additionally the roof runoff of the large buildings on site should be directed to nearby rain gardens to meet the design requirements of Performance Requirement 1.

B. Performance Requirement 2 (PR2) – Water Quality Treatment

The purpose of this requirement is to reduce pollutant loads and concentrations in site generated stormwater runoff using physical, biological, and chemical removal processes. Regulated projects (the Harbor Terrace project would be considered a Regulated project) have three options, listed in preference order, to treat runoff.

- **Low impact development (LID)** treatment systems involve harvesting and use, infiltration, or evapotranspiration storm water control measures to collectively retain storm water runoff equal to the volume of runoff generated by the 85th percentile 24-hour storm event.
- **Biofiltration treatment** systems remove pollutants through the use of natural systems, such as swales or filter strips. Must demonstrate that the swale can treat site runoff of 0.2 inches per hour over a 24 hour period or 2 times the 85th percentile storm without causing scour, erosion, or channeling.
- **Non-Retention based treatment systems – "end of pipe" treatment approaches**. Must treat the volume generated by the 85th percentile 24-hour storm event. This is the least preferred option and there must be good reasoning to go this route.

The storm water quality portion of the site design is directed by Performance Requirement 2, which has the purpose of reducing pollutant loads and concentrations in storm water generated on site. This requirement has been met in the design by implementing a combination of Low Impact Development (LID) treatment systems, in the form of bio-swales and rain gardens. The bio-retention swales function as water transport, filtering, and settling devices. They perform these three functions by first collecting flow from the impervious areas across the site. Then, by having a combination of soil and rock media to filter out contaminants. And lastly, by staggering flow at checkdams to increase transport time and allow settling to occur. The raingardens are the main source of stormwater treatment on the site. They receive flows from the swales and provide a combination of filtering and flow staggering. Once runoff enters a raingarden, it will be filtered through an 18" deep vegetative soil layer that filters out and traps contaminants. The

runoff will then be collected by subdrains within an underlying layer of crushed rock, for discharge to the project's storm drain system. This discharge is required because the site's steep slopes may be destabilized by concentrated infiltration of runoff underneath the project's many proposed rain gardens. Since the raingardens are built with an impermeable base, during larger storms that the underdrain is not sized for, the raingarden will fill and discharge into an overflow pipe that is connected to the piped stormwater system.

To meet the treatment requirements set by PR2 the bio-retention filtration system needs to be capable of treating site runoff given a 0.2-inchs per hour rainfall intensity loading rate and assumes an infiltration rate of 5 inches per hour, thus requiring a treatment area equal to 4% of the impervious area in each watershed area. (See Exhibit B for watershed locations)

In order to implement these systems the impervious areas of the site are sloped so that runoff is directed to the bio-retention swales and transported to the rain gardens. This two phased system will remove a large percentage of the contaminants. As seen below, in Table 1 which breaks down treatment calculations per watershed, the area of rain garden treatment that will be provided meets the minimum 4% requirement.

TABLE 1 - RAIN GARDEN SIZING SUMMARY

WATERSHED	IMPERVIOUS AREA (SF)	TREATMENT AREA REQUIRED (SF)	TREATMENT AREA PROVIDED (SF)
A1	22,900	916	440
A2			580
B	49,072	1,963	2,058
C1	27,800	1,112	480
C2			860
D	86,700	3,468	3,747
E	23,100	924	2,190
F	69,396	2,776	2,897
G	27,200	1,088	1,423
H	17,200	688	751
I	22,400	896	2,883
J	0	0	0
K	9,400	376	2,298
L	27,800	1,112	1,174
M	7,100	284	1,530
N	21,800	872	960
O	0	0	0
P	0	0	0
Q	0	0	0
R	0	0	0
TOTAL AREA	411,868	16,475	24,271

C. Performance Requirement 3 (PR3) – Runoff Retention

The purpose of this requirement is to retain the beneficial uses of a project's receiving waters. To meet this requirement a volume of water determined by a formula set in the San Luis Obispo Post Construction Requirement Handbook must be retained on site. Although the project is exempt from this requirement, criteria to conform and limiting site constraints are discussed further in Section V.

