Avila Beach First Street Drainage – Conceptual Design Report

Avila Beach, CA

Prepared for
San Luis Obispo County
1055 Monterey Street
San Luis Obispo, CA 93408

Prepared by
Cannon
1050 Southwood Drive
San Luis Obispo, CA 93401

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Table of Contents

1.0 Introduction

The purpose of this report is to develop, analyze, and recommend drainage improvements to reduce flooding in the Avila Beach parking lot and First Street/San Francisco Street intersection in Avila Beach, California.

This report provides background information, calculations to clarify the flooding and drainage issues which restricts usage of the existing parking lot, and drainage alternatives to alleviate the flooding. The report is organized into the following sections:

1. Introduction
2. Project Background
3. Design Criteria and Methodology
4. Field Observations
5. Descriptions of Drainage Alternatives
6. Analysis of Drainage Alternatives
7. Conclusions

2.0 Project Background

2.1 Existing Drainage Conditions

The community of Avila Beach is fronted by water on the north, west, and south ends by the Pacific Ocean and San Luis Obispo Creek. The Avila Beach parking lot and adjacent First Street/San Francisco Street intersection are located within the northeastern corner of Avila Beach. The parking lot is maintained by the Port of San Luis Harbor District while the adjacent roadways and drainage systems are generally maintained by the County of San Luis Obispo.

The drainage shed contributing to the parking lot consists of commercial and residential property, impervious asphalt concrete and pervious, undeveloped lots (see Figure 2). The slopes of the site converge at a low point in the middle of the parking lot and First Street/San Francisco Street intersection. Valley gutters and pipes convey drainage to the manmade swale on the northwest perimeter of the parking lot. The swale drains to an underground 36” storm drain system, covered by a trash rack, which ultimately discharges northeast at San Luis Obispo Creek through a duckbill outfall. The duckbill outfall was recently replaced in 2014.

The outfall in the creek lies in an area affected by tidal action; therefore, the fluctuating creek levels influence the flow from the outfall. During times of high creek levels, the outfall check valve remains closed, preventing the release of storm water into San Luis Obispo Creek. Based on observations during the Avila Beach Remediation work conducted in the late 1990’s and early 2000’s, high groundwater was present in the existing parking lot and First Street.

2.2 Flood Plain Information

The FEMA Flood Insurance Rate Map (FIRM) Community Panel Number 06079C1340G, revised November 16, 2012, indicates that the parking lot is located within Zone X. Zone X is defined as: areas of 0.2% annual chance flood; areas of 1% annual chance flood with

average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

San Luis Obispo Creek lies to the north of the parking lot opposite side of Avila Beach Drive. The creek is in an area of 100-year flooding with base flood elevations defined.

2.3 Previous Studies and Projects

The project location drainage shed, hydrology, hydraulics and tidal action have been analyzed in previous reports by Cannon. These reports can be found in the Appendix and include:

1. Drainage Study for The Colony at Avila Beach, July 2004
2. Amendment to the Drainage Study for The Colony at Avila Beach, June 2006
3. Revised Drainage Study for The Landing, June 2006

These reports calculated the total flood volume accumulated in the parking lot during the time of closure for the check valve. The flood volumes calculated were produced from the 10-year, 25-year, 50-year and 100-year, 24 hour storms. Flood elevations were calculated using the flood volumes and the existing topography.

The methods and calculations outlined in this report replicate the work done in the previous reports with the exception of updated rainfall intensity and tidal data.

2.4 Objectives

The objective of this report is to propose drainage improvements and recommendations for the following objectives

Reduce inundation of the existing parking lot and First Street/San Francisco Intersection during small storm events
Minimize environmental impacts
Comply with Federal, State and local standards

3.0 Design Criteria and Methodology

This section provides a summary of the design criteria and methodology used to analyze the existing conditions.

3.1 General

The following standards were used for hydrologic, hydraulic and tidal calculations of the existing conditions.

San Luis Obispo County Department of Public Works – 2014 Public Improvement Standards
United States Department of Agriculture (USDA) National Resource Conservation Service – Technical Release 55
Industry standard practice

3.2 Hydrologic Design Criteria

Refer to Amendment to the Drainage Study for the Colony at Avila Beach, June 2006 in Appendix C for hydrologic methodology.

3.3 Hydraulic Design Criteria

Refer to Amendment to the Drainage Study for the Colony at Avila Beach, June 2006 in Appendix C for hydraulic methodology associated with the existing duckbill and creek hydraulics.

3.4 Precipitation Data

NOAA Atlas 14, Volume 6 prepared by the U.S. Department of Commerce, was used to determine the point participation frequency estimates at the parking lot for varying storm events. This data, compared to monthly and daily precipitation stations around Avila Beach from the County of San Luis Obispo's precipitation data website, were evaluated for magnitude of storm events flooding the parking lot.

3.5 Tidal Design Criteria

The reach of San Luis Obispo Creek near Avila Beach is influenced by tidal action; therefore, we used tidal data to estimate creek elevations in relation to the invert of the 36" outfall. Furthermore, the outfall lies in the 100-year flood plain so FEMA's Flood Insurance Rate Map (FIRM) was used to find the 100-year base-flood elevation of San Luis Obispo Creek.

Based on the Amendment to the Drainage Report for The Colony at Avila Beach, Rea Strange of Pacific Weather Analysis and Mesti-Miller of Mesti-Miller Engineering concluded maximum wave setup height of 2 feet above still water was valid for analysis purposes. According to Pacific Weather, the wave set-up effect should not last longer than 3-4 hours, so to be conservative; the 2 foot wave setup was used for the entire 12 hour tidal cycle.

The following assumptions were used in determining the creek elevations at the 36" outfall:

- Tidal data from Port San Luis Station approximately equates to tidal elevations in San Luis Obispo Creek at the 36" outfall
- The 100-year peak flow will occur during high tide and dissipate in one tidal cycle

3.6 Hydrologic and Tidal Calculation Method

The tidal data and 100-year flood elevation were layered on one another to determine the highest water level at the 36" outfall. A graph of the anticipated water levels for a 24 hour period was prepared and is included in Appendix A. Using the graph, we determined the duckbill valve will be closed for approximately five hours. During those five hours, storm water will accumulate in the parking lot until the water elevation head in the parking lot can create enough pressure at the duckbill valve to overcome the creek's back pressure.

Using the 24-hour storm hydrograph, we found the most rainfall intense five hour interval in order to determine a conservative max flood volume in the parking lot. HydroCAD version 10.00 by HydroCAD Software Solutions LLC was used in calculating volume runoff.

The table below summarizes the 5-year, 10-year, 25-year and 100-year, 5-hour runoff volumes.

Design Storm	Runoff Volume (acre-ft)
5-Year Storm Event	2.60
10-Year Storm Event	3.11
25-Year Storm Event	3.80
100-Year Storm Event	4.82

After the five hour period, the creek elevation will lower enough for the outfall to partially flow. As the creek levels continue to drop, the flow of the outfall will continue to increase until it reaches its full flow of 39 cfs (at approximately 9 hours after the start of the cycle). By the time the creek levels rise again during the next high tide, the parking lot will have completely drained.

Following the first 12 hour cycle, creek levels will be substantially lower and the 36" outfall will be able to keep pace with the storm inflow. Therefore, calculations for the second 12 hours were not developed since the flood volumes will be lower.

4.0 Field and Historical Observations

4.1 General

Field reconnaissance was conducted during the month of July 2015 to observe tidal effects on the duckbill and water elevations within the existing manmade swale north of the parking lot. During these site visits, the duckbill appeared to be fully submerged at the 36" outfall and the water surface elevation was nearly spilling into the parking lot at the overflow spill location. These conditions appeared to hold constant during both low and high tide events and during all field observations.

Current tidal information was based on NOAA's Port San Luis – Station ID 9412110 during site visits and can be found at
http://tidesandcurrents.noaa.gov/stationhome.html?id=9412110#info

Based on the assumption that the duckbill is generally submerged and groundwater keeps the manmade swale at capacity, there is very little storage capacity before the parking lot and First Street/San Francisco Street intersection become inundated.

Conversations with the County indicated the project area is inundated several times a year. Review of the daily precipitation records for gauge stations Diablo Canyon #196.2 and SLO Airport #205.4 from 2012 to 2015 indicated participation depths greater than 0.40 inches/day

occurred 6 times on average per year which correlate to the constant inundation of the parking lot as described by the County.

4.2 Groundwater

Evaluation of groundwater conditions are based on observational data and an existing geotechnical report prepared by GeoSolutions, Inc., dated December 2004 (see Appendix C)

In an interview with John Evans of Cannon, the parking lot was reconstructed during the Avila Beach remediation work conducted during the late 1990s and early 2000s. High groundwater was observed during the reconstruction and initial placement of large rock to provide a level subgrade/native base for paving operations was unsuccessful. A petromat geotextile was required to create a bridge between the saturated native material and proposed pavement section. It was also observed the installation of the new sewer and water lines in First Street required constant pumping of the trench.

GeoSolutions provided geotechnical services for a development project in 2004. In evaluating the subsurface for design considerations, GeoSolutions provided an exploratory boring which found groundwater at approximately 7.0-ft of depth. Refer to Appendix C for boring information.

Prior reports and calculations in Appendix C did not account for groundwater effects.

4.3 Sand Shoaling

It has been observed that sand accumulation at the discharge of San Luis Obispo Creek into the Pacific Ocean has been severed and needed maintenance to re-establish free flow for the creek. Analysis of tidal actions and their effects on sand shoaling were not provided in this report.

5.0 Description of Drainage Alternatives

5.1 Alternative #1 - Gravity System into Sewer System

Alternative #1 includes the construction of a gravity storm drain connection to the existing sewer system to drain excess rain water. A proposed 12” line would be installed at the existing drainage inlet located at the First Street/Beach Colony Lane intersection and connect to the existing 8 inch sanitary sewer main in First Street. A manually operated valve would be installed in this connection and only opened during inundation of the parking lot.

5.2 Alternative #2 - Pumping Options

Several options were considered for Alternative #2 including the following:

2.1 Install a permanent or temporary suction pump at the 36 inch inlet of the parking lot, jack and bore a 2 to 4 inch pipe across Avila Beach Drive to the canoe storage area,

construct a dissipater structure (rock or concrete), and provide a bioswale or small basin before discharging into San Luis Obispo Creek.

2.2 Install a permanent or temporary suction pump at the 36 inch inlet of the parking lot, jack and bore a 2 to 4 inch pipe across Avila Beach Drive to the open space between the Bob Jones Trail and Avila Beach Golf Course, and install a perforated pipe and earthen swale for eventual infiltration into the groundwater basin.

2.3 Install a permanent or temporary suction pump at the north eastern terminus of the manmade gabion swale, install a baker tank for excess water storage on the County owned property (APN: 076-196-001), and release of the excess water back into the manmade gabion swale after subsidence of the storm event.

Options 2.2 and 2.3 were removed from further consideration due required storage volume needed during inundation events. Refer to Appendix A for volume storage calculation requirements. Minimum storage requirements were approximately 0.19 acre-feet or 8,300 cubic-feet. Preliminary assessment of option 2.2 provided 1800 cubic feet of storage and option 2.3 provided 1400 cubic feet of storage.

5.3 Alternative #3 – Standpipe

Alternative #3 includes the installation of a standpipe above the existing mean higher-high water level on the existing outfall pipe. This improvement would allow water to outfall during periods when the duckbill is closed due to high tide levels.

5.4 Alternative #4 – Parking Lot Reconstruction

Alternative #4 includes the regrading of the existing parking lot and First Street to raise the sump points higher for additional storage prior to ponding and provides more hydraulic head to the storm drain system.

Further review of this alternative rendered it unfeasible due to the private property and existing utility impacts based on raising the sump elevations at the intersection of First Street/San Francisco Street. Existing finished floors of adjacent First street homes and businesses would be affected by raising elevations in the general area.

6.0 Analysis of Drainage Improvements

The following subsection provides the framework for the analysis of alternatives: Environmental Permitting Requirements, Stakeholder Maintenance and Maintenance Responsibilities, and Costs.

6.1 Permitting Requirements

6.1.1 Alternative #1 - Gravity System into Sewer System

Several agencies may be involved with the review of this proposed alternative. Some of the agencies include, but are not limited to, County of San Luis Obispo, Avila Beach Community Services District, and Regional Water Quality Control Board (RWQCB).

The existing sewer system and wastewater treatment plant is under the regulatory authority of the Avila Beach CSD. Discharge into the existing sewer system could affect the capacity of the existing system and may require a modification to the existing NPDES permit with the RWQCB. Also, if the storm water has high concentrations of salinity, the wastewater treatment plant may not be capable of handling this additional discharge.

6.1.2 Alternative #2 – Pumping Options

Several agencies may be involved with the review of these proposed alternatives. Some of the agencies include, but are not limited to, County of San Luis Obispo, Port of San Luis Harbor District, Regional Water Quality Control Board (RWQCB), US Army Corps of Engineers, US Fish & Wildlife, Coastal Commission, Cal OSHA, and ABR Property LP.

Alternative 2.1 will require a 404 permit will be submitted to the Army Corps for review on potential impacts to San Luis Obispo Creek. As part of the 404 permit, US Fish & Wildlife will be consulted regarding additional impacts to the creek ecosystem. On the state level, RWQCB will review the alternatives for water quality control measures for discharges into San Luis Obispo Creek. Coastal Commission will review the alternatives for coastal impacts. Cal OSHA will review the boring activities necessary for installing the pipe underneath Avila Beach Drive. The permit the boring work will be obtained by the Contractor during construction.

6.1.3 Alternative #3– Standpipe

Removal of the duckbill with a standpipe will require compliance with the County.

6.2 Stakeholder Maintenance and Maintenance Responsibilities

6.2.1 Alternative #1 - Gravity System into Sewer System

Alternative #1 will require new maintenance of the valve and additional maintenance requirements of the existing sewer and wastewater treatment plant systems.

The valve will be the responsibility of the County will the remaining system will we maintained by Avila Beach CSD with share costs by the County.

6.2.2 Alternative #2 – Pumping Options

Alternative #2.1 will require maintenance of the pump and swale or basin. The County will own and maintain the system with cost sharing between the County and Harbor District.

6.2.3 Alternative #3 – Standpipe

Alternative #3 will require no additional maintenance.

6.3 Preliminary Opinion of Probable Costs

6.3.1 Alternative #1 - Gravity System into Sewer System

Alternative #1 will cost approximately $65,000. These costs assume no upgrades to the sewer or wastewater treatment facility infrastructure based on water quality issues or additional flow rates.

Description	Costs
Project Development	$20,000
Construction	$40,000
Construction Management	$5,000
Total	$65,000

6.3.2 Alternative #2 – Pumping Options

Alternative #2.1 will cost approximately $375,000.

Description	Costs
Project Development	$100,000
Construction	$250,000
Construction Management	$20,000
Total	$375,000

6.3.3 Alternative #3- Standpipe

Alternative #3 will cost approximately $27,000.

Description	Costs
Project Development	$10,000
Construction	$15,000
Construction Management	$2,000
Total	$27,000

7.0 Conclusion

Initial analysis of the existing storm drain system, duckbill outfall, and tidal conditions provide data which does not appear to represents field observations. In review of the calculations, the manmade swale north of the parking lot should have been observed as dry during the month of July. However, the water surface elevation in the manmade swale was generally observed to be near the spill elevation of the parking lot during all site visits.

During field visits with the County, the initial assumption was the existing duckbill was not performing and allowed backwater into the system. This assumption would explain the constant water surface elevation of the swale. Because the duckbill was constantly submerged, this theory was most plausible.

Duckbills are typically installed in tidal/marine conditions as their rubber construction minimizes corrosion experienced by flap or tide gates. Further research of the duckbill indicated they performed well in minimizing backwater effects. Previously, this outfall was operated by a flap gate. The efficiency of the flap gate declined as debris stuck the gate in the open position. As tides rose, backwater in the system created more frequent flooding in Avila Beach. The County determined the duckbill, which was recently replaced in 2014, was the better alternative for this outfall condition.

Upon further review of the site conditions and historical data, it was brought to the teams attention that high groundwater was experienced during the Avila Beach Remediation project in the late 1990s. John Evans explained the difficulty of the parking lot reconstruction efforts and utility installations because of constant groundwater in the area. In review of a geotechnical boring conducted in the area, groundwater was observed approximately 7 feet below the surface near Front Street. Based on this data and John's observation, we believe high groundwater is present in the area and is keeping the manmade swale full of water when the duckbill is submerged and cannot release water. Additional evidence points to the frequency of flooding at the project site. Minimal rainfall events will inundate the parking lot and intersection, per the calculations as shown in Appendix A, and correlates to the daily precipitation records in the general area. Also, due to the low elevations of the spill points of the parking lot and intersection, minor tidal effects to the groundwater elevation may explain standing water in the area when precipitation is not observed.

The conditions of the existing sandbar, which may be restricting San Luis Obispo Creek flow, may also be contributing to the high water levels at the duckbill observed during field visits. If flows are restricted to the Ocean, the backwater effect main be the principal cause of the high water level observed at the duckbill. The observation of no noticeable impacts to the water elevation during high tides vs. low tides may also be explained by this restriction of flow from the Creek.

Alternative #1 is contingent on many factors including; existing water quality (salinity), impacts to the treatment plant for treatment upgrades or upsizing of the system to accommodate additional flows, and maintenance and operating agreements between the County and Avila Beach CSD. As many of these items are presently unknown, the costs can exponentially increase if the existing plant requires upgrades.

Alternative #3 provides little to no benefit to the flooding problem. The standpipe will provide additional release of flow, but will need to be elevated above the Mean Higher-High Water level calculated in Appendix A. This outfall elevation compared to the spill elevation only provides a few inches of grade differential before the parking lot begins to flood. Also, in a 100-yr event, the standpipe would allow for backwater and additional flooding of the system.

Alternative #2 is recommended for this project due to the amount of options available to the stakeholders. Initial calculations with a 250 gpm rated pump will drain the site in less than 15 hours based on the runoff volume generated during a 0.8 inch, 24-hr storm event. This alternative also provides the stakeholders with the option to install a permanent pump in place, purchase of a mobile pump on a trailer, or rental of a pump.