D. Performance Requirement 4 (PR4) – Peak Management

The purpose of this requirement is to retain the beneficial uses of a projects receiving waters. The requirement is to manage peak flow storm water runoff. The project designer will need to demonstrate that post-development peak flows discharged from the site do not exceed pre-project peak flows for the 2 through 10 year storm events in the storm water control plan. Though the project is exempt from this requirement, methods to meet the retention quantities are discussed further in Section V.

III. Existing Conditions

The existing site consists of a terraced hillside that is sparsely vegetated with scrub brush and small trees. The paved access road that leads up the hill branches off into multiple paved zones that are used for storage of containers and other harbor related materials. At the top of the hill is a water tank that serves potable water access points across the site. There is also a paved road, Babe Lane, on the east portion of the site. Along Babe Lane there are mobile homes and concrete pads for RV parking.

The defining characteristic of this site is the steep slope of the hillside. The slopes of the hillside range from 10 to 66 percent and the existing roadway is at a 9 percent grade in places. The west two-thirds of the site is composed mainly of fill that has been placed over many years with smaller zones of Monterey Formation and Franciscan Mélange soils. The eastern portion of the site is in a potential landslide area, named Landslide Area 1 in the Geotechnical report. Based on findings from the Geologic and Geotechnical Hazards Study performed by Earth Systems Pacific in July 2014, the soils within the project limits are mostly fill and are not well suited for infiltration. Additionally, the areas near the 8 landslide areas could pose a hazard given heavy rains or oversaturation from infiltration. Because of this, infiltration across the site will need to be limited. Areas of concentrated flow will need to be discharged to not inundate the surrounding native soil.

The existing site drainage is broken up into five watersheds (SEE EXHIBIT A). Watershed 1 encompasses the west side of the site from bottom to top and is 19.3 acres. It is approximately 5% impervious with a Curve Number (CN) weighted average value of 80 and a Time of Concentration of 22.1 minutes. Watershed 1 drains down to Avila Beach Drive and discharges through the existing outfall into San Luis Obispo Bay. Watershed 2 spans the middle of the site from top to bottom and is 10.6 acres. It is approximately 5% impervious with a CN weighted average value of 80 and a Time of Concentration of 22.0 minutes. This watershed drains down to Avila Beach Drive and into the swale on the north side of the road where it flows east. Watershed 3 is located in the southeast corner of the site and is 3.9 acres. It is approximately 23% impervious with a CN weighted average value of 83 and a Time of Concentration of 6.4

minutes. Watershed 3 also drains to Avila Beach Drive and meets up with the flow from Watershed 2. Watersheds 2 and 3 continue in the swale until discharging into a catch basin after Babe Lane. Watersheds 4 and 5 do not influence any portions of the site containing either existing or proposed development, and so have not been included in this report. Between Watersheds 1, 2, and 3 there are 2.4 acres of impervious area. All watersheds, except Watershed 1, discharge into a roadside swale. All discharges eventually outfall to the bay. The peak discharges and flows for the 2, 10, 25, and 100-year storms are shown in the table below (Table 2).

TABLE 2 - EXISTING SITE - PEAK DISCHARGES

WATERSHED/OUTLET	2-YEAR DISCHARGE 2-YR, 24HR = 3.3-IN		10-YEAR DISCHARGE 10-YR, 24HR = 4.6-IN		25-YEAR DISCHARGE 25-YR, 24HR = 5.7-IN		100-YEAR DISCHARGE 100-YR, 24HR = 6.7-IN	
	VOLUME (ACRE-FT)	PEAK FLOW RATE (CFS)	VOLUME (ACRE-FT)	PEAK FLOW RATE (CFS)	VOLUME (ACRE-FT)	PEAK FLOW RATE (CFS)	VOLUME (ACRE-FT)	PEAK FLOW RATE (CFS)
1	2.4	11.3	4.1	22.3	5.6	29.1	7.1	39.2
2	1.3	6.2	2.2	12.3	3.1	16.1	3.9	21.6
3	0.5	3.5	0.9	6.6	1.2	8.4	1.5	11.1
TOTAL	4.2	21	7.2	41.2	9.9	53.6	12.5	71.9

Note: All rainfall data from San Luis Obispo D graphs, rainfalls for lower drainage areas, and includes a full 24-hour storm event. The method used for total volume and flow calculations is SCS TR-20.