8.0 Figures

The following exhibits are included:

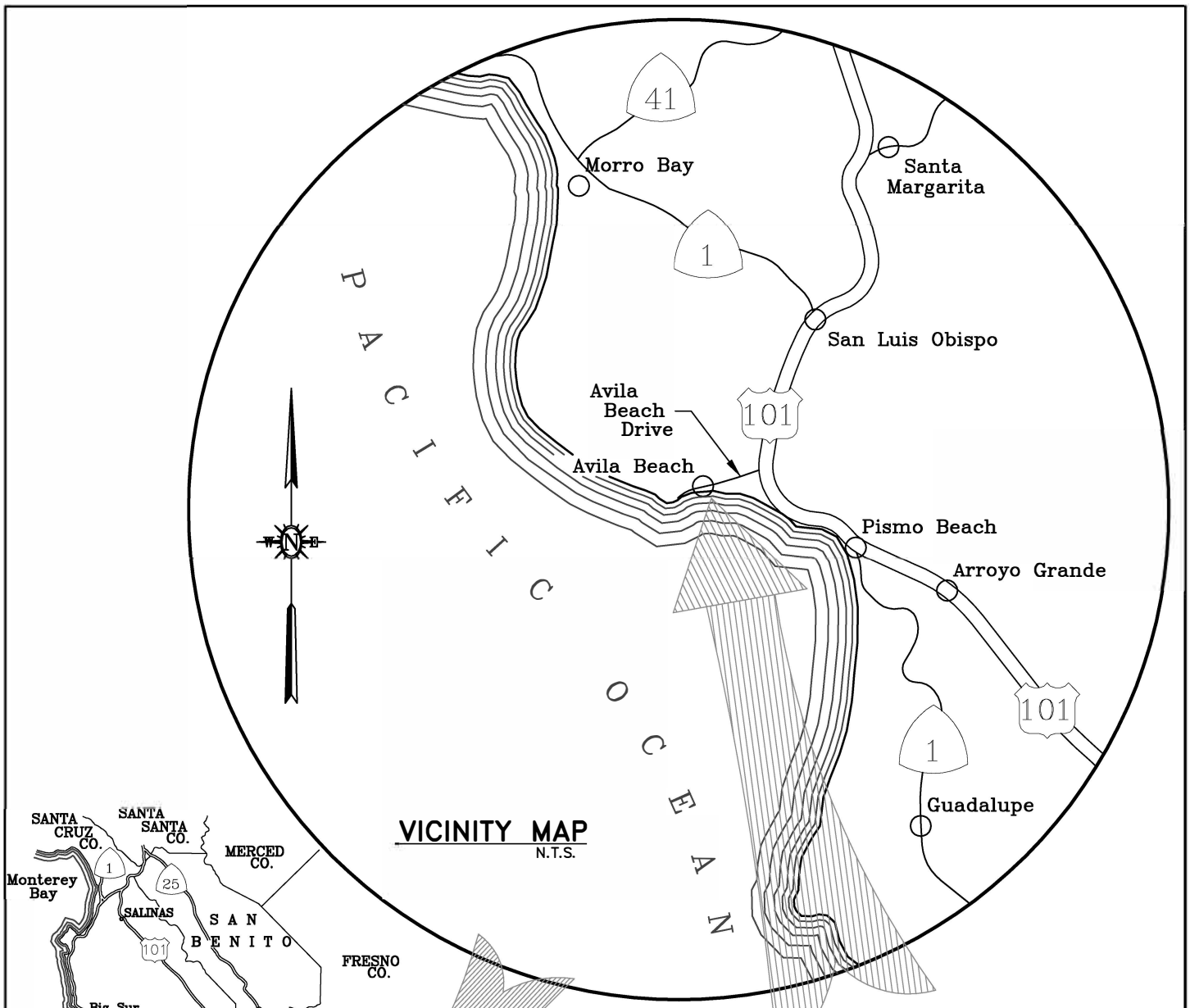
Figure 1: Vicinity Map
Figure 2: Shed Map/Inundation Limits
Figure 3: Existing Drainage Facility Map
Figure 4.1: Alternative #1
Figure 4.2: Alternative #2
Figure 4.3: Alternative #3

9.0 Technical Appendices

The following technical appendices are included:

Appendix A: Calculations
Appendix B: NOAA and San Luis Obispo County Precipitation Records
Appendix C: Previous Studies and Reports

Figures



VICINITY MAP
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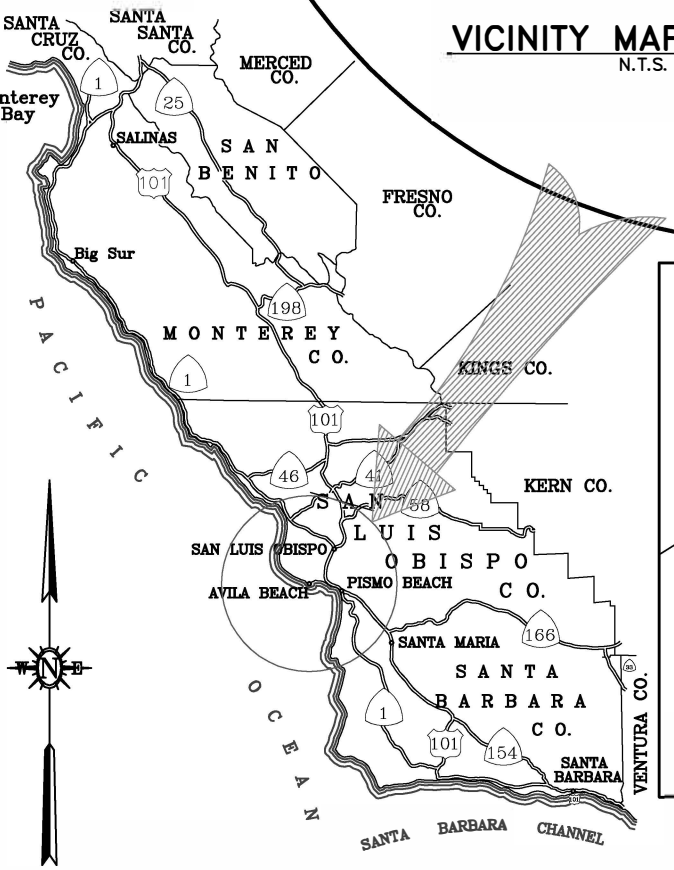

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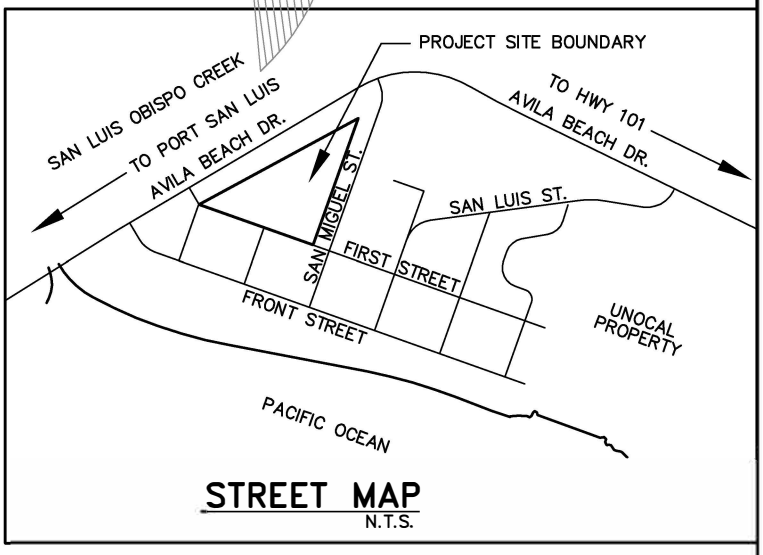

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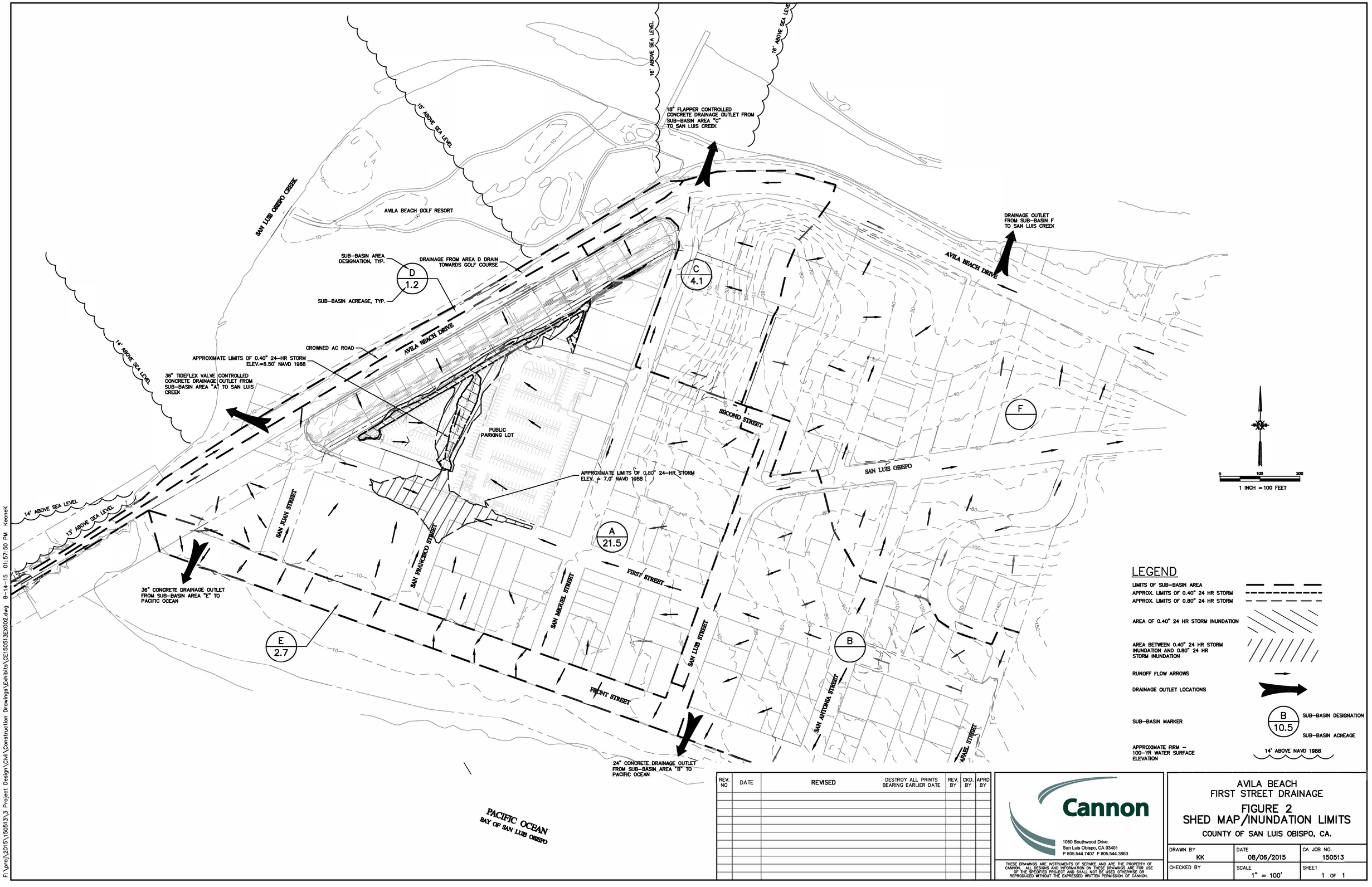

LEGEND

- LIMITS OF SUB-BASIN AREA
- APPROX. LIMITS OF 0.40" 24 HR STORM
- APPROX. LIMITS OF 0.80" 24 HR STORM
- AREA OF 0.40" 24 HR STORM INUNDATION
- AREA BETWEEN 0.40" 24 HR STORM INUNDATION AND 0.80" 24 HR STORM INUNDATION
- RUNOFF FLOW ARROWS
- DRAINAGE OUTLET LOCATIONS
- SUB-BASIN MARKER — B / 10.5 — SUB-BASIN DESIGNATION / SUB-BASIN ACREAGE
- APPROXIMATE FIRM – 100-YR WATER SURFACE ELEVATION — 14' ABOVE NAVD 1988

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Cannon
1050 Southwood Drive
San Luis Obispo, CA 93401
P 805.544.7407 F 805.544.3863

AVILA BEACH
FIRST STREET DRAINAGE
FIGURE 2
SHED MAP/INUNDATION LIMITS
COUNTY OF SAN LUIS OBISPO, CA.

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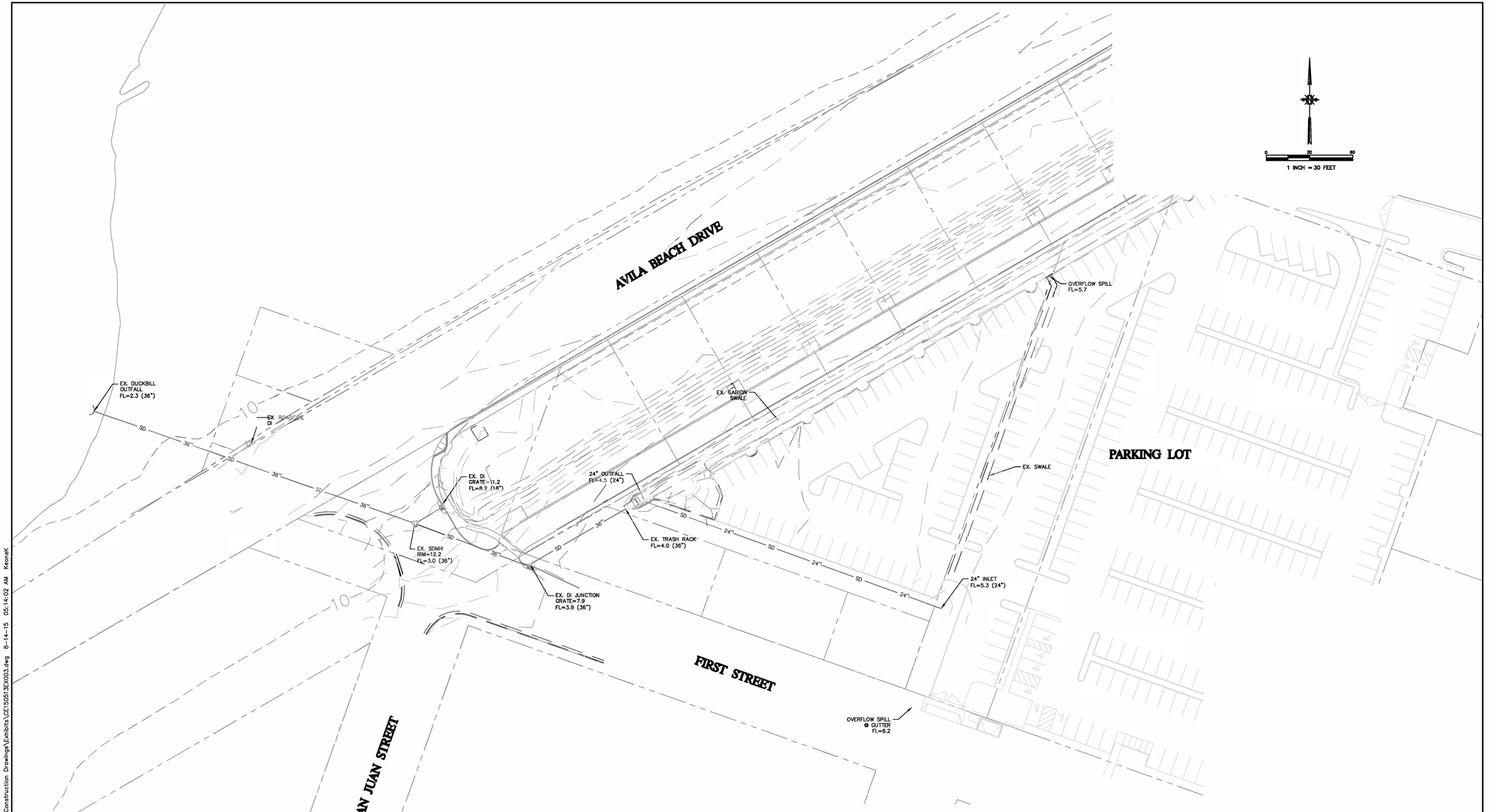

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AVILA BEACH
FIRST STREET DRAINAGE

FIGURE 3
EXISTING DRAINAGE FACILITY MAP

COUNTY OF SAN LUIS OBISPO, CA.

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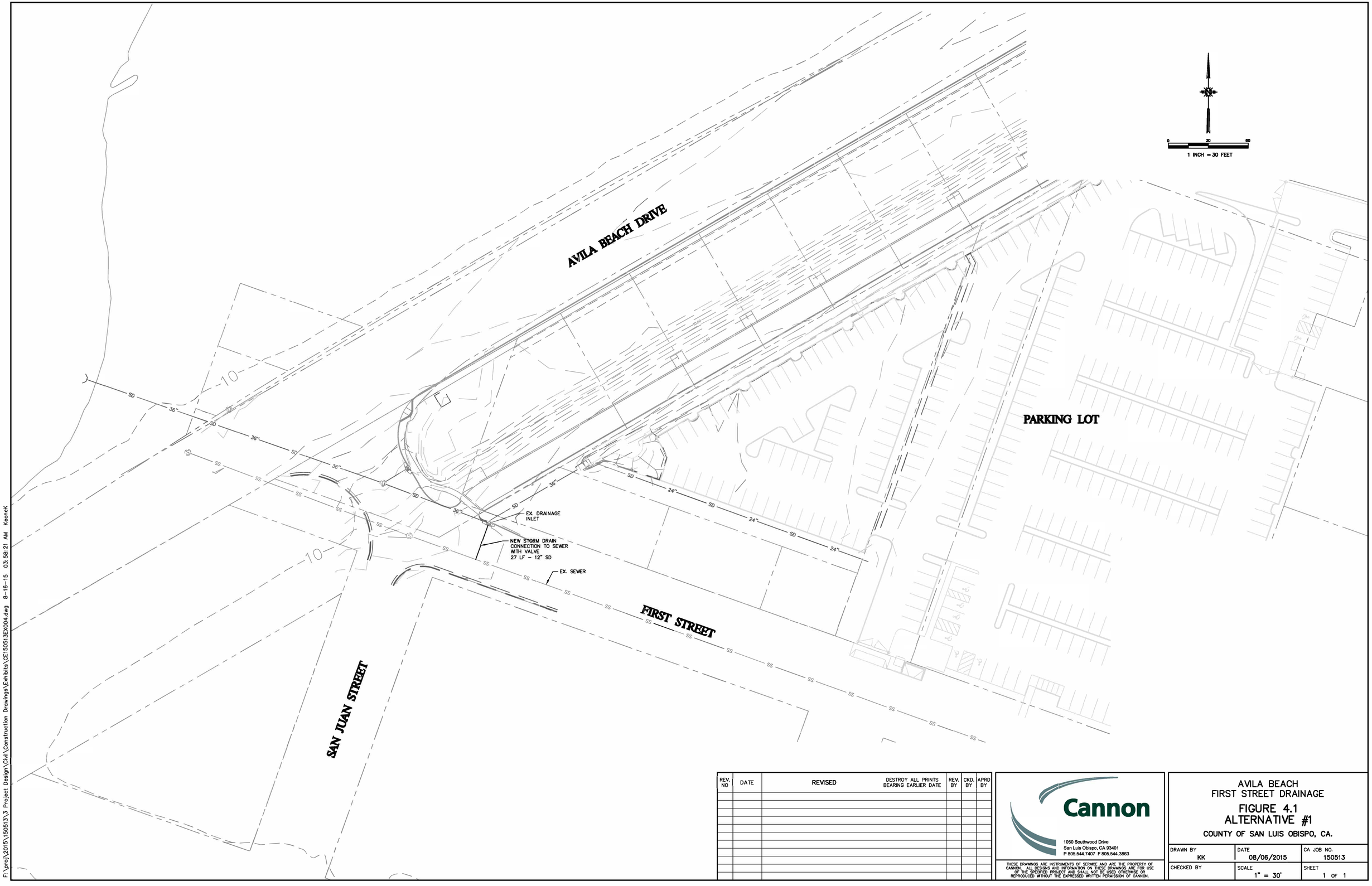

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AVILA BEACH FIRST STREET DRAINAGE

FIGURE 4.1 ALTERNATIVE #1

COUNTY OF SAN LUIS OBISPO, CA.

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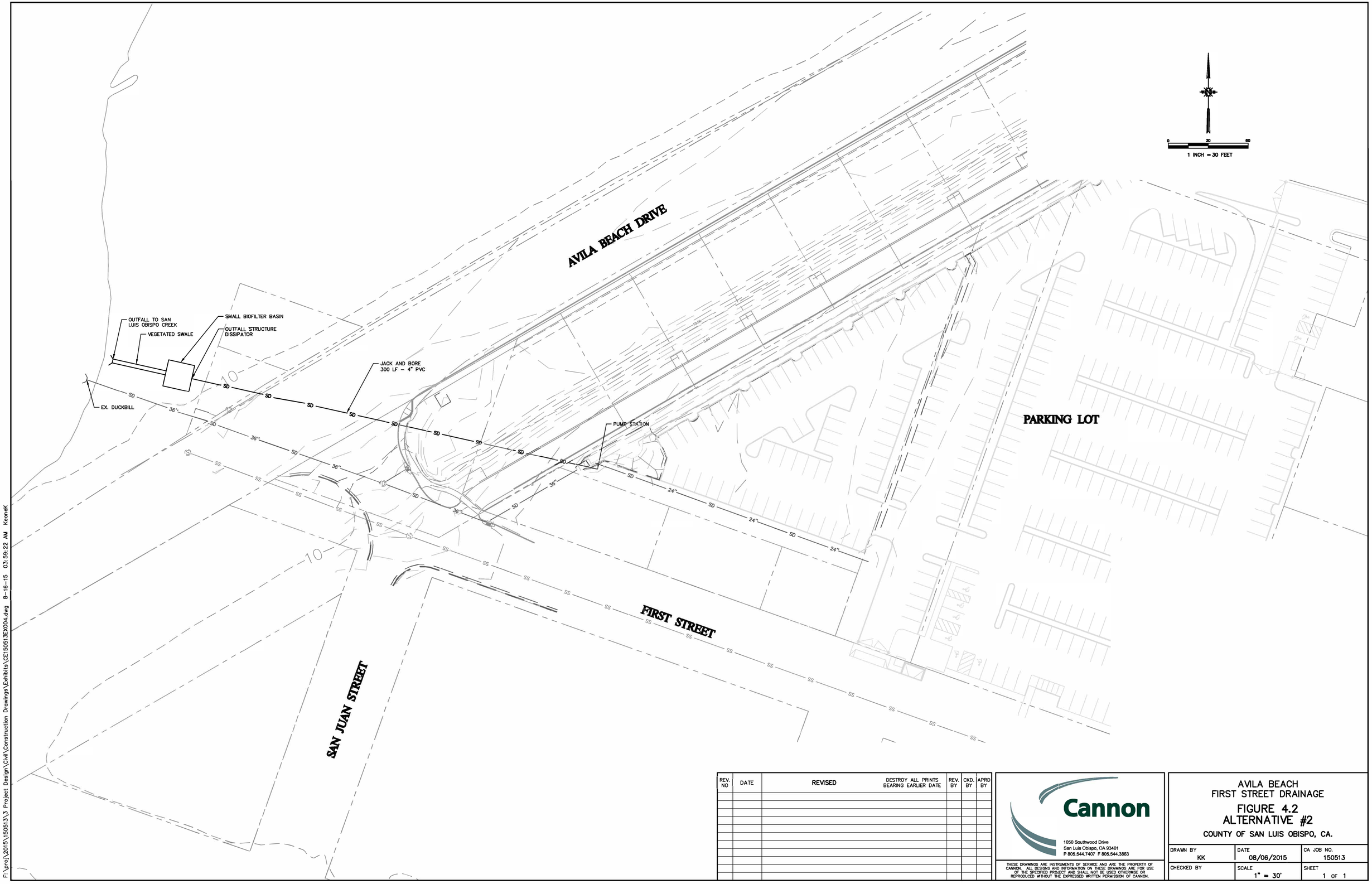

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AVILA BEACH FIRST STREET DRAINAGE

FIGURE 4.2 ALTERNATIVE #2

COUNTY OF SAN LUIS OBISPO, CA.

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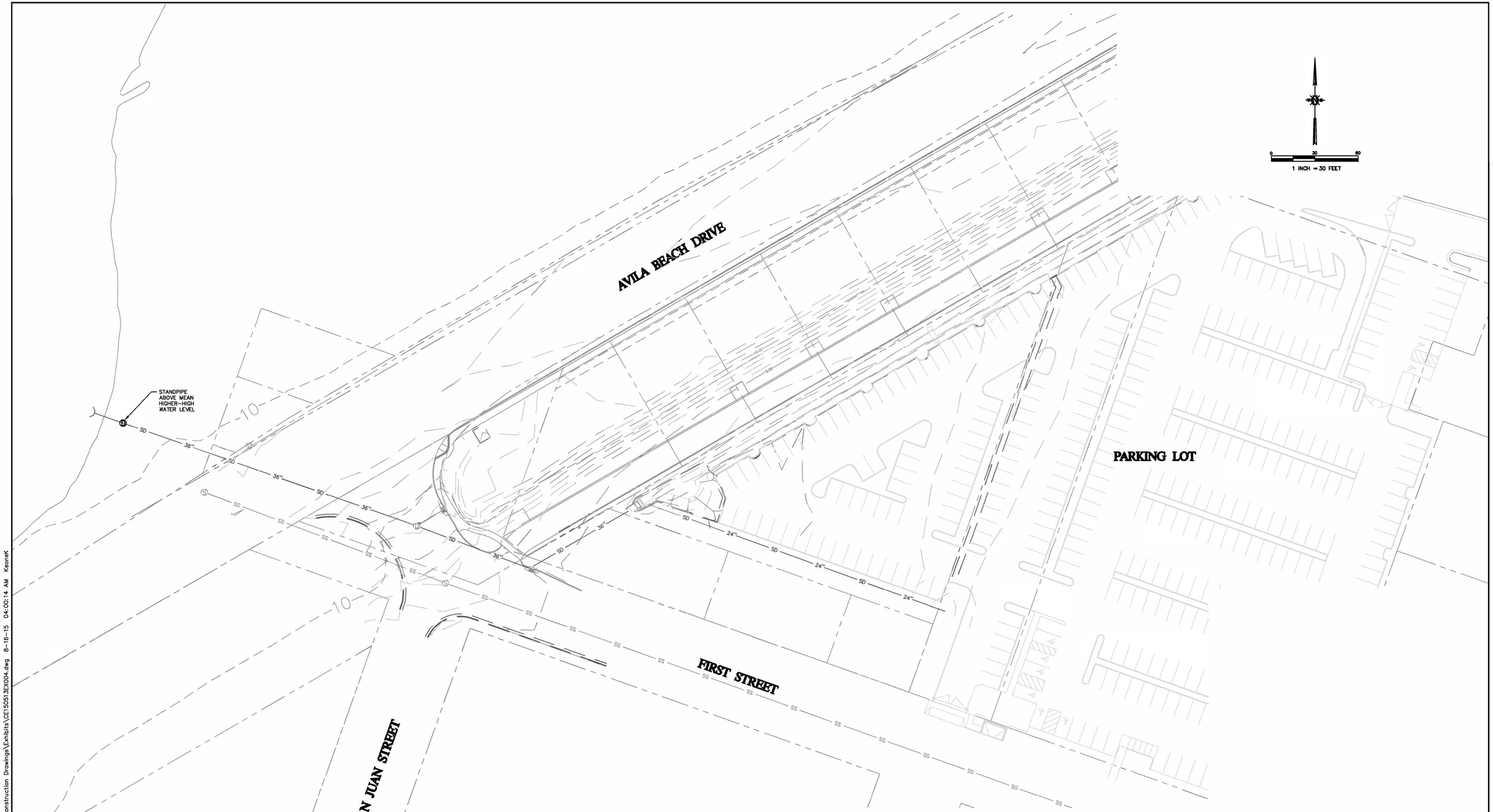

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AVILA BEACH FIRST STREET DRAINAGE

FIGURE 4.3 ALTERNATIVE #3

COUNTY OF SAN LUIS OBISPO, CA.

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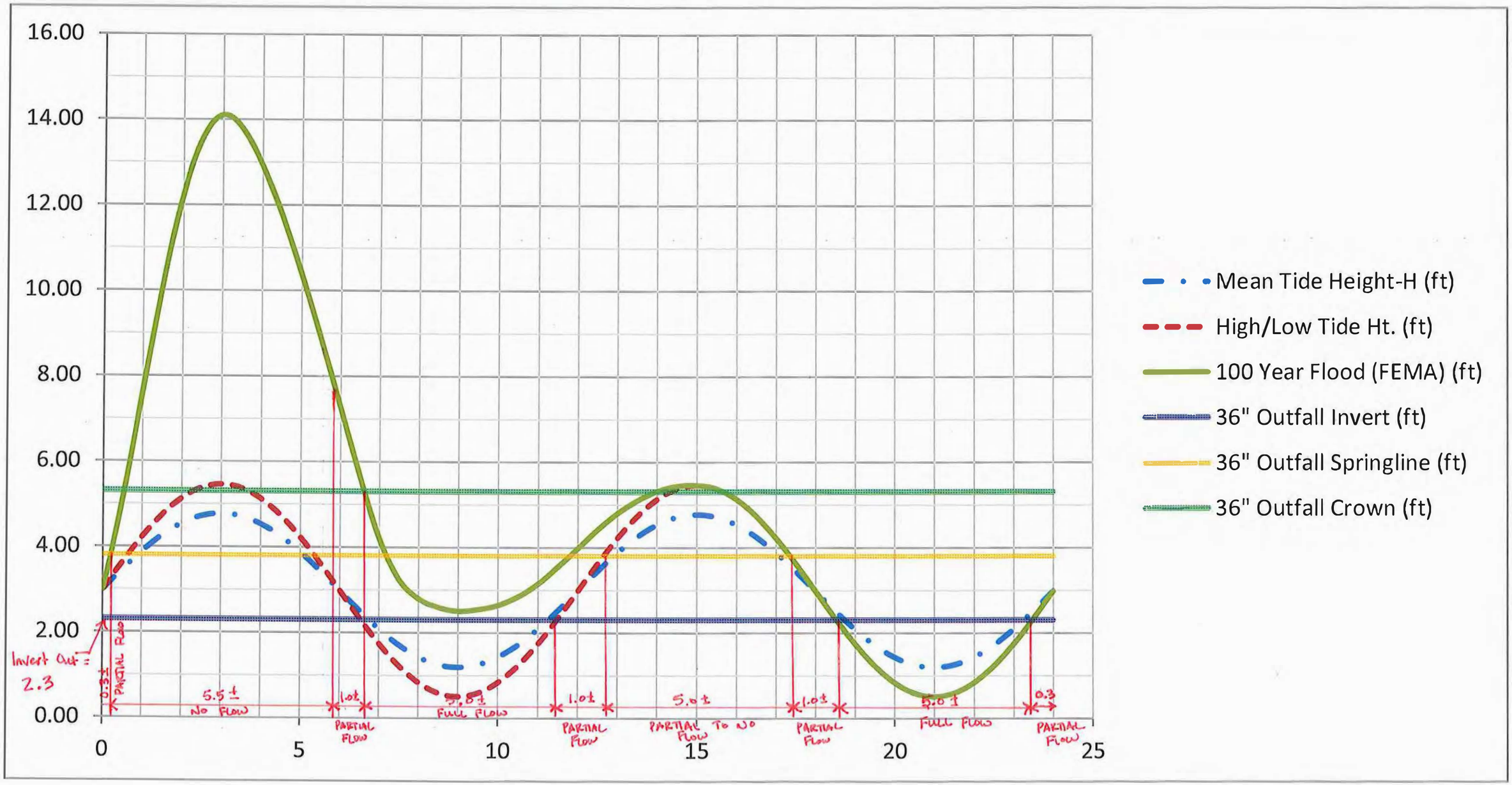
Appendix A

Tidal Data and Calculations

NOAA Tidal Data (May 1, 2014 — May 1, 2015)																	
Year	Month	Highest	MHHW	MHW	MSL	MTL	MLW	MLLW	DTL	GT	MN	DHQ	DLQ	HWI	LWI	Lowest	Inferred
2014	5	6.191	5.295	4.577	2.769	2.79	1.004	-0.046	2.625	5.341	3.573	0.719	1.05	5.85	11.95	-0.896	0
2014	6	6.522	5.505	4.705	2.904	2.93	1.155	0.056	2.782	5.446	3.55	0.801	1.099	5.83	11.92	-1.26	0
2014	7	6.877	5.607	4.836	3.045	3.064	1.289	0.302	2.953	5.305	3.547	0.771	0.991	5.78	11.91	-1.158	0
2014	8	6.634	5.449	4.783	3.015	3.022	1.263	0.548	2.999	4.902	3.52	0.666	0.715	5.78	11.91	-1.05	0
2014	9	6.404	5.541	5.02	3.235	3.248	1.476	0.801	3.173	4.744	3.543	0.522	0.679	5.81	11.94	-0.325	0
2014	10	6.558	5.581	5.128	3.301	3.33	1.532	0.682	3.132	4.898	3.596	0.453	0.85	5.79	11.96	-0.236	0
2014	11	6.306	5.459	4.833	2.972	3	1.168	0.177	2.818	5.282	3.665	0.627	0.991	5.78	11.94	-1.086	0
2014	12	6.844	5.853	5.033	3.189	3.212	1.388	0.335	3.094	5.518	3.645	0.817	1.053	5.81	11.96	-1.076	0
2015	1	6.736	5.636	4.81	2.982	2.995	1.178	0.125	2.881	5.512	3.629	0.827	1.053	5.82	11.92	-1.198	0
2015	2	6.175	5.338	4.695	2.884	2.897	1.099	0.289	2.813	5.049	3.596	0.643	0.81	5.75	11.87	-1.099	0
2015	3	5.873	5.023	4.603	2.805	2.818	1.033	0.341	2.682	4.682	3.57	0.42	0.692	5.87	12.02	-0.463	0
2015	4	6.22	4.885	4.472	2.68	2.702	0.932	0.197	2.541	4.688	3.54	0.413	0.735	5.82	11.98	-0.676	0
2015	5	6.24	5.236	4.593	2.802	2.828	1.06	0.112	2.674	5.125	3.533	0.643	0.948	5.83	11.97	-1.073	0

SLO CREEK ELEVATIONS
FOR 24-HR PERIOD
DURING 100-YR. STORM
AT 36" ϕ RCP OUTLET



Storage Volumes and Calculations

Existing Storage: Avila Beach First Street Drainage (Prior to Overflow into Parking Lot)

Storage Items (Prior to Overflow):

Pipe:	ID*	Type	Length (ft)	Area (sf)**	Volume (cf)
24"	22.5	Concrete	190	1.08	205.20
36"	34	Concrete	400	5.89	2356.00
				Total:	2561.20

* Approximate
**Partial Flow Areas Determined from Flowmaster

Swales:	Length (ft)	Area (sf)	Volume (cf)		
Gabion***	430	18	5358		
Concrete****	140	12	502	Total:	5860

*** Gabion Swale Dimensions: ~3'x6', well defined
**** Concrete swale:~3'x4', ties into gabion swale directly. Approximate area based on site visit/survey.

TOTAL STORAGE BEFORE OVERFLOW:	8421.20	CF
	311.90	CY
	0.19	Acre-ft

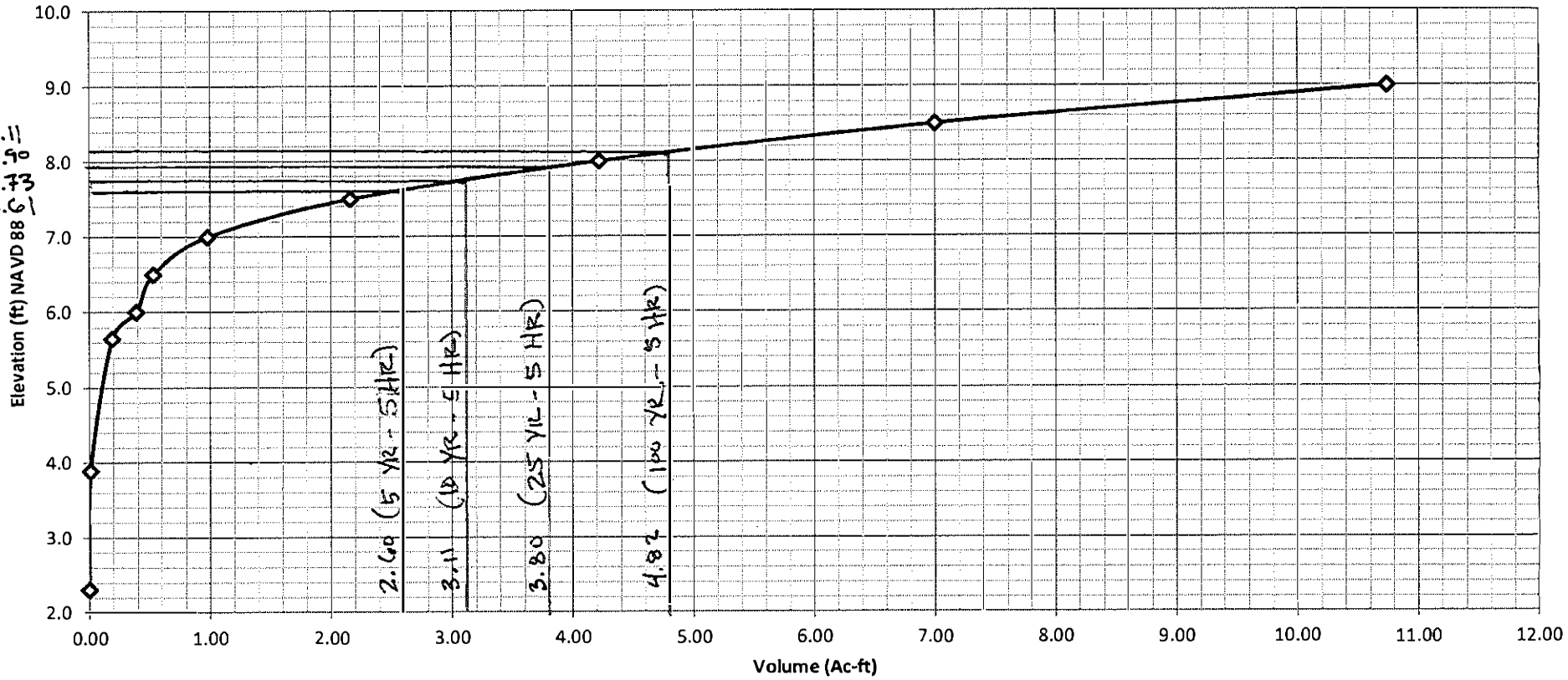
Existing Storage: Avila Beach First Street Drainage (Parking Lot) Small Storms

Stage vs. Storage of Ex. Parking Lot (Manmade Swale Full)

Elev. (NAVD88)	Storage (ac-ft)
5.65	0
6	0.03
6.5	0.17
7	0.62
7.5	1.8
8	3.86
8.5	6.46
9	10.38

24-HR Storm Depth (in)	Runoff Volume (ac-ft)	Peak Runoff (cfs)	Depth of Flooding (elev)
0.1	0	0	0
0.2	0.026	0.03	5.95
0.3	0.094	0.42	6.23
0.4	0.189	1.26	6.50
0.5	0.302	2.29	6.60
0.6	0.428	3.46	6.80
0.7	0.564	4.72	6.90
0.8	0.706	6.05	7.00
0.9	0.854	7.43	7.10
1.0	1.000	8.84	7.20

Avila Flood Plain: Flood Elevation vs. Volume (No Groundwater)

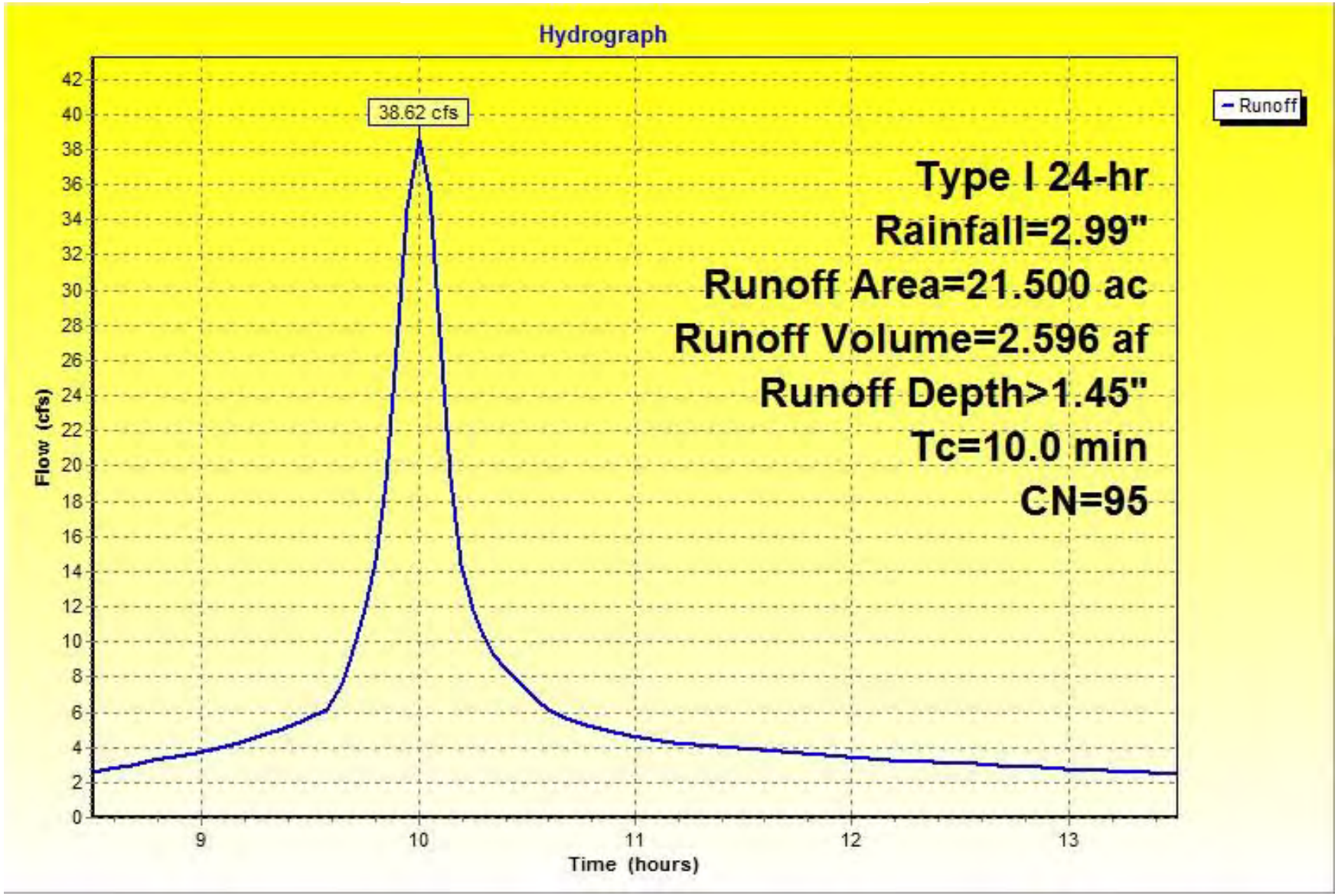


SPILL ELEV. = 5.65 FT.