IV. Proposed Conditions

The proposed Port San Luis Harbor Terrace Campground includes a main commercial building at the base of the site, 32 hotel/motel units spread across four zones of the site, and generally 3 comfort stations providing restroom and sink access, along with dog washing stations at certain locations. Additionally, there are five paved RV parking areas located on terraces going up the hillside of the site and a harbor storage area in the northwest corner of the site. There are also vehicle parking lots at the base of the site and along roadways providing access to the various areas. In total these impervious areas comprise 9.5 acres of the 32 acre site. The remainder of the site is pervious area, of which some of the east portion of the site will be used for walk-in and car camping. Car camping will occur on Babe Lane. Hotel/motel units are located throughout the site and will be placed to accommodate minimal grading. The harbor storage requires an expansive paved area to accommodate equipment and boat access. The areas between the terraces will be graded to accommodate the steepness of the site and the northern portion of the site will remain undisturbed.

The proposed site is broken up into 20 sub-watersheds (SEE EXHIBIT B). These sub-watersheds, with the exception of Watershed D, are between 0.5 and 3.0 acres and have similar methods of stormwater collection, treatment, and discharge. Watershed D includes area outside the property boundary up to the ridgeline and is approximately 15 acres with approximately 2 acres of impervious area. The runoff from the pervious area of Watershed D drains directly into the piped network, while the runoff from the impervious area is treated through swales and into raingardens within the watershed, before being discharged into the pipe network. The typical treatment methodology used on this site has been to direct the stormwater in a roadside bio-swale and to route the runoff to a lined rain garden for treatment and discharge to the stormwater pipe network and outfall. This method of stormwater routing is being implemented to limit infiltration on site during storm events, where the soil can become saturated, and allows the site to conform to the San Luis Bay Coastal Area Plan which prohibits detention basins and other devices that can cause oversaturation of the underlying soils.

Due to the steepness of the proposed grades, the swales have slopes up to 12%. In order to mitigate flow velocity, and erosion of the bio-swales, check dams shall be built every 20 to 30 linear feet, depending on the slope. Additionally, in order to create level treatment areas, retaining walls, approximately six feet or lower have been provided at many of the raingardens. Using this methodology, combined with the existing and proposed site conditions, runoff coefficients and Time of Concentration (Tc) were developed for each sub-catchment area. The impervious area across the site has increased, which reduces infiltration. Thus the quantity of water leaving the site has increased, however the flow velocity has been maintained, increasing the time of concentration as the water travels through the site, and improving the quality by routing the flows through a treatment train. In the Harbor Terrace Geologic / Geo-Technical Hazards Study by Earth Systems International it is recommended not to increase infiltration of water near the landslide areas. Although the water remains on site for a longer period of time in the proposed conditions, there is less infiltration overall and no low points for inadvertent water collection and soil saturation.

The main discharge point of the site is the piped outfall that discharges into the bay. This will receive flow from all new development, which includes all of the sub-catchments, except N and R. Sub-catchments N and R, and will discharge into the roadside swale. The peak discharges and flow rates for the 2, 10, 25, and 100-year storms are shown in the table below (Table 3). This table also shows a comparison of pre to post-development discharge volumes and flow rates for the site as a whole.

TABLE 3 - PROPOSED SITE - PEAK DISCHARGES								
OUTLET	2-YEAR DISCHARGE 2-YR, 24HR = 3.3-IN		10-YEAR DISCHARGE 10-YR, 24HR = 4.6-IN		25-YEAR DISCHARGE 25-YR, 24HR = 5.7-IN		100-YEAR DISCHARGE 100-YR, 24HR = 6.7-IN	
	VOLUME (ACRE-FT)	PEAK FLOW RATE (CFS)	VOLUME (ACRE-FT)	PEAK FLOW RATE (CFS)	VOLUME (ACRE-FT)	PEAK FLOW RATE (CFS)	VOLUME (ACRE-FT)	PEAK FLOW RATE (CFS)
PIPED OUTFALL	4.9	19.08	8	38.7	10.8	48.7	13.4	56.9
ROADSIDE SWALE	0.3	1.7	0.4	3.15	0.6	3.94	0.7	5.18
TOTAL - PROPOSED	5.2	20.78	8.4	41.85	11.4	52.64	14.1	62.08
TOTAL - EXISTING	4.2	21	7.2	41.2	9.9	53.6	12.5	71.9
Δ RUNOFF	1	-0.22	1.2	0.65	1.5	-0.96	1.6	-9.82