HydroCAD Reports

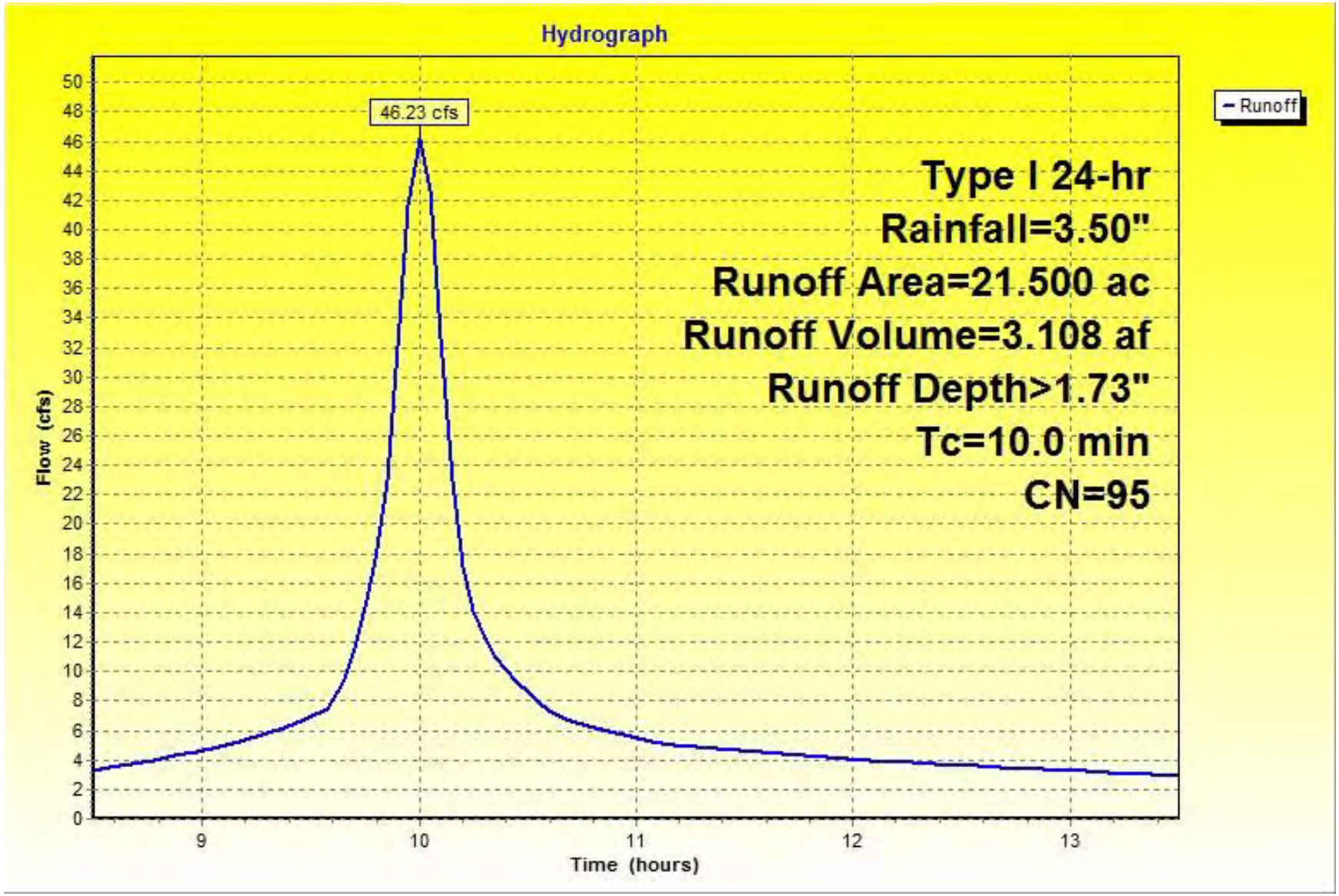
5-Year, 24-Hour Storm Event

5 Hour Time Interval (8.5-13.5 hour)



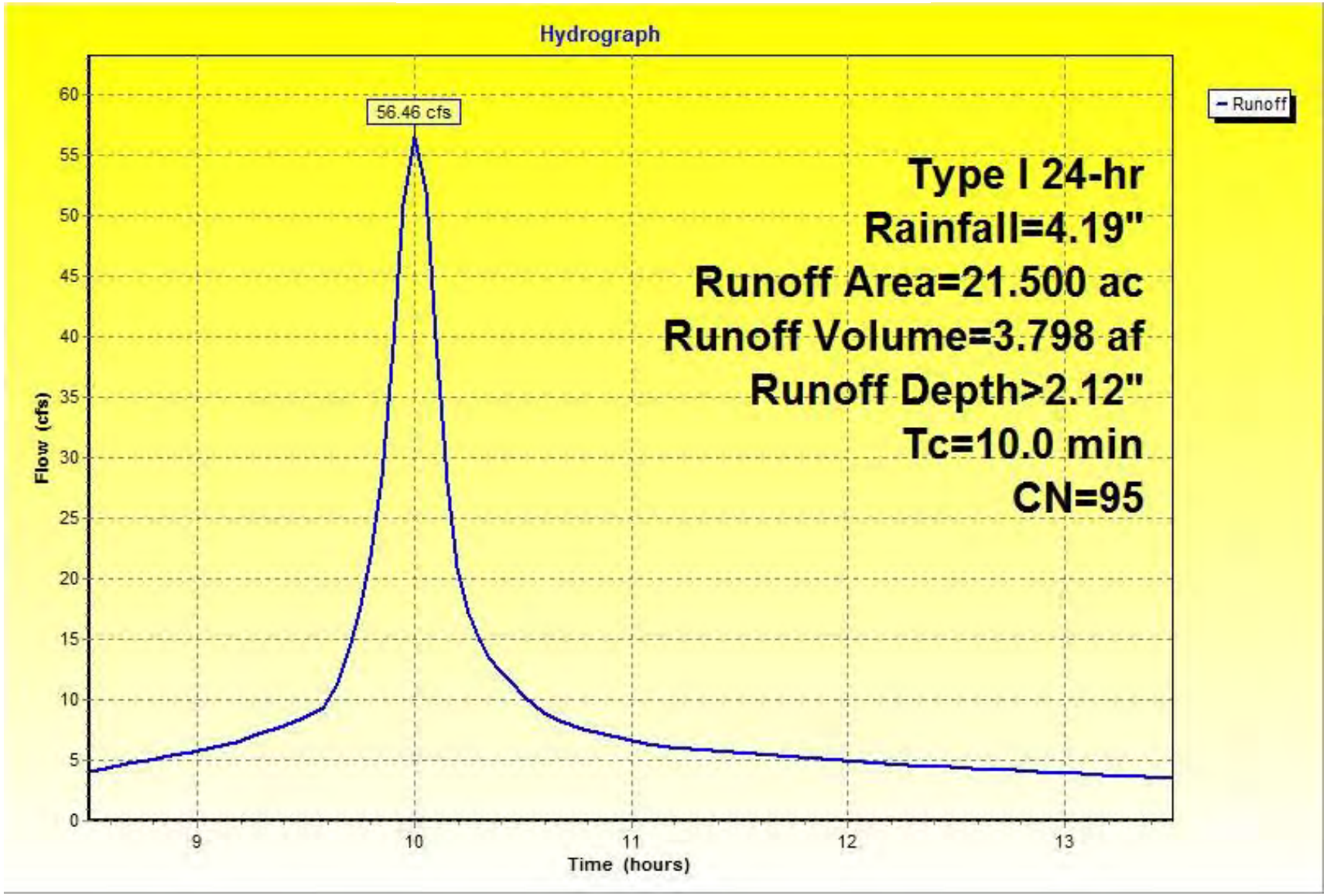
10-Year, 24-Hour Storm Event

5 Hour Time Interval (8.5-13.5 hour)



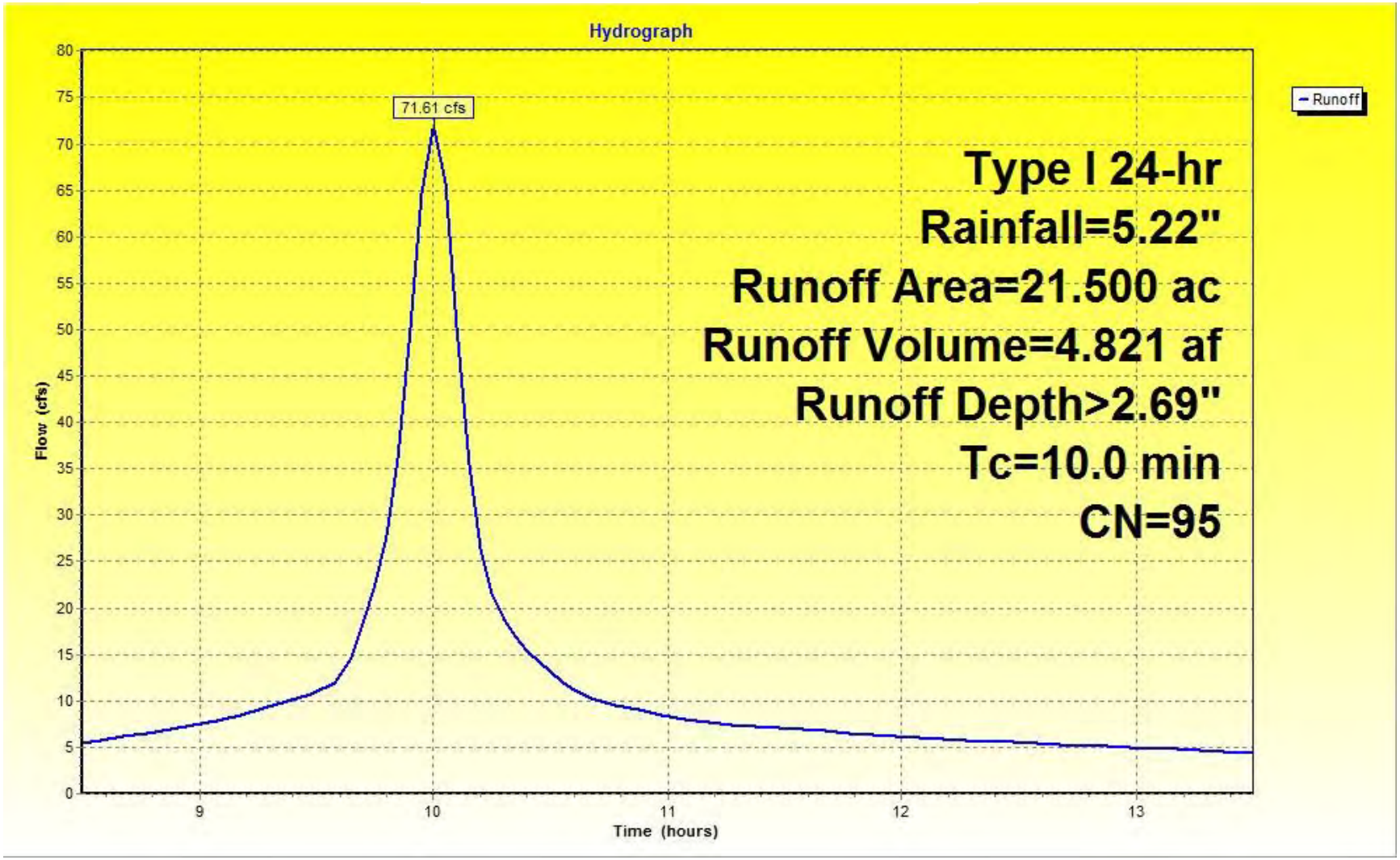
25-Year, 24-Hour Storm Event

5 Hour Time Interval (8.5-13.5 hour)

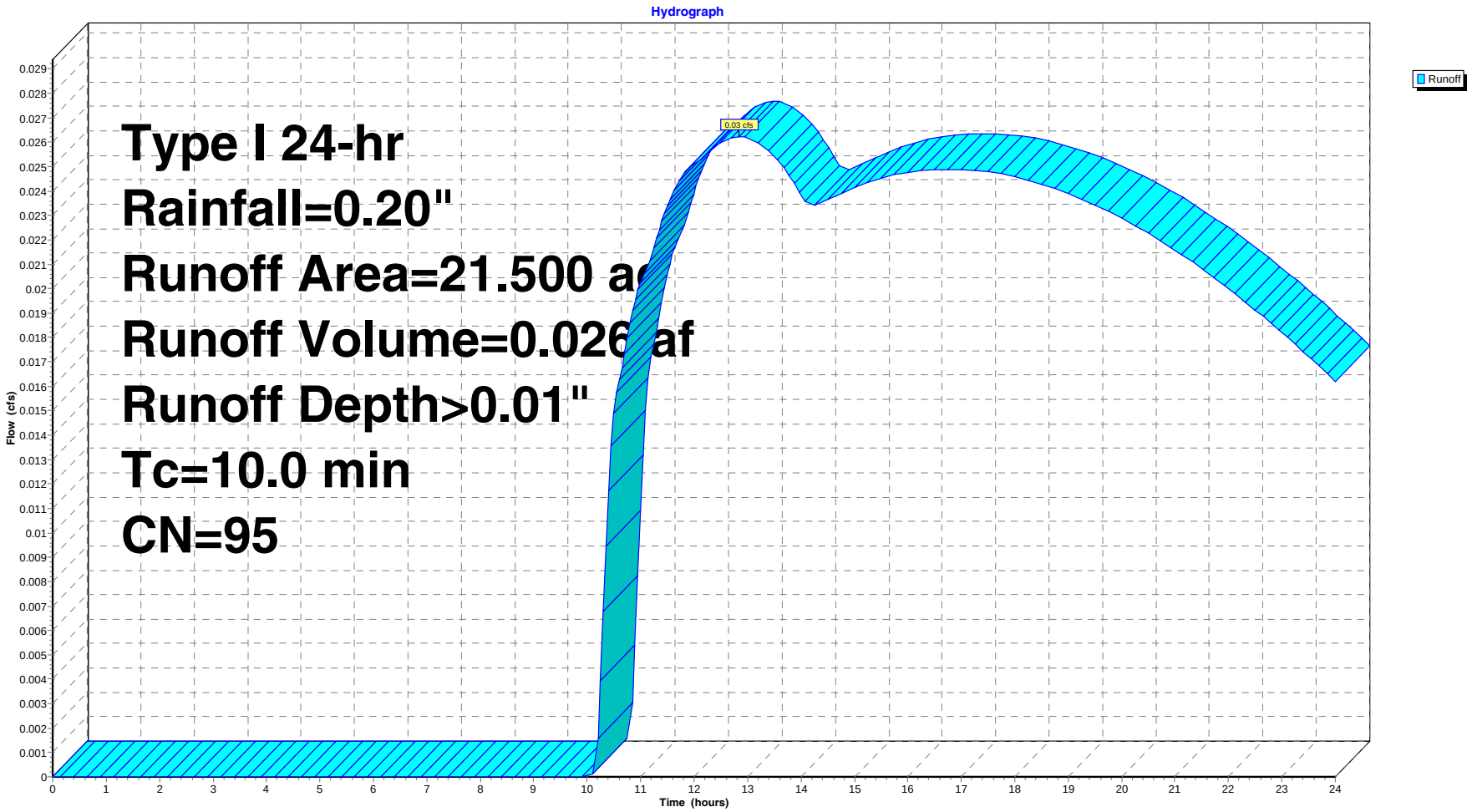


100-Year, 24-Hour Storm Event

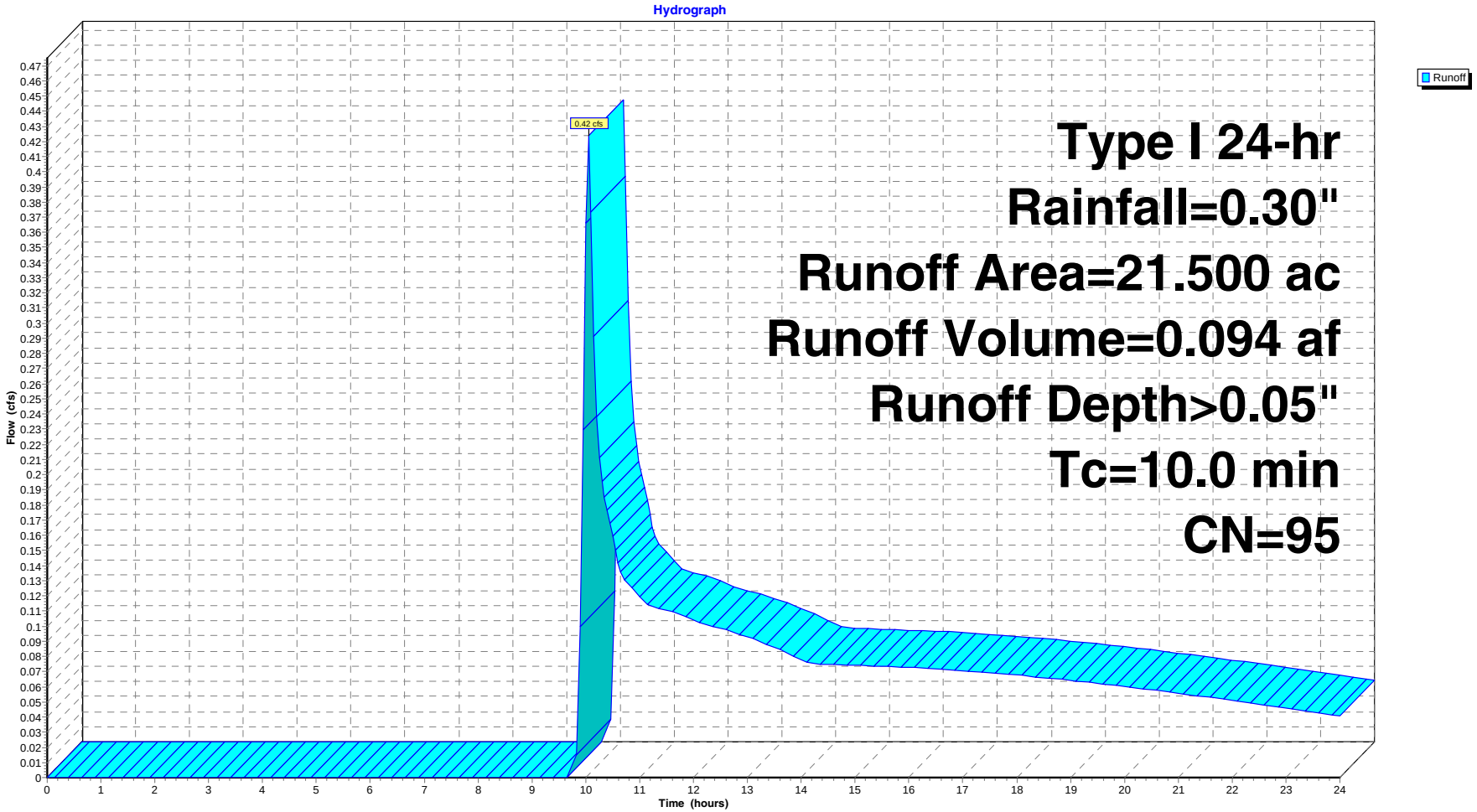
5 Hour Time Interval (8.5-13.5 hour)