Note: All rainfall data from San Luis Obispo D graphs, rainfalls for lower drainage areas, and includes a full 24-hour storm event. The method used for total volume and flow calculations is SCS TR-20.

V. Additional Considerations

The project has designed its storm water treatment to incorporate Low Impact Development measures around the site in order to meet minimum requirements - PR 1 and PR 2. The developer shall work with the Port San Luis Harbor District to consider achieving additional performance requirements, PR 3- Runoff Retention and PR 4-Peak Management to the maximum extent practical. As noted previously, there are geological and geotechnical safety constraints on this site that directly conflict with the hydrological goals and the county's preferred methods for meeting the Performance Requirements. Runoff retention typically requires rain water capture and infiltration or re-use for toilet flushing or irrigation use. Due to the prohibition of infiltration on site, a below ground cistern or similar storage device would need to be used to hold water for re-use. For consecutive storm events, which would overload a cistern, discharge from the site via the piped network would be required. In order to meet the requirements of PR-4 the post-construction runoff volume must not be greater than the pre-construction volume for the 10-year storm. Currently that volume is calculated to be 1.1 acre-feet, so that volume would need to retained either at grade or below grade and released slowly, into the stormwater pipe network, over a 4 hour period. This could also be achieved with a large enough cistern. Any below ground structures used for water storage would need to be constructed within the limits set by the geotechnical report for earthquake safety.