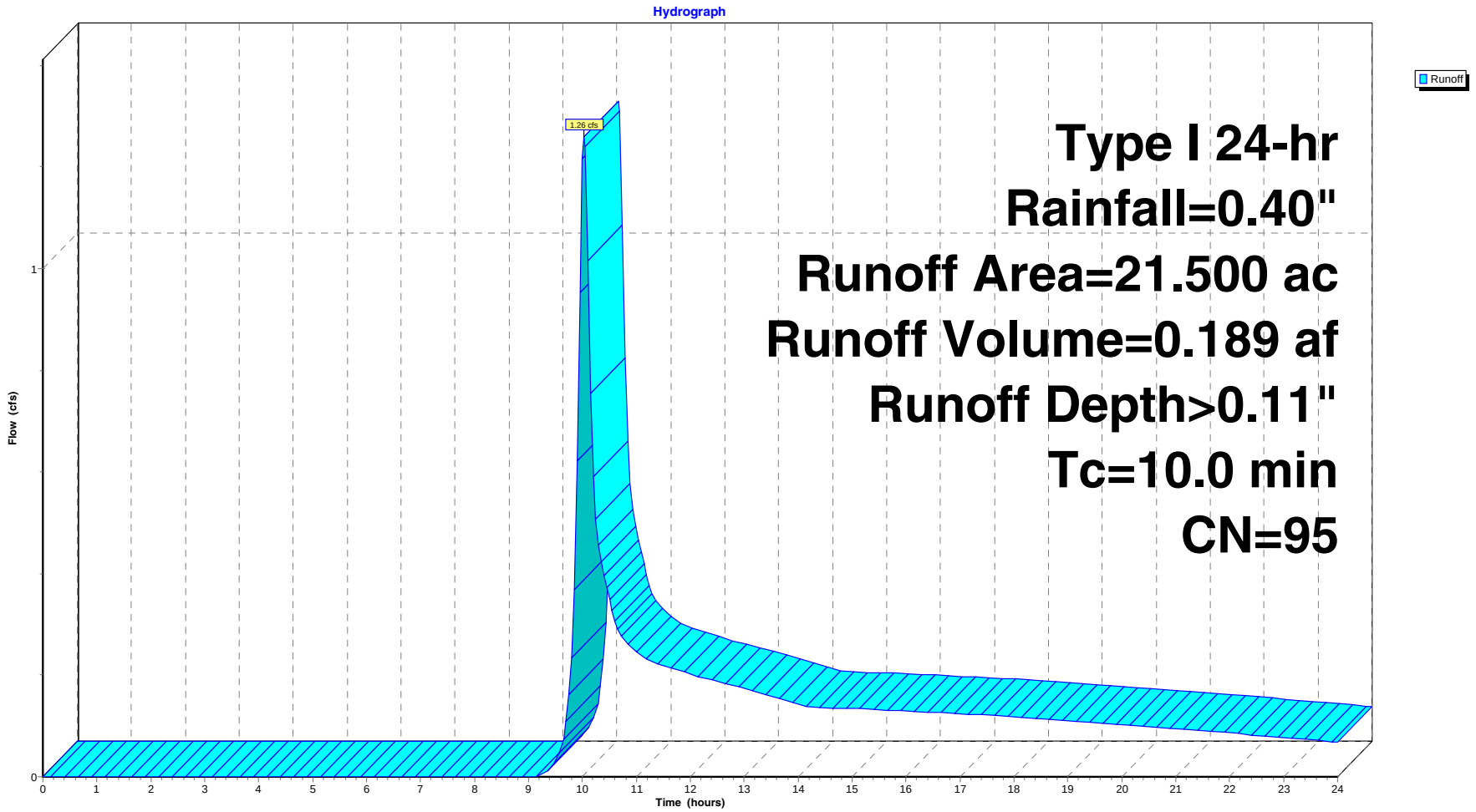
Subcatchment 1S: Avila Beach



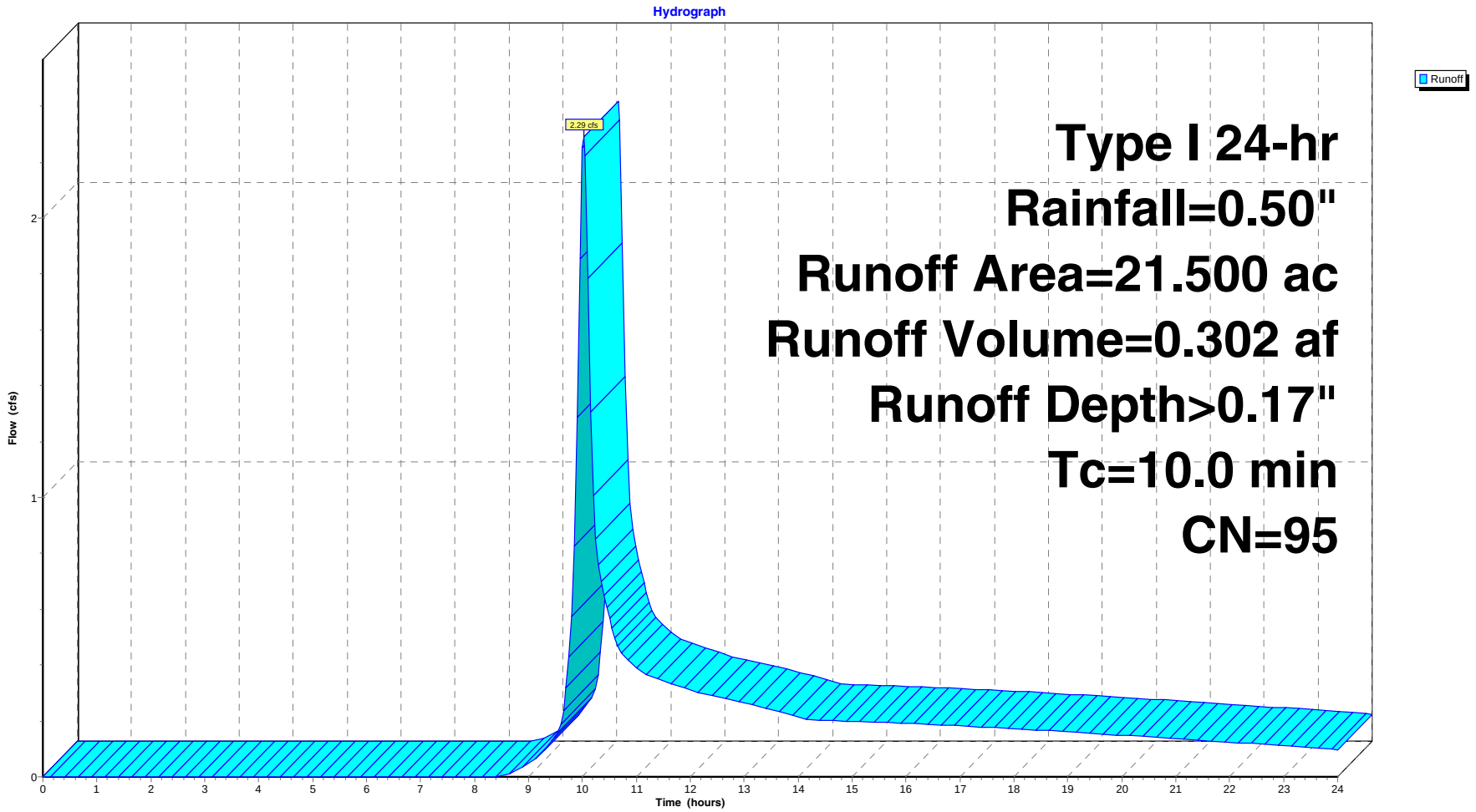
Subcatchment 1S: Avila Beach



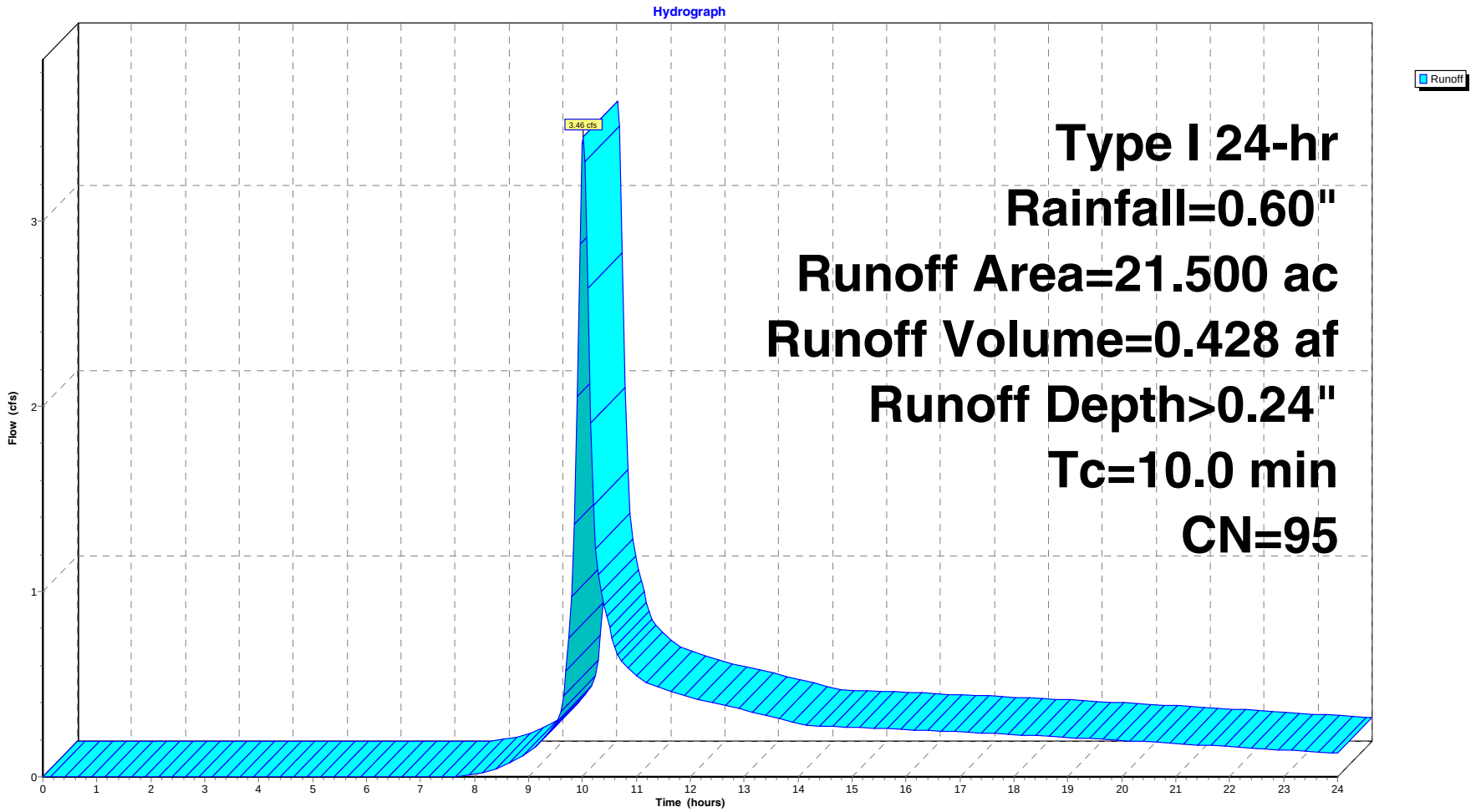
Subcatchment 1S: Avila Beach



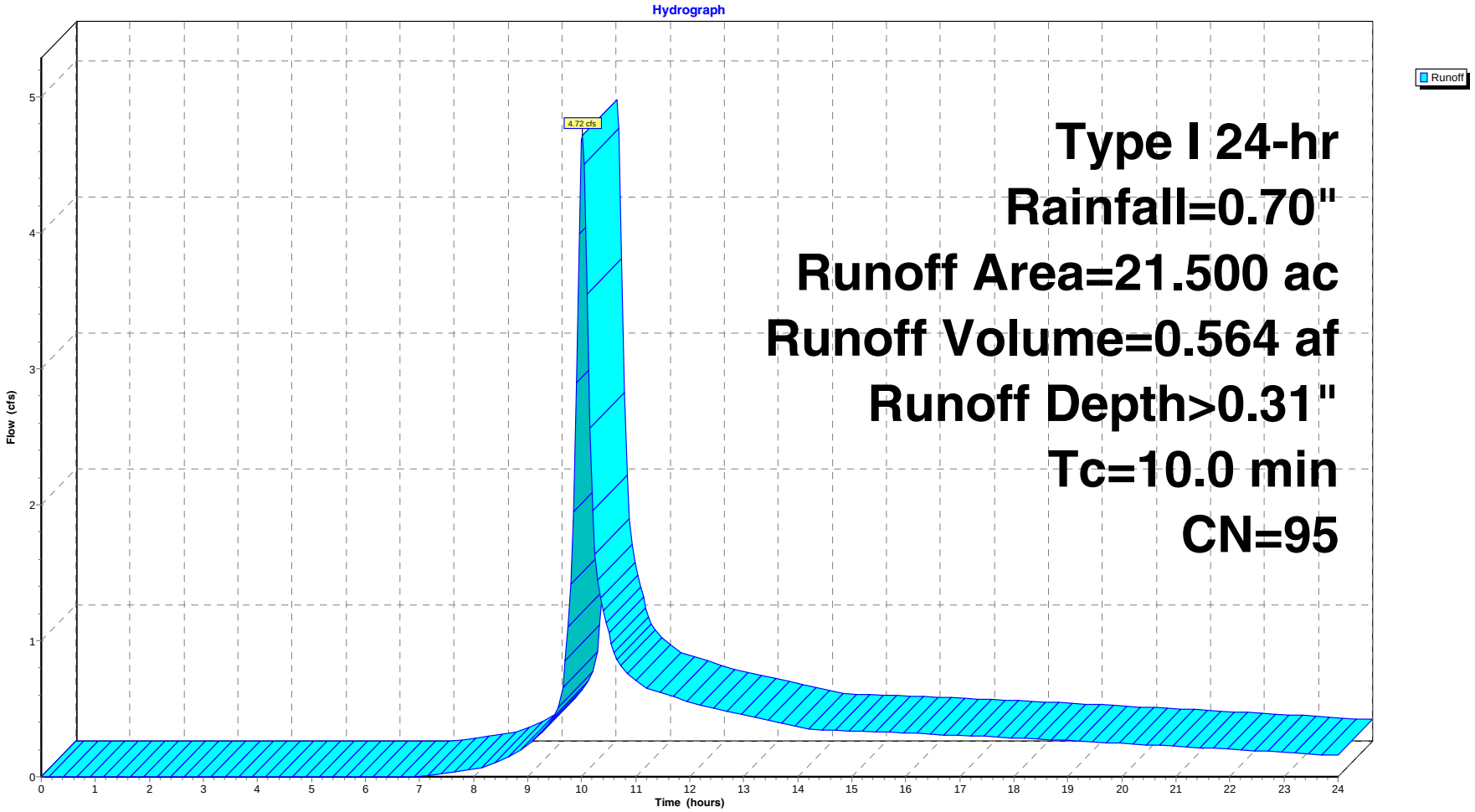
Subcatchment 1S: Avila Beach



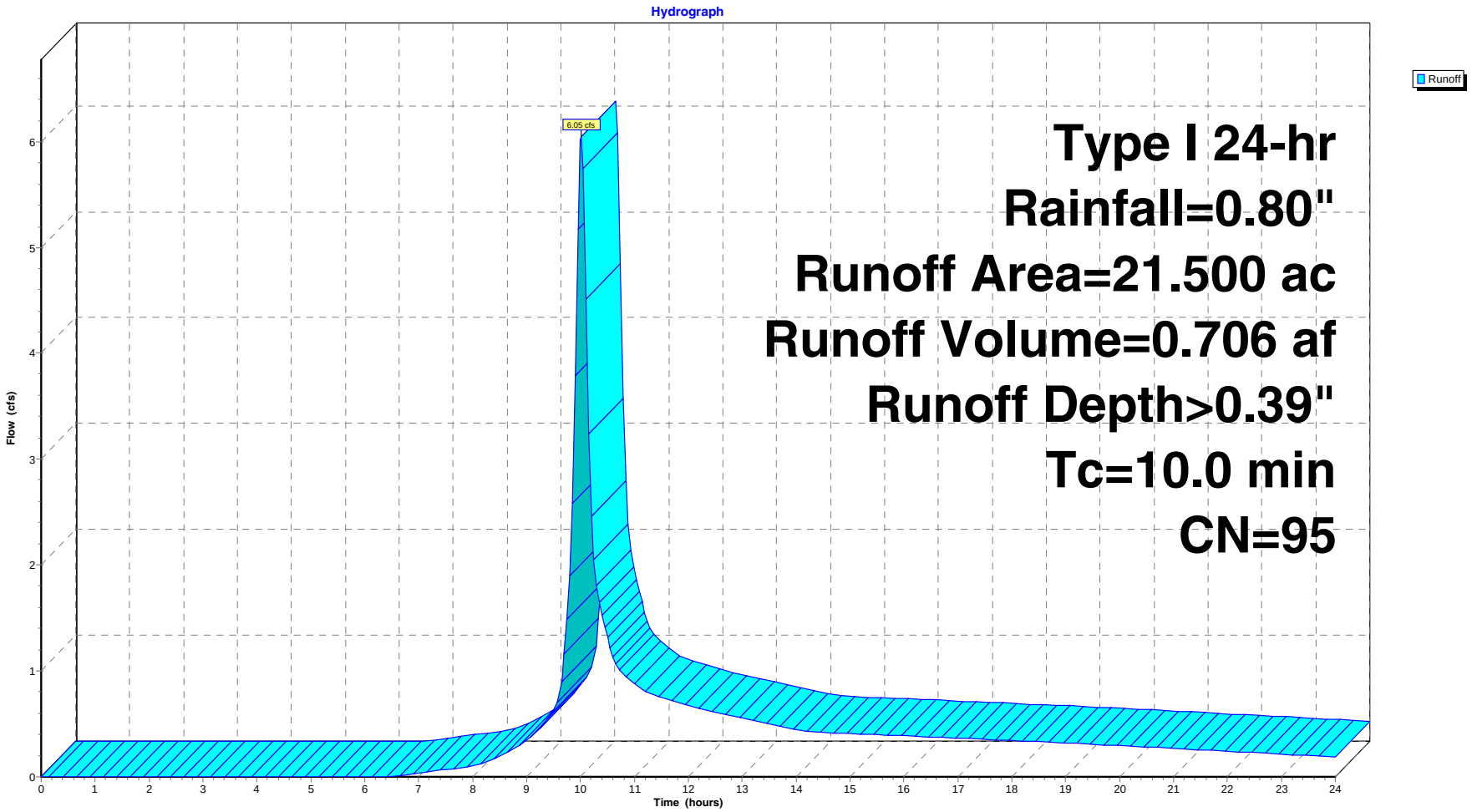
Subcatchment 1S: Avila Beach



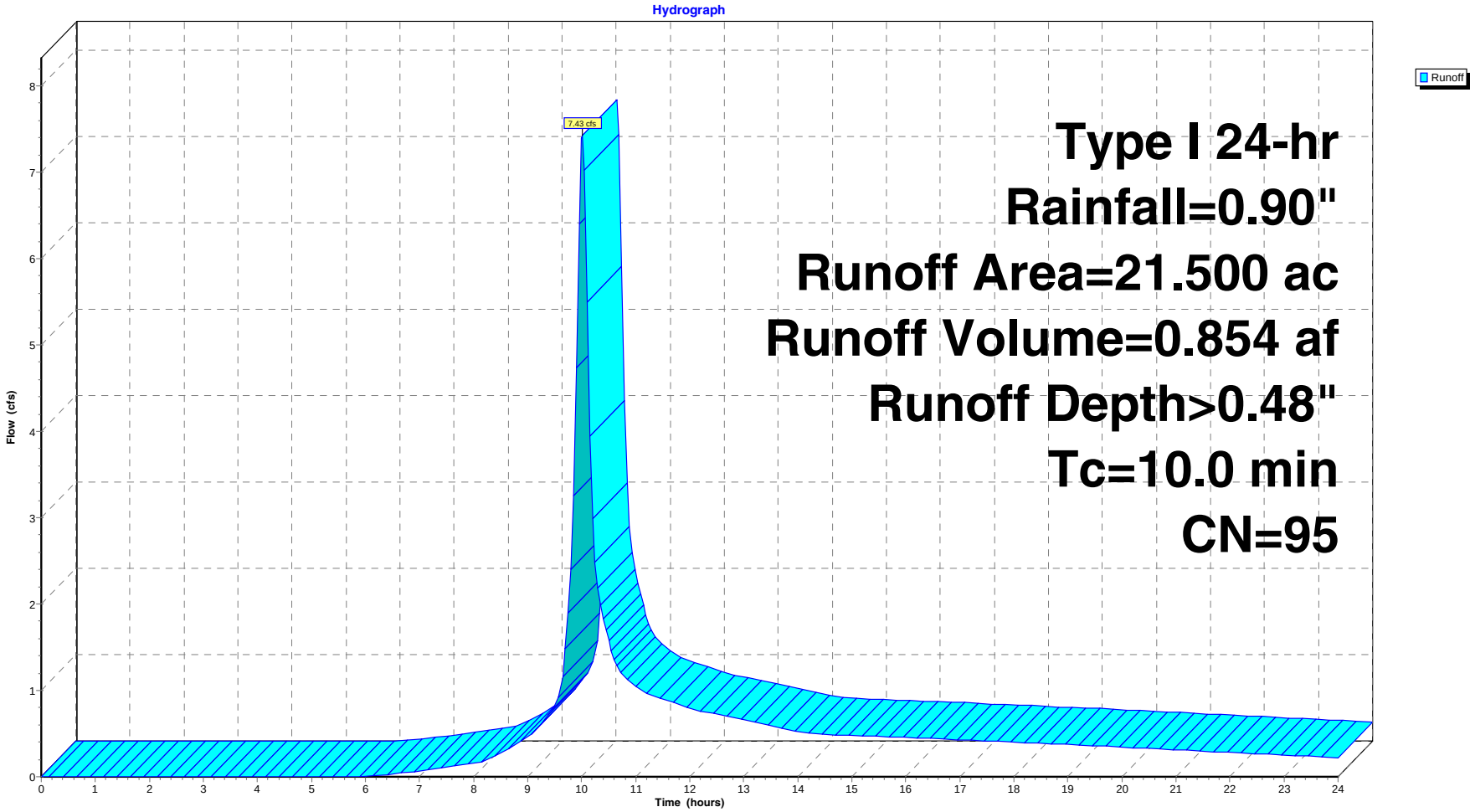
Subcatchment 1S: Avila Beach



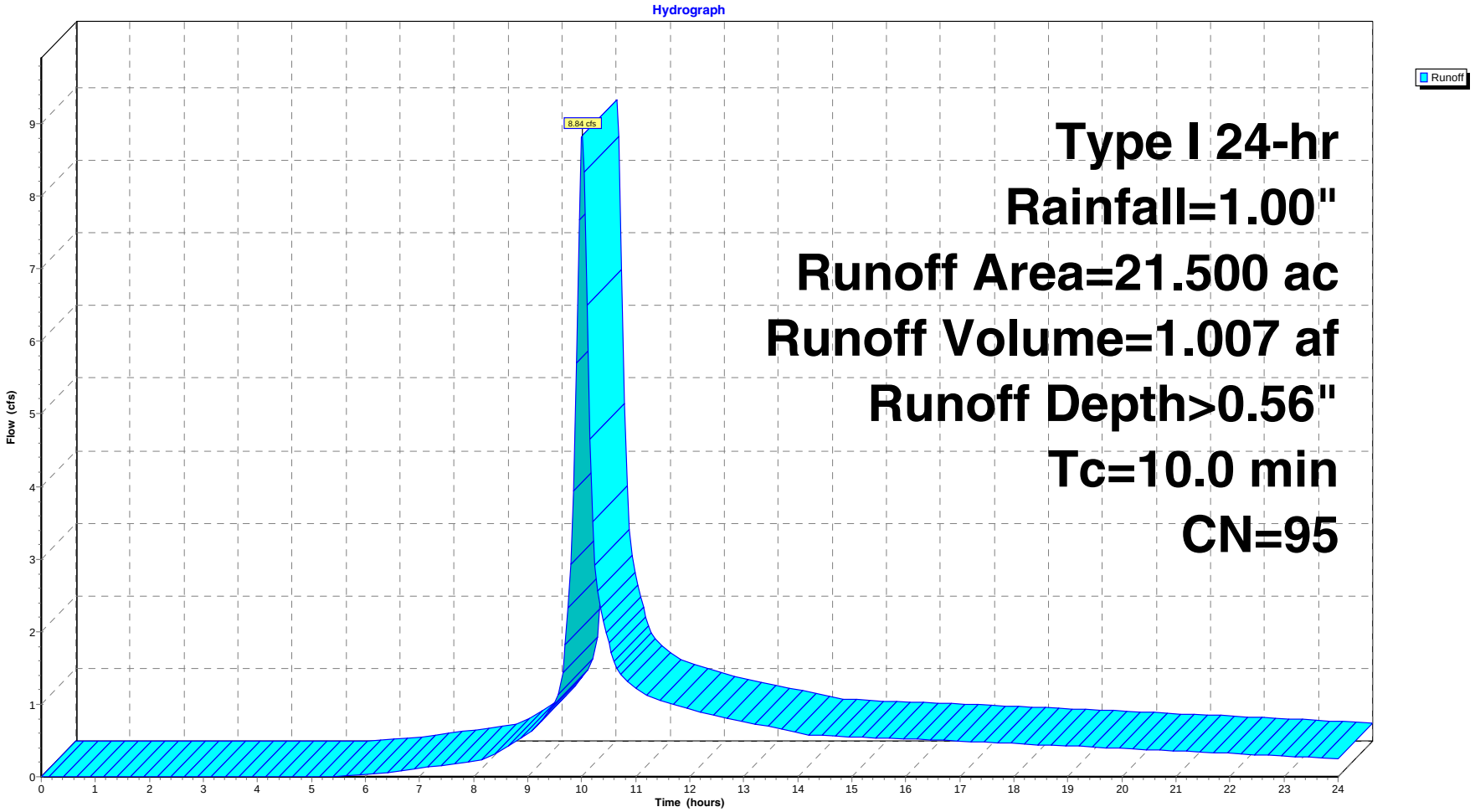
Subcatchment 1S: Avila Beach



Subcatchment 1S: Avila Beach



Subcatchment 1S: Avila Beach



Appendix B

NOAA Atlas 14, Volume 6, Version 2
Location name: Avila Beach, California, US*
Latitude: 35.1804°, Longitude: -120.7336°
Elevation: 37 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.121 (0.104-0.140)	0.154 (0.133-0.180)	0.197 (0.170-0.231)	0.232 (0.198-0.274)	0.278 (0.229-0.342)	0.313 (0.251-0.395)	0.348 (0.271-0.452)	0.384 (0.289-0.515)	0.432 (0.310-0.608)	0.468 (0.323-0.686)
10-min	0.173 (0.150-0.201)	0.221 (0.191-0.258)	0.283 (0.244-0.331)	0.332 (0.284-0.393)	0.399 (0.328-0.490)	0.449 (0.360-0.566)	0.499 (0.389-0.648)	0.551 (0.415-0.738)	0.619 (0.444-0.871)	0.671 (0.463-0.983)
15-min	0.209 (0.181-0.243)	0.267 (0.231-0.312)	0.342 (0.295-0.400)	0.402 (0.344-0.475)	0.482 (0.396-0.593)	0.543 (0.435-0.685)	0.604 (0.470-0.784)	0.666 (0.502-0.893)	0.749 (0.538-1.05)	0.812 (0.560-1.19)
30-min	0.295 (0.255-0.343)	0.377 (0.326-0.439)	0.482 (0.416-0.564)	0.567 (0.484-0.670)	0.680 (0.559-0.836)	0.766 (0.614-0.965)	0.852 (0.663-1.10)	0.939 (0.708-1.26)	1.06 (0.758-1.49)	1.15 (0.790-1.68)
60-min	0.420 (0.364-0.490)	0.537 (0.465-0.627)	0.688 (0.593-0.805)	0.808 (0.691-0.956)	0.970 (0.797-1.19)	1.09 (0.875-1.38)	1.21 (0.946-1.57)	1.34 (1.01-1.79)	1.50 (1.08-2.12)	1.63 (1.13-2.39)
2-hr	0.648 (0.562-0.755)	0.810 (0.701-0.945)	1.01 (0.874-1.19)	1.17 (1.00-1.38)	1.37 (1.13-1.69)	1.52 (1.22-1.92)	1.67 (1.30-2.16)	1.81 (1.36-2.43)	2.00 (1.44-2.81)	2.14 (1.47-3.13)
3-hr	0.827 (0.717-0.964)	1.03 (0.891-1.20)	1.28 (1.10-1.49)	1.47 (1.25-1.73)	1.71 (1.40-2.10)	1.88 (1.51-2.37)	2.05 (1.60-2.66)	2.22 (1.67-2.97)	2.43 (1.74-3.42)	2.58 (1.78-3.78)
6-hr	1.16 (1.01-1.36)	1.45 (1.25-1.69)	1.79 (1.54-2.09)	2.04 (1.75-2.41)	2.36 (1.94-2.91)	2.59 (2.08-3.27)	2.81 (2.19-3.64)	3.02 (2.27-4.04)	3.28 (2.36-4.62)	3.48 (2.40-5.09)
12-hr	1.48 (1.28-1.73)	1.86 (1.61-2.17)	2.32 (2.00-2.72)	2.68 (2.29-3.16)	3.13 (2.57-3.85)	3.46 (2.77-4.36)	3.77 (2.94-4.89)	4.08 (3.08-5.47)	4.48 (3.21-6.30)	4.77 (3.29-6.98)
24-hr	1.85 (1.69-2.06)	2.35 (2.15-2.61)	2.99 (2.73-3.34)	3.50 (3.17-3.94)	4.19 (3.68-4.87)	4.71 (4.05-5.58)	5.22 (4.40-6.34)	5.75 (4.71-7.16)	6.46 (5.09-8.36)	6.99 (5.33-9.35)
2-day	2.25 (2.06-2.51)	2.90 (2.65-3.23)	3.74 (3.42-4.18)	4.43 (4.02-5.00)	5.38 (4.72-6.25)	6.11 (5.26-7.24)	6.85 (5.76-8.30)	7.62 (6.24-9.48)	8.66 (6.83-11.2)	9.48 (7.23-12.7)
3-day	2.58 (2.36-2.87)	3.34 (3.06-3.72)	4.35 (3.97-4.86)	5.18 (4.69-5.83)	6.33 (5.56-7.35)	7.22 (6.22-8.56)	8.15 (6.86-9.88)	9.11 (7.47-11.3)	10.4 (8.23-13.5)	11.5 (8.76-15.4)
4-day	2.80 (2.56-3.12)	3.64 (3.33-4.06)	4.76 (4.35-5.32)	5.70 (5.16-6.42)	6.99 (6.14-8.13)	8.01 (6.90-9.50)	9.07 (7.63-11.0)	10.2 (8.34-12.7)	11.7 (9.23-15.2)	12.9 (9.87-17.3)
7-day	3.30 (3.02-3.67)	4.31 (3.94-4.80)	5.67 (5.18-6.34)	6.82 (6.18-7.68)	8.43 (7.40-9.80)	9.71 (8.36-11.5)	11.1 (9.30-13.4)	12.5 (10.2-15.5)	14.5 (11.4-18.7)	16.1 (12.3-21.5)
10-day	3.72 (3.40-4.14)	4.87 (4.46-5.43)	6.43 (5.87-7.19)	7.76 (7.03-8.74)	9.63 (8.45-11.2)	11.1 (9.57-13.2)	12.7 (10.7-15.4)	14.4 (11.8-17.9)	16.7 (13.2-21.6)	18.6 (14.2-24.9)
20-day	4.76 (4.37-5.30)	6.29 (5.76-7.02)	8.38 (7.65-9.37)	10.1 (9.19-11.4)	12.6 (11.1-14.7)	14.6 (12.6-17.4)	16.8 (14.1-20.3)	19.0 (15.6-23.7)	22.2 (17.5-28.7)	24.8 (18.9-33.1)
30-day	5.82 (5.33-6.48)	7.71 (7.06-8.60)	10.3 (9.38-11.5)	12.5 (11.3-14.0)	15.5 (13.6-18.0)	18.0 (15.5-21.3)	20.6 (17.3-24.9)	23.3 (19.1-29.0)	27.2 (21.4-35.2)	30.3 (23.1-40.6)