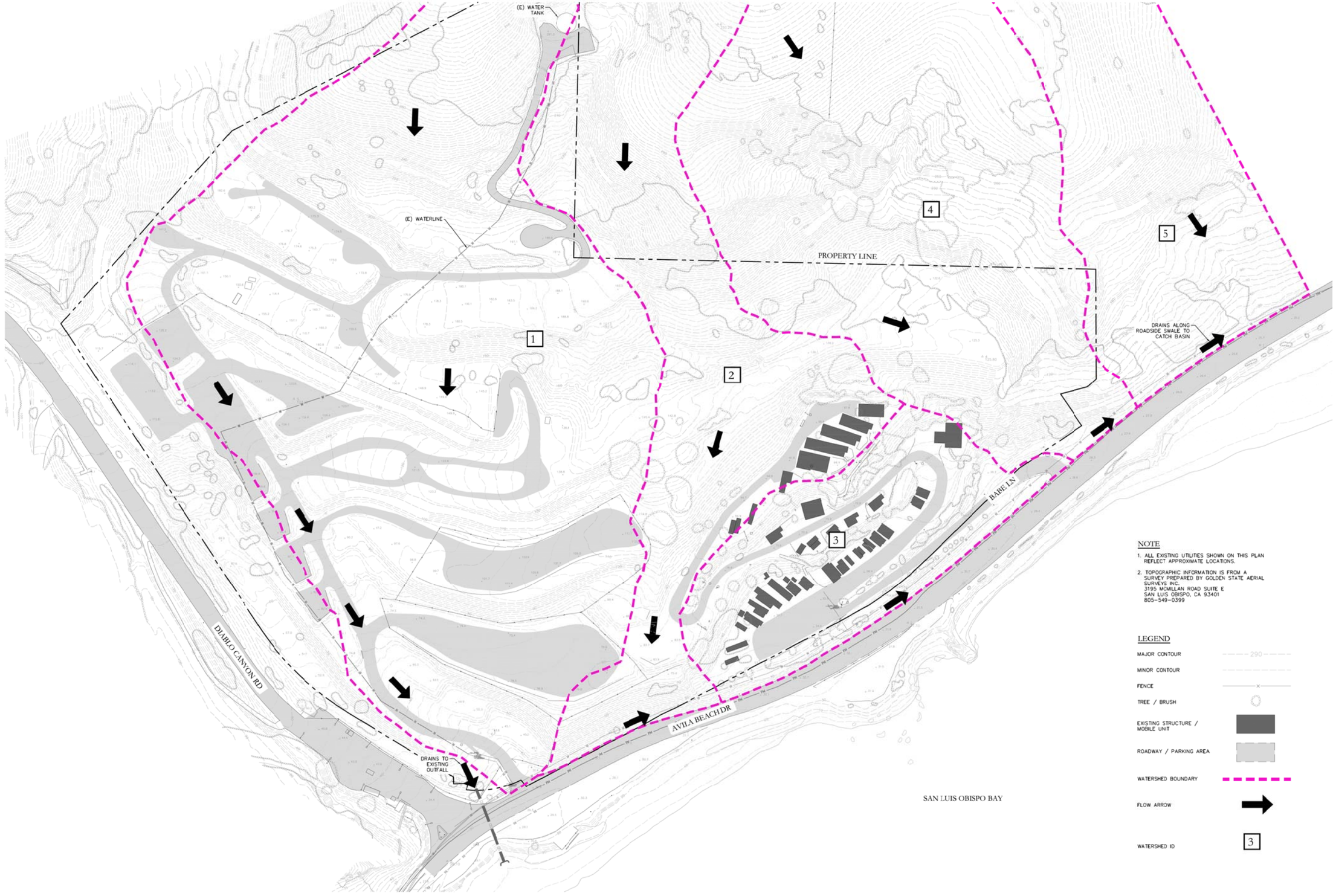

EXHIBIT A - EXISTING CONDITION

Scale 1"=60'
0' 60' 120' 240'
North
July 23, 2014

Port San Luis Harbor Terrace Campground

LAND USE PERMIT SET

lisa wise consulting, inc. | SHERWOOD DESIGN ENGINEERS | WRT | Coastal Conservancy

DRAINAGE NOTES

1. THIS PLAN ONLY DISPLAYS PRIMARY DRAIN INLETS AND PIPING 8" INCHES AND GREATER. STORM DRAIN FACILITIES 6" AND SMALLER ARE NOT SHOWN.

DRAINAGE LEGEND

- RETAINING WALL
- STORM DRAIN
- WATERSHED BOUNDARY
- SWALE
- RAINGARDEN/BIO-RETENTION AREA
- DRAIN INLET
- MANHOLE
- X — WATERSHED ID
- CULVERT

STORM WATER TREATMENT SIZING

WATERSHED ID	TOTAL TRIBUTARY AREA (SF)	IMPERVIOUS AREA (SF)	TREATMENT REQUIRED (SF)	TREATMENT PROVIDED (SF)
A	29,300	22,900	916	1,020
B	66,300	49,072	1,963	2,058
C	129,700	27,800	1,112	1,340
D	650,700	86,700	3,468	3,747
E	65,800	23,100	924	2,190
F	117,600	69,396	2,776	2,897
G	62,000	27,200	1,088	1,423
H	49,000	17,200	688	751
I	55,200	22,400	896	2,883
J	38,900	0	0	0
K	25,300	10,500	420	1,518
L	47,500	27,800	1,112	1,174
M	19,700	7,100	284	1,530
N	74,500	2',800	872	960
O*	21,500	–	–	–
P*	21,800	–	–	–
Q*	46,900	–	–	–
R*	86,400	–	–	–
TOTAL	1,609,000	4'2,968	16,519	23,491

*ALL AREAS WITHIN WATERSHED BOUNDARY TO REMAIN UNDISTURBED AND UNCHANGED

Scale 1"=60'
0' 60' 120' 240'
North

August 1, 2014

EXHIBIT B - PROPOSED CONDITIONS

LAND USE PERMIT SET

Port San Luis Harbor Terrace Campground

lisa wise consulting, inc. | SHERWOOD DESIGN ENGINEERS | WRT | Coastal Connections