45-day	7.03 (6.44-7.82)	9.29 (8.50-10.4)	12.4 (11.3-13.8)	14.9 (13.5-16.8)	18.6 (16.3-21.6)	21.5 (18.5-25.4)	24.5 (20.6-29.7)	27.7 (22.7-34.5)	32.2 (25.4-41.7)	35.9 (27.4-48.0)
60-day	8.28 (7.58-9.22)	10.9 (9.97-12.1)	14.4 (13.2-16.1)	17.4 (15.7-19.6)	21.5 (18.9-25.0)	24.8 (21.3-29.4)	28.2 (23.7-34.2)	31.8 (26.1-39.6)	36.9 (29.1-47.7)	40.9 (31.2-54.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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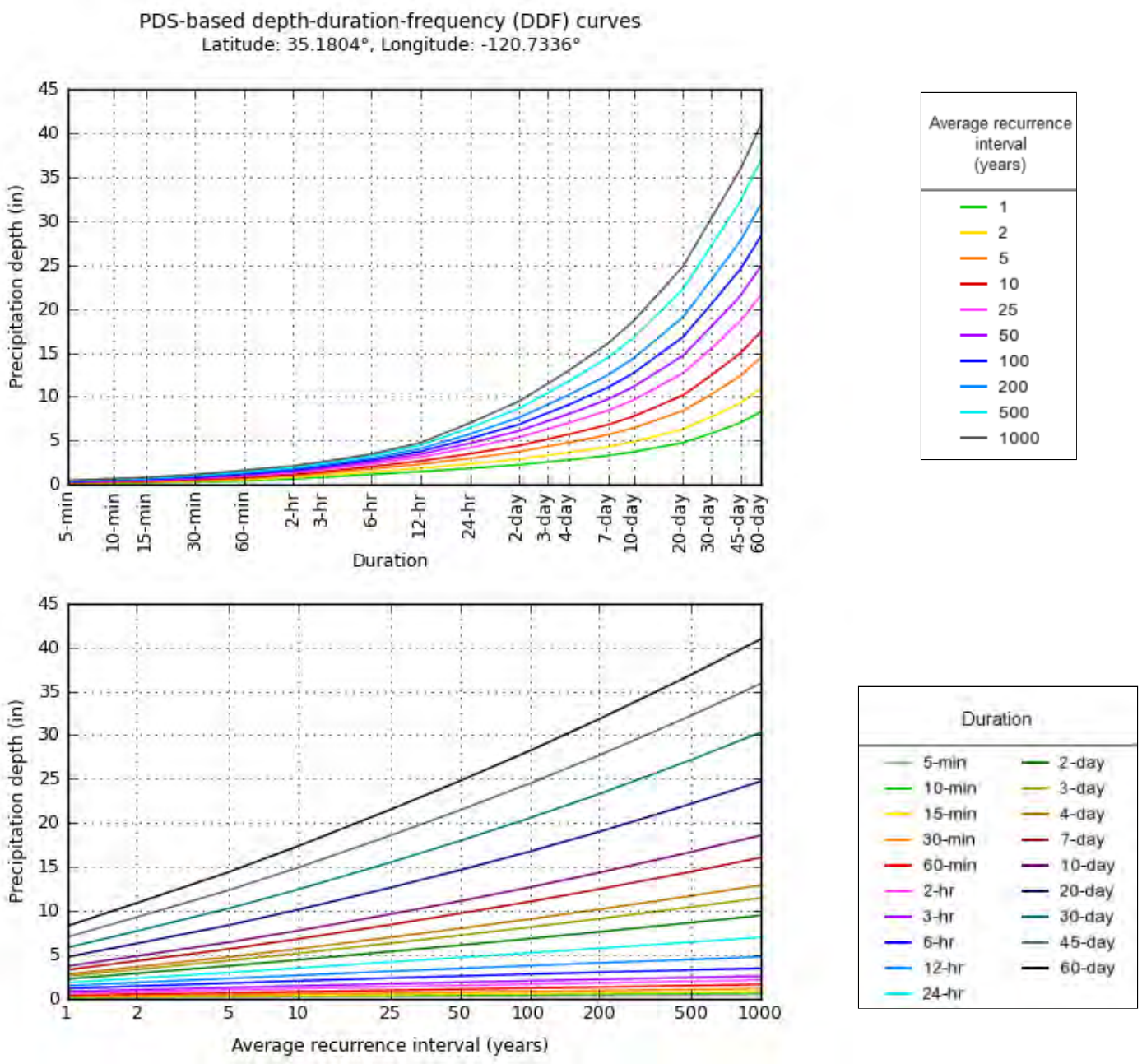
PF graphical



NOAA Atlas 14, Volume 6, Version 2

Created (GMT): Thu Aug 6 17:19:57 2015

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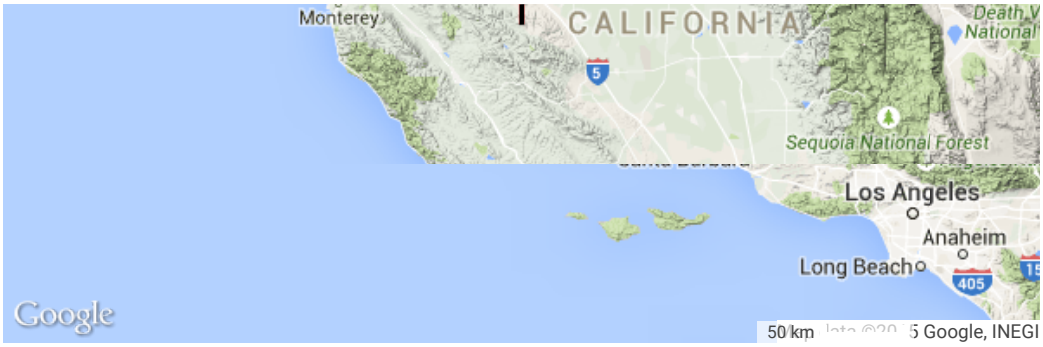
Maps & aerials

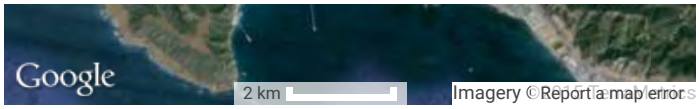
Small scale terrain



Large scale terrain

Large scale map

Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
Office of Hydrologic Development
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

San Luis Obispo County Public Works

Volunteer Precipitation Gauge Station

MONTHLY PRECIPITATION REPORT

Station Name - Avila Beach # 213.1

Station Location -

Latitude - 35° 11' 25"

Longitude - 120° 43' 10"

Description - Avila Beach

Water Years -

Beginning - 1987-1988

Ending - 2014-2015

Station Statistics -

Month	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
Average	0.00	0.01	0.14	0.81	1.94	4.30	3.56	3.21	2.60	1.20	0.47	0.08	18.33
Maximum	0.00	0.10	1.80	3.60	6.20	12.50	10.37	11.30	11.15	5.00	2.35	1.40	33.30
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.48

San Luis Obispo County Public Works

Volunteer Precipitation Gauge Station

MONTHLY PRECIPITATION REPORT

Station Name and no. Avila Beach # 213.1

*** All units are in inches ***

Water Year	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Total
2014-2015	0.00	0.00	0.00	0.00	1.45	5.05	0.00	1.10	0.23	0.80	0.00	0.00	8.63
2011-2012	0.00	0.00	0.00	0.88	0.85	4.89	0.74	0.74	0.38	0.00	0.00	0.00	8.48
2010-2011	0.00	0.00	0.00	2.30	3.50	12.50	2.50	2.70	6.95	0.20	1.25	1.40	33.30
2007-2008	0.00	0.10	0.00	0.30	0.10	3.00	6.25	3.40	0.00	0.40	0.00	0.00	13.55
2005-2006	0.00	0.00	0.10	0.50	1.10	2.60	7.20	1.30	6.40	5.00	2.35	0.00	26.55
2004-2005	0.00	0.00	0.00	3.60	3.30	6.15	6.20	5.45	3.15	1.90	2.05	0.00	31.80
2003-2004	0.00	0.00	0.00	0.00	1.40	5.45	2.05	5.70	0.85	0.00	0.00	0.00	15.45
2002-2003	0.00	0.00	0.00	0.00	2.70	5.60	0.40	3.20	2.30	1.63	1.50	0.00	17.33
2001-2002	0.00	0.00	0.00	0.60	5.65	3.80	1.85	0.65	1.50	0.45	0.20	0.00	14.70
2000-2001	0.00	0.00	0.00	1.80	0.00	0.20	5.55	8.45	3.25	1.50	0.00	0.00	20.75
1999-2000	0.00	0.00	0.00	0.00	2.10	0.10	3.95	11.30	1.80	4.55	0.25	0.12	24.17
1998-1999	0.00	0.00	0.00	0.35	3.35	1.00	4.10	1.85	5.40	2.15	0.00	0.00	18.20
1996-1997	0.00	0.00	0.00	1.55	6.20	11.90	10.37	0.00	0.00	0.00	0.00	0.00	30.02
1992-1993	0.00	0.00	0.00	0.70	0.00	4.65	6.53	0.00	0.00	0.00	0.00	0.00	11.88
1991-1992	0.00	0.00	0.00	0.50	1.20	3.30	3.55	7.60	2.30	0.15	0.00	0.00	18.60
1990-1991	0.00	0.00	0.85	0.00	0.30	0.80	0.90	2.42	11.15	0.95	0.00	0.00	17.37
1989-1990	0.00	0.00	1.80	0.50	0.45	0.00	2.75	1.35	0.40	0.55	1.15	0.00	8.95
1988-1989	0.00	0.00	0.00	0.00	2.30	6.70	1.00	1.35	2.45	0.30	0.20	0.00	14.30
1987-1988	0.00	0.00	0.00	1.90	1.00	4.00	1.80	2.50	0.80	2.27	0.00	0.00	14.27

San Luis Obispo County Public Works

Volunteer Precipitation Gauge Station

MONTHLY PRECIPITATION REPORT

Station Name - Diablo Canyon # 196.2

Station Location -

Latitude - 35° 13' 39"

Longitude - 120° 51' 13"

Description - San Luis Obispo

Water Years -

Beginning - 1973-1974

Ending - 2013-2014

Station Statistics -

Month	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
Average	0.10	0.07	0.31	0.72	1.72	2.04	3.12	2.92	3.05	0.99	0.43	0.14	15.61
Maximum	2.72	0.92	2.41	4.79	21.54	8.56	16.72	9.32	15.49	4.20	3.08	1.51	51.76
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.42

San Luis Obispo County Public Works

Volunteer Precipitation Gauge Station

MONTHLY PRECIPITATION REPORT

Station Name and no. Diablo Canyon # 196.2

*** All units are in inches ***

Water Year	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Total
2013-2014	0.00	0.00	0.01	0.11	0.14	0.26	0.01	4.02	0.24	0.96	0.01	0.00	5.76
2012-2013	0.00	0.01	0.00	0.92	1.61	4.18	1.01	0.53	0.64	0.10	0.05	0.03	9.08
2009-2010	0.00	0.02	0.04	2.55	0.04	2.68	6.82	3.91	0.90	1.61	0.15	0.00	18.72
2008-2009	0.00	0.02	0.00	0.26	1.38	1.54	0.65	3.84	0.51	0.22	0.18	0.37	8.97
2007-2008	0.01	0.12	0.06	0.54	0.04	2.63	7.14	2.05	0.03	0.42	0.00	0.00	13.04
2006-2007	0.00	0.00	0.01	0.14	0.57	2.14	2.02	3.31	0.41	1.08	0.03	0.00	9.71
2005-2006	0.00	0.01	0.00	0.37	1.16	2.79	5.99	0.81	5.40	4.20	2.76	0.00	23.49
2004-2005	0.00	0.00	0.00	4.79	2.40	8.56	7.12	6.79	3.00	1.51	1.46	0.07	35.70
2001-2002	0.00	0.00	0.00	0.30	5.23	1.15	1.20	0.33	2.10	0.08	0.00	0.00	10.39
2000-2001	0.00	0.00	0.00	1.04	0.04	0.12	2.40	4.20	4.44	2.77	0.04	0.00	15.05
1999-2000	0.00	0.00	1.15	0.00	0.84	0.08	2.16	5.59	0.96	1.40	0.10	0.30	12.58
1998-1999	0.00	0.00	0.32	0.20	1.36	0.60	1.60	1.36	2.20	0.92	0.00	0.00	8.56
1997-1998	0.00	0.00	0.00	0.40	2.91	3.62	3.70	7.01	4.26	1.84	1.75	0.00	25.49
1996-1997	0.00	0.00	0.00	0.26	0.81	1.84	1.83	0.00	0.23	0.00	0.00	0.00	4.97
1995-1996	0.00	0.00	0.02	0.01	0.88	0.76	1.66	5.65	0.04	1.26	0.25	0.01	10.54
1994-1995	0.00	0.00	1.88	0.50	2.32	1.25	16.72	1.52	15.49	1.06	0.93	0.91	42.58
1993-1994	0.02	0.00	0.00	0.69	1.68	1.81	2.97	3.87	1.62	1.60	0.67	0.01	14.94
1992-1993	0.50	0.03	0.02	2.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.42
1991-1992	2.72	0.00	0.00	0.00	0.00	0.06	2.44	6.52	3.56	0.08	0.01	0.11	15.50
1990-1991	0.00	0.92	0.76	0.23	0.19	0.69	0.55	1.89	11.66	0.45	0.00	1.51	18.85
1989-1990	0.00	0.03	0.65	2.07	0.00	1.02	0.98	1.20	0.26	0.09	1.06	0.23	7.59
1988-1989	0.06	0.17	0.01	0.02	1.70	6.06	1.08	1.03	2.32	0.34	0.18	0.98	13.95
1987-1988	0.04	0.01	0.00	1.85	0.69	4.67	1.23	2.39	0.13	1.14	3.08	0.04	15.27
1986-1987	0.08	0.00	1.06	0.00	0.42	0.58	0.63	3.14	4.83	1.42	0.03	0.01	12.20
1985-1986	0.00	0.00	0.31	0.83	2.97	1.97	2.75	5.74	5.48	0.31	0.00	0.01	20.37
1984-1985	0.03	0.05	0.11	0.74	3.04	2.85	0.23	0.56	0.97	0.24	0.03	0.09	8.94
1983-1984	0.00	0.18	1.27	1.28	2.91	3.92	0.10	0.42	0.73	0.47	0.77	0.00	12.05
1982-1983	0.00	0.10	0.49	1.17	21.54	2.60	7.48	9.32	7.48	1.42	0.15	0.01	51.76
1981-1982	0.06	0.04	0.06	0.10	1.00	0.98	2.02	0.60	4.85	3.46	0.18	0.20	13.55
1980-1981	0.19	0.00	0.00	0.12	0.00	1.00	3.64	2.12	6.50	0.35	0.23	0.06	14.21
1979-1980	0.00	0.00	0.00	0.94	1.28	3.97	6.03	5.03	2.04	0.42	0.19	0.00	19.90
1978-1979	0.00	0.06	0.89	0.05	3.11	0.86	4.75	2.14	3.32	0.43	0.00	0.00	15.61
1977-1978	0.00	0.24	0.10	0.25	0.37	6.22	6.87	7.05	5.10	3.34	0.01	0.00	29.55
1976-1977	0.00	0.74	2.41	0.39	0.77	1.12	1.38	0.07	1.54	0.16	1.11	0.07	9.76
1975-1976	0.01	0.01	0.01	0.73	0.02	0.04	2.93	0.00	0.54	0.05	0.41	0.00	4.75
1974-1975	0.00	0.00	0.00	0.00	0.17	0.90	1.11	3.84	1.94	0.71	0.00	0.00	8.67
1973-1974	0.00	0.00	0.00	0.00	0.00	0.00	4.39	0.14	6.96	0.79	0.00	0.00	12.28

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Diablo Canyon # 196.2** Season **2013-2014**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1										0.55			1
2								0.25		0.28			2
3								0.58		0.01			3
4													4
5													5
6								0.86					6
7						0.23							7
8								0.02					8
9				0.01				0.20					9
10								0.10					10
11													11
12													12
13													13
14													14
15													15
16													16
17													17
18													18
19						0.03							19
20					0.02						0.01		20
21					0.12								21
22			0.01										22
23													23
24													24
25										0.01			25
26								0.01	0.08	0.11			26
27								0.48					27
28				0.03				1.07					28
29				0.07				0.16					29
30							0.01	0.29	0.16				30
31													31

Total	0.00	0.00	0.01	0.11	0.14	0.26	0.01	4.02	0.24	0.96	0.01	0.00	
Cum. Total	0.00	0.00	0.01	0.12	0.26	0.52	0.53	4.55	4.79	5.75	5.76	5.76	

Season Total **5.76**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **Diablo Canyon # 196.2** Season **2012-2013**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	0.05	0.00	0.00	1
2	0.00	0.00	0.00	0.00	0.00	0.47	0.00	0.00	0.00	0.00	0.00	0.00	2
3	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.01	3
4	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	4
5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5
6	0.00	0.00	0.00	0.00	0.00	0.00	0.83	0.00	0.21	0.00	0.04	0.00	6
7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	7
8	0.00	0.00	0.00	0.00	Trace	0.00	0.00	0.26	0.33	0.03	0.00	0.00	8
9	0.00	0.00	0.00	0.00	0.06	0.00	0.00	0.07	0.00	0.00	0.00	0.00	9
10	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10
11	0.00	0.00	0.00	0.86	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11
12	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	14
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15
16	0.00	0.00	0.00	0.00	0.18	0.06	0.00	0.00	0.00	0.00	0.00	0.00	16
17	0.00	0.00	0.00	0.00	0.81	0.02	0.00	0.00	0.00	0.00	0.00	0.00	17
18	0.00	0.00	0.00	0.00	0.03	0.23	0.00	0.00	0.00	0.00	0.00	0.00	18
19	Trace	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	19
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.00	0.00	0.00	0.00	20
21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21
22	0.00	0.00	0.00	0.01	0.00	1.08	0.00	0.00	0.00	0.00	0.00	0.00	22
23	0.00	0.00	0.00	0.01	0.00	0.14	0.00	0.00	0.00	0.00	0.00	0.00	23
24	0.00	0.00	0.00	0.00	0.00	0.32	0.16	0.00	0.00	0.00	0.00	0.01	24
25	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.01	25
26	0.00	0.00	0.00	0.00	0.00	0.93	0.00	0.00	0.00	0.00	0.00	0.00	26
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27
28	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	28
29	0.00	0.00	0.00	0.00	0.11	0.44	0.00	0.00	0.00	0.00	0.00	0.00	29
30	0.00	0.00	0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30
31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	31
Total	0.00	0.01	0.00	0.92	1.61	4.18	1.01	0.53	0.64	0.10	0.05	0.03	
Cum. Total	0.00	0.01	0.01	0.93	2.54	6.72	7.73	8.26	8.90	9.00	9.05	9.08	

Season Total **9.08**

San Luis Obispo County Public Works

Volunteer Precipitation Gauge Station

MONTHLY PRECIPITATION REPORT

Station Name - SLO Airport # 205.4

Station Location -

Latitude - 35° 14' 14"

Longitude - 120° 38' 05"

Description - San Luis Obispo

Water Years -

Beginning - 1981-1982

Ending - 2014-2015

Station Statistics -

Month	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
Average	0.02	0.03	0.26	0.95	1.94	3.89	4.00	4.41	3.45	1.29	0.40	0.07	20.70
Maximum	0.35	0.63	2.00	5.05	5.96	13.75	14.80	14.82	13.70	5.94	3.10	1.30	44.14
Minimum	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.30	0.00	0.00	0.00	0.00	7.40

San Luis Obispo County Public Works

Volunteer Precipitation Gauge Station

MONTHLY PRECIPITATION REPORT

Station Name and no. SLO Airport # 205.4

*** All units are in inches ***

Water Year	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Total
2014-2015	0.00	0.00	0.00	1.25	0.45	5.25	0.10	2.80	0.55	1.13	0.15	0.00	11.68
2013-2014	0.00	0.00	0.00	0.25	0.35	0.30	0.05	4.00	2.05	0.40	0.00	0.00	7.40
2012-2013	0.00	0.00	0.00	0.90	1.80	4.58	1.35	0.95	0.80	0.00	0.00	0.00	10.38
2011-2012	0.00	0.00	0.10	1.15	3.30	0.40	4.00	0.82	2.85	3.40	0.00	0.00	16.02
2010-2011	0.00	0.00	0.00	2.25	2.90	13.75	2.75	3.07	6.75	0.30	1.50	1.30	34.57
2009-2010	0.00	0.00	0.00	3.55	0.00	5.15	8.58	4.65	1.65	2.14	0.25	0.00	25.97
2008-2009	0.00	0.00	0.00	0.10	1.70	1.85	0.60	5.06	0.85	0.50	0.35	0.25	11.26
2007-2008	0.00	0.00	0.00	0.95	0.05	1.57	8.50	2.20	0.10	0.50	0.00	0.00	13.87
2006-2007	0.00	0.00	0.00	0.00	0.45	2.20	1.55	2.72	0.45	1.50	0.10	0.00	8.97
2005-2006	0.00	0.00	0.00	0.00	1.30	2.09	7.90	1.95	5.94	5.94	1.60	0.00	26.72
2004-2005	0.00	0.00	0.00	5.05	2.45	8.55	8.58	5.35	4.70	0.35	0.65	0.00	35.68
2003-2004	0.00	0.00	0.00	0.00	2.30	4.70	1.30	8.36	0.75	0.00	0.00	0.00	17.41
2002-2003	0.00	0.00	0.00	0.00	4.05	5.45	0.55	2.98	2.40	1.00	0.00	0.00	16.43
1999-2000	0.00	0.00	0.00	0.00	0.00	2.25	3.97	10.55	2.00	2.25	0.20	0.25	21.47
1998-1999	0.00	0.00	0.44	0.30	1.15	0.92	2.60	1.65	4.50	2.20	0.00	0.00	13.76
1997-1998	0.00	0.00	0.00	0.00	5.50	4.75	5.35	14.82	5.50	3.15	3.10	0.00	42.17
1996-1997	0.00	0.00	0.00	2.75	4.10	12.55	11.70	0.30	0.00	0.00	0.00	0.00	31.40
1995-1996	0.00	0.00	0.00	0.00	0.50	3.60	2.85	9.60	1.70	1.35	0.75	0.00	20.35
1994-1995	0.00	0.00	1.99	1.64	1.70	1.14	14.80	2.30	13.70	0.80	1.15	0.00	39.22
1993-1994	0.35	0.00	0.00	0.00	2.15	1.80	3.05	5.90	1.75	0.95	0.45	0.00	16.40
1992-1993	0.25	0.00	0.00	1.60	0.00	6.17	9.10	8.05	4.92	0.10	0.25	0.00	30.44
1991-1992	0.00	0.00	0.00	0.51	1.60	4.70	3.55	9.40	2.67	0.05	0.00	0.00	22.48
1990-1991	0.00	0.00	0.40	0.00	0.40	1.05	0.90	2.50	11.90	0.40	0.00	0.50	18.05
1989-1990	0.00	0.00	1.51	1.10	0.55	0.00	1.72	2.40	0.65	0.12	1.20	0.00	9.25
1988-1989	0.00	0.00	0.00	0.00	1.75	7.06	0.85	1.90	1.45	0.25	0.20	0.00	13.46
1987-1988	0.00	0.00	0.00	1.59	0.67	4.70	2.38	2.95	0.80	2.06	0.31	0.00	15.46
1986-1987	0.00	0.00	0.97	0.00	0.30	1.08	3.12	2.42	3.60	0.45	0.00	0.00	11.94
1985-1986	0.03	0.00	0.03	1.03	3.70	1.84	2.02	7.76	6.17	0.17	0.00	0.00	22.75
1984-1985	0.00	0.05	0.00	0.96	4.08	3.76	1.11	1.77	3.32	0.15	0.00	0.00	15.20
1983-1984	0.00	0.63	2.00	0.32	4.15	5.16	0.09	0.55	0.08	0.64	0.00	0.00	13.62
1982-1983	0.00	0.30	0.73	1.44	5.96	4.90	8.61	9.91	8.42	3.16	0.71	0.00	44.14
1981-1982	0.00	0.00	0.00	1.55	2.57	1.13	4.40	1.41	7.47	5.89	0.00	0.00	24.42

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **SLO Airport # 205.4** Season **2014-2015**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1					0.30	0.15			0.45				1
2						0.75			0.10				2
3						0.05							3
4						0.55							4
5						0.35							5
6								0.75					6
7								0.60		0.75			7
8								0.45					8
9													9
10													10
11						2.00							11
12						0.10							12
13													13
14											0.15		14
15						0.60							15
16						0.45							16
17						0.10							17
18						0.10							18
19						0.05							19
20													20
21													21
22								0.35					22
23								0.05					23
24										0.13			24
25										0.25			25
26							0.10						26
27													27
28								0.60					28
29													29
30					0.15								30
31				1.25									31

Total	0.00	0.00	0.00	1.25	0.45	5.25	0.10	2.80	0.55	1.13	0.15	0.00	
Cum. Total	0.00	0.00	0.00	1.25	1.70	6.95	7.05	9.85	10.40	11.53	11.68	11.68	

Season Total **11.68**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **SLO Airport # 205.4** Season **2013-2014**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1									1.25	0.40			1
2								0.75	0.10				2
3													3
4													4
5													5
6						0.30		0.50					6
7								0.05					7
8								0.10					8
9								0.15					9
10				0.25									10
11													11
12													12
13													13
14													14
15													15
16													16
17													17
18													18
19													19
20					0.25								20
21					0.10								21
22													22
23													23
24													24
25													25
26								0.60					26
27								1.35					27
28								0.50					28
29									0.20				29
30							0.05						30
31									0.50				31

Total	0.00	0.00	0.00	0.25	0.35	0.30	0.05	4.00	2.05	0.40	0.00	0.00	
Cum. Total	0.00	0.00	0.00	0.25	0.60	0.90	0.95	4.95	7.00	7.40	7.40	7.40	

Season Total **7.40**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **SLO Airport # 205.4** Season **2012-2013**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1						0.45							1
2						0.63							2
3													3
4													4
5							0.45		0.15				5
6							0.40		0.15				6
7								0.25	0.45				7
8								0.35					8
9													9
10				0.01									10
11				0.74									11
12						0.10							12
13													13
14													14
15						0.10							15
16					0.40	0.15							16
17					0.30	0.30							17
18								0.05					18
19								0.30					19
20													20
21						0.25							21
22				0.15		0.65							22
23						0.80	0.25						23
24							0.20						24
25						0.60	0.05						25
26						0.05							26
27													27
28					0.60	0.40							28
29					0.25	0.10							29
30					0.25				0.05				30
31													31

Total	0.00	0.00	0.00	0.90	1.80	4.58	1.35	0.95	0.80	0.00	0.00	0.00	
Cum. Total	0.00	0.00	0.00	0.90	2.70	7.28	8.63	9.58	10.38	10.38	10.38	10.38	

Season Total **10.38**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **SLO Airport # 205.4** Season **2011-2012**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1													1
2													2
3				0.20	0.25								3
4				0.80	0.10								4
5				0.15	0.40								5
6								0.20					6
7								0.20					7
8													8
9													9
10			0.10					0.10		0.95			10
11					0.50	0.25				0.20			11
12						0.15		0.10		0.90			12
13								0.20		1.05			13
14													14
15													15
16									1.25				16
17									0.40				17
18									0.10				18
19					0.85								19
20					1.20		2.00						20
21													21
22							1.50						22
23							0.50						23
24									0.60	0.10			24
25									0.25	0.20			25
26													26
27									0.10				27
28													28
29													29
30													30
31								0.02	0.15				31

Total	0.00	0.00	0.10	1.15	3.30	0.40	4.00	0.82	2.85	3.40	0.00	0.00	
Cum. Total	0.00	0.00	0.10	1.25	4.55	4.95	8.95	9.77	12.62	16.02	16.02	16.02	

Season Total **16.02**

San Luis Obispo County Public Works

DAILY PRECIPITATION

(inches)

Station Name and no. **SLO Airport # 205.4** Season **2010-2011**

Day	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	Day
1							1.25						1
2							1.00		0.15				2
3												0.20	3
4												0.50	4
5				0.50		0.85						0.60	5
6				0.25	0.10				0.15				6
7					0.30								7
8										0.10			8
9													9
10													10
11													11
12													12
13													13
14								0.10			0.20		14
15								0.45					15
16						0.50		0.20			0.95		16
17				0.20		0.90		0.10			0.25		17
18				0.20		4.20		0.95	0.35				18
19					1.10	2.25		0.55	3.00				19
20					1.20	0.75			1.10	0.15			20
21						1.25			0.30				21
22						0.50			0.05				22
23									0.70	0.05			23
24					0.20			0.12	0.65				24
25				0.35		1.20		0.50	0.05				25
26								0.10	0.25				26
27													27
28						1.25					0.10		28
29						0.10	0.30						29
30				0.75			0.20						30
31													31

Total	0.00	0.00	0.00	2.25	2.90	13.75	2.75	3.07	6.75	0.30	1.50	1.30	
Cum. Total	0.00	0.00	0.00	2.25	5.15	18.90	21.65	24.72	31.47	31.77	33.27	34.57	

Season Total **34.57**

Appendix C

REVISED
DRAINAGE STUDY

For

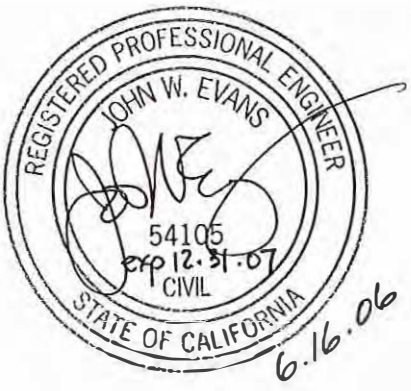
The Landing

Avila Beach, County of San Luis Obispo, California

Revised June 2006

Prepared by:

Cannon Associates
364 Pacific Street
San Luis Obispo, CA
93401



Executive Summary

This Study examines the runoff and drainage patterns for 10-year and 25-year design storms for The Landing project in Avila Beach under normal tidal and creek level conditions, and addresses 25-year and 100-year flood elevations during inundated conditions when creek levels restrict flow from the 36"-diameter outfall pipe. This Study references the Amended Drainage Study for The Colony project (included as Appendix II) which determines the inundated conditions. The Amended Colony Study found that the 10-year, 25-year and 100-year flood elevations are 5.00', 5.14' and 5.25', respectively (NGVD 1929).

For normal tidal conditions, no adverse impacts to facilities are anticipated due to construction of The Landing. But due to the possibility of inundated conditions, additional flood protection measures should be employed. These measures include flood-proofing as required by SLO County Construction Standards 23.07.066 and raising all building pads or finish floor elevations 1.0 foot above the determined 100-year flood elevation of 5.25' (NGVD 1929) per SLO County Standard Section 11-351.1504A.

Per these standards, the garages for lots 7, 8, 9 and 17 will require flood-proof measures and the finish floors for lot 7 will need to be a minimum of 6.25'.

As the minimum driveway entrance elevation for the basement level parking for lots 10, 18, 19 and 20 exceeds 6.25' at 6.91' (BSW), the garages for these lots will not require floodproofing. This is illustrated on Section B-B', Drainage Exhibit 5, Appendix A.

Elevation Datum

The elevation datum used for the project is the NGVD 1929 datum with the 1960 adjustment.

In 1991, at least one nearby Tidal Benchmark (Tidal 6) was resurveyed by differential

leveling and the benchmark height was adjusted by the National Geodetic Survey. The adjustment of this benchmark did not affect the base elevation of 0 feet (NGVD29) for the area and to which the base flood elevations determined in this study are referenced. Key elevations in this report are FEMA's 100-year wave setup elevation of 9.9 feet (NGVD29), FEMA's 100-year maximum San Luis Creek height of 11.5 feet (NGVD29) at the 36-inch diameter pipe outlet, and the highest observed water level in Avila Bay of 7.68 feet (MLLW datum, observed 1/18/73), all of which are unaffected by the 1991 adjustment of Tidal 6.

1.0 Purpose of Study (Non-Inundated Conditions)

It is the intent of this Drainage Study to determine storm water runoff and drainage patterns related to The Landing project in Avila Beach, California. This study will show that project hydrologic and hydraulic systems for storm water runoff meet the County's standards and specifications.

This Study was prepared according to San Luis Obispo County Specifications and Standards, Section 11-351.1500 and as required per project Condition of Approval #9, which states:

> *Prior to issuance of a construction permit, the applicant shall submit a drainage plan to the County Engineer for review and approval. The plan shall incorporate Best Management Practices to handle the runoff from the site in compliance with the San Luis Bay (Coastal) Planning Area requirements.*
>
> *A flood study addressing street flooding shall be submitted to the Public Works Dept for review and approval prior to issuance of a construction permit*
>
> .

This portion of the study limits its review to smaller (up to 25-year) design storms and favorable tide conditions where flow from the 36"-diamater discharge pipe to the Pacific Ocean is unrestricted. Larger design storms (25-year and 100-year) under inundated conditions, where tidal influences and creek levels restrict discharge of storm water into San Luis Creek, are addressed in the Amended Drainage Study

prepared for The Colony (a nearby project site in Avila Beach with similar flooding conditions). The original Colony Drainage Study is included in Appendix I and the Amended Study is included in Appendix II.

2.0 Methodologies and Assumptions (Non-Inundated Conditions)

This Study uses the following methodologies in preparing calculations:

- County requirements state that, for contributory areas less than one square mile, capacity calculations must consider 10-year and 25-year design storms.
- For hydrologic analysis, the Rational Method was used to calculate flow rates. Existing conditions were determined based on a topographic survey data and field observations. Calculations incorporate County standard IDF curves and runoff coefficients.
- For hydraulics analysis, Manning's formula for closed conduit and open channel conveyance was used. Calculations incorporate n-values listed in the County Specifications.
- This report assumes that the storm drain system in Avila Beach is flowing freely and not restricted by tidal conditions or periods of heavy rainfall (25-year storm events and higher) which inundate the system.

3.0 Project and Site Description

The Landing is a 0.6-acre mixed-use project located in downtown Avila Beach. The project consists of eight separate lots (lot #s 7, 8, 9, 10, 17, 18, 19, 20). Buildings are either two or three stories, with commercial space at ground level, residential space on the second story, and a basement-level garage in the three-story structures. A hardscape "mid-block passage" walkway provides access through the site to the ground-level shops.

As shown on the Vicinity Map in Appendix A, the Landing site is bounded by Front Street to the south, First Street to the north, San Francisco Street to the west, and existing commercial buildings to the east. The site is currently undeveloped, and the project will provide urban infill. Existing drainage conditions for the site are described below.

4.0 Flood Plain Information

The FEMA flood insurance rate map shows that the project site is located in a Zone 'B', which is defined as, "Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood." See Exhibits 5A and 5B in Appendix A.

A drainage report prepared for The Colony, a nearby project, has been previously submitted for The Landing, as project conditions are similar. The original Colony report, prepared in July 2004 (Appendix I), determined the 100-year flood elevation to be 6.2 feet; however, upon further analysis we have determined that the assumptions used in the original Colony drainage report are overly conservative. The Colony report assumed the simultaneous occurrence of the 100-year peak flow in San Luis Creek, maximum localized flow, and high tide and did not allow for any flow out of the existing 36"-diameter outfall drain pipe during a 100-year, 24-hour storm event. Upon further analysis and taking into consideration the effects of creek flow, wave setup, and tidal cycles on the existing storm drain system, we have determined that the outfall pipe will allow flow during portions of the 24-hour storm event. Therefore, the 100-year flood elevation is appropriately lowered from 6.2' (as stated in the original Colony Study) to 5.25' (as stated in the Amended Colony Study).

5.0 Existing Drainage Conditions

The project site consists of a dirt lot that slopes down from Front Street towards First Street and surface drains onto First Street. There is not currently an underground storm drain in First Street. Instead, storm water collects in a street gutter system via an existing concrete drainage swale that ties into the municipal storm drain system before discharging into San Luis Creek. Exhibit 2 (Appendix A) shows pre-developed drainage conditions.

6.0 Proposed Drainage Conditions

In preparing the drainage design for this project, we assumed that the existing municipal drainage facilities off-site from this project adequately and safely convey runoff from design

storms when tidal and creek levels allow flow from the discharge pipe. The amended Colony drainage report, as included in Appendix II, discusses time periods in which the discharge pipe does not flow and the resulting detention area flood levels during those periods. The County of San Luis Obispo has indicated that drainage from lots 17 through 20 should be directed to Front Street. Hydrologic and hydraulic calculations for non-inundated conditions are included in Appendix B.

Exhibit 3 (Appendix A) shows the onsite discharge areas for the proposed project. Drainage Area A includes runoff from Lots 18 through 20 and the access driveway for the site. Runoff from the buildings is collected via roof drains and is then directed to an oil/water/sand separator, along with surface flow from the driveway area. From the oil/water/sand separator, treated runoff is pumped through the building on Lot 19 to an existing catch basin in Front Street which ties into the Avila Beach municipal storm drain system (see pump calculations in Appendix B). Drainage Area B includes runoff from Lot 17. Runoff collected via roof drains flows to a pump within the building on Lot 17, and then to an existing catch basin in Front Street. Drainage Area C includes a small drive area constructed of pavers. This area is pervious, allowing runoff to infiltrate directly into the underlying sandy soil. Drainage Area D includes the majority of the runoff from Lots 7 through 10. Runoff is collected in roof drains and the landscape drainage system. Collected runoff outlets through sidewalk underdrains to First Street and will operate unless First Street is inundated. Drainage Area E includes the remainder of the runoff from Lots 8 through 10. Runoff is collected via roof drains and/or surface flows to San Francisco Street. Drainage Area F includes the remainder of the runoff from Lot 7. Runoff is collected via roof drains and/or surface flows to First Street.

Areas A and B each drain to an existing 6" storm drain in Front Street. The storm drain lines were constructed during the Front Street Enhancement Project for future development, and these two storm drains are not yet in use. Hydraulic calculations on these storm drain lines show that each line has a capacity of 0.86 cfs. The anticipated 25-year runoff from Area A into the exiting storm drain is approximately 0.53 cfs. The anticipated runoff from Area B into the other storm drain is approximately 0.14 cfs. There

is sufficient capacity in the existing storm drain lines for the anticipated 25-year flow from these project areas and they are not affected by the area of inundation.

New sidewalk underdrains in First Street convey the runoff from Area D to the municipal storm drain system. The sidewalk underdrains were sized to adequately convey runoff for a 25-year storm event in non-inundated conditions. Hydraulic calculations are included in Appendix B.

Exhibit 4 (Appendix A) shows the offsite watershed used to determine street flow in First Street at the Project location during non-inundated conditions. The contributory area for First Street was calculated to be approximately 2.6 acres, including approximately 0.2 acres from this project. Using Manning's equation to analyze post-project conditions, the 10-year gutter flow depth in First Street was found to be 0.37 feet from gutter flowline; the 25-year gutter depth was found to be 0.38 feet. Based on these calculations, the 10- and 25-year runoff is adequately conveyed within the street during non-inundated conditions and is not anticipated to impact the Project site.

7.0 Conclusions

Based on our review of the proposed hydrologic and hydraulic conditions of the project, we have determined that the existing storm facilities and/or street capacity are adequately sized to handle calculated 25-year runoff from the project site during non-inundated conditions. During inundated conditions, flood protection measures such as those listed in SLO County Construction Standards 23.07.066 (see Appendix C) are required. No adverse effects to downstream facilities are anticipated due to construction of The Landing.

Appendix A: Exhibits

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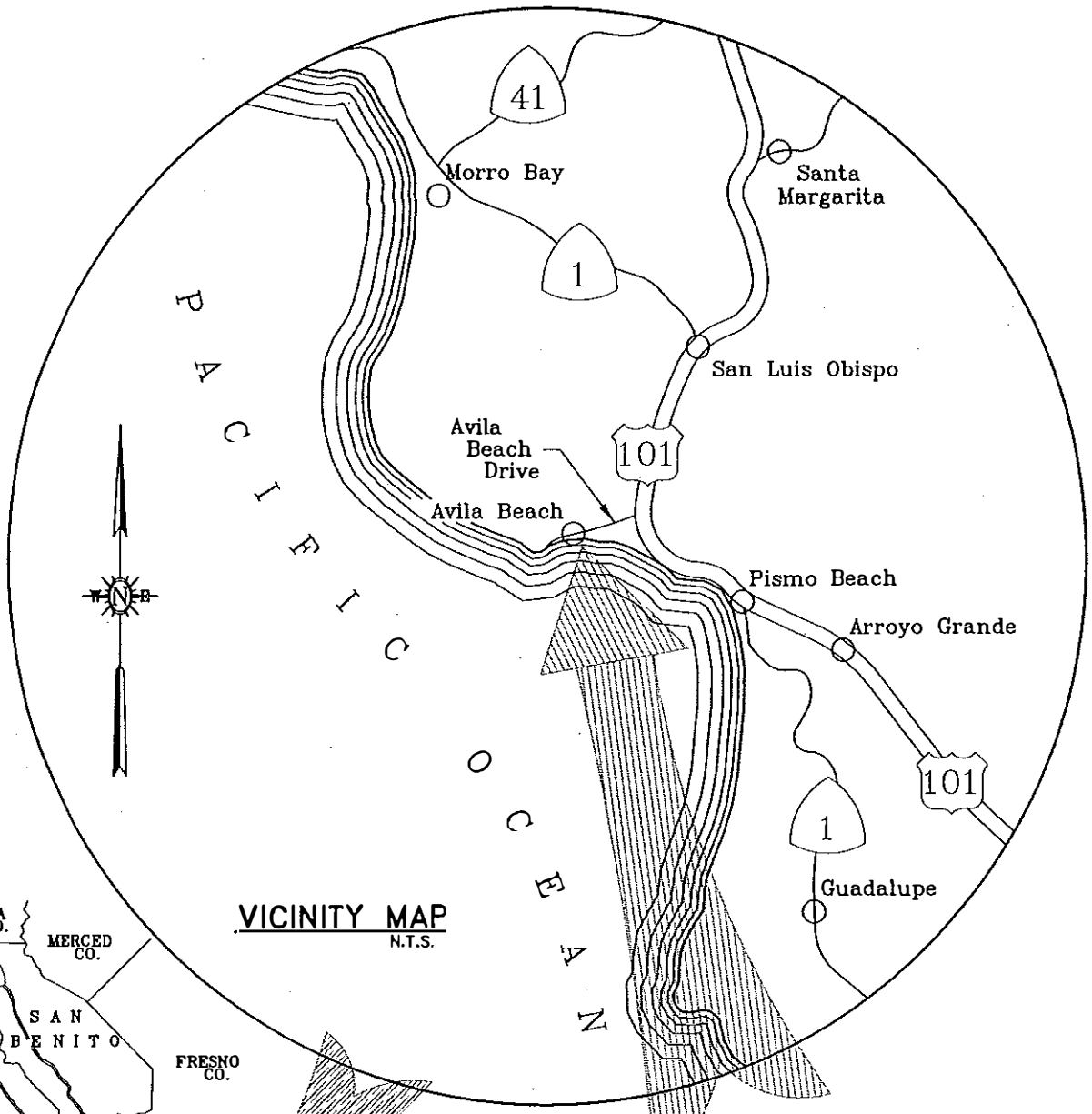
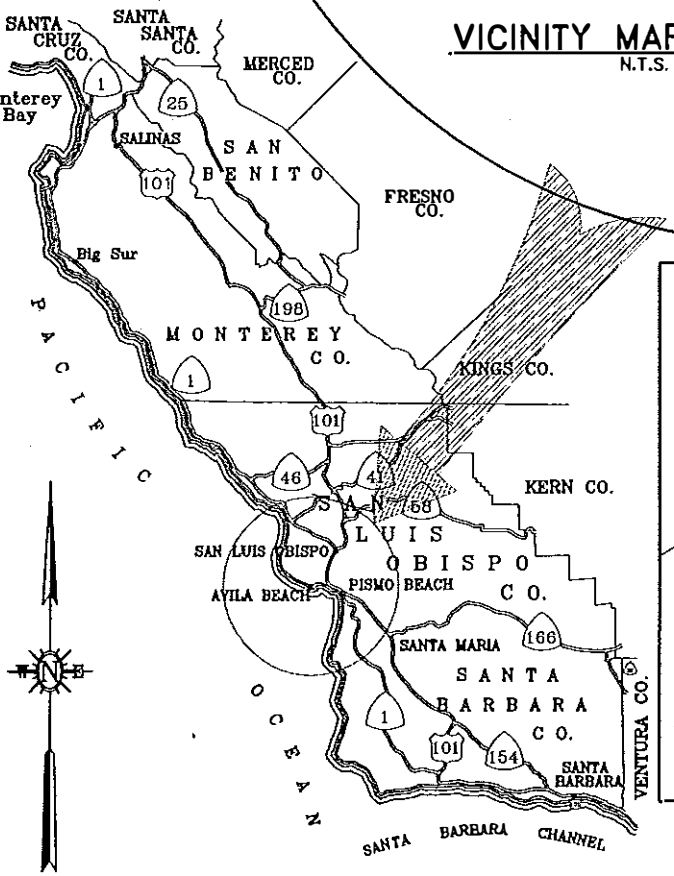
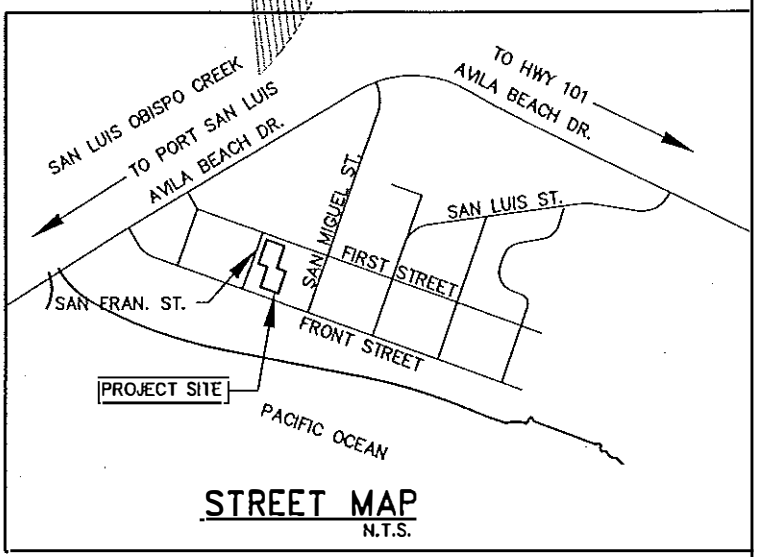


VICINITY MAP
N.T.S.



AREA MAP
N.T.S.



STREET MAP
N.T.S.

EXHIBIT 1

THE LANDING, AVILA BEACH

NOTE: SEE EXHIBIT 5 FOR 25-YR AND 100-YR STORM FLOOD PLAIN ELEVATIONS AND EXTENTS

TO 36" RCP CREEK OUTLET

EXISTING CURB OPENING STREET DRAIN

PUBLIC PARKING LOT

STREET DRAINAGE TRIBUTARY APPROX. AREA = 3.0 ACRES

ON-SITE DRAINAGE AREA = 0.6 ACRES

SAN FRANCISCO STREET

SAN MIGUEL STREET

FIRST STREET

SAN LUIS STREET

10

20

30

40

PRE-DEVELOPED RUNOFF CALCULATIONS

USE Q=CiA

FROM SLO CO. I-D-F CURVE, D-6:
i(10)=2.25 in/hr
i(25)=2.5 in/hr

ON-SITE:
A=0.6 ac
C=0.35
Q(10)=(0.35)*(2.25)*(0.6)= 0.47 cfs
Q(25)=(0.35)*(2.5)*(0.6)= 0.53 cfs

STREET DRAINAGE:
A=3.0 ac
C(composite)=0.75
Q(10)=(0.75)*(2.25)*(3.0)= 5.1 cfs
Q(25)=(0.75)*(2.5)*(3.0)= 5.6 cfs

LEGEND

LIMITS OF SUB-BASIN AREA

RUNOFF FLOW ARROWS

1 INCH = 40 FEET

REVISIONS		
NO.	DATE	DESCRIPTION

Cannon ASSOCIATES
ENGINEERS
PLANNERS
SURVEYORS

EXHIBIT 2 – DRAINAGE MAP PRE-DEVELOPED CONDITIONS (NON-INUNDATED CONDITIONS) THE LANDING, AVILA BEACH

COUNTY OF SAN LUIS OBISPO, CALIFORNIA

DRAWN BY	DATE	CA JOB NO.
LAR	APRIL 2006	040834
CHECKED BY	SCALE	SHEET
LAR/JWE	1" = 40'	1 OF 1

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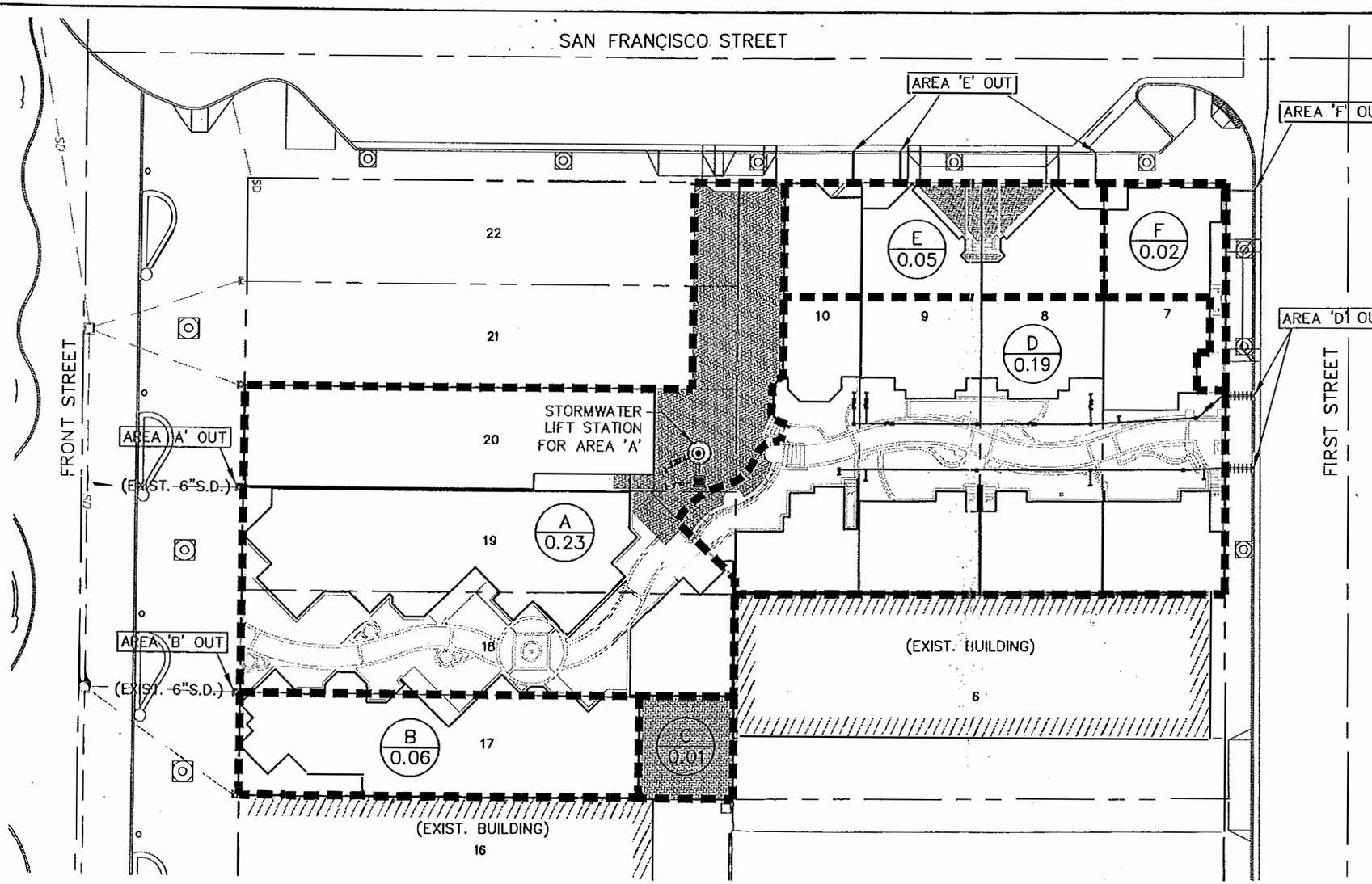

RUNOFF CALCULATIONS

USE Q=CiA

C=0.9
FROM SLO CO. I-D-F CURVE, D-6:
i(10)=2.25 in/hr
i(25)=2.55 in/hr

AREA A:
A=0.23 ac
Q(10)=(0.9)*(2.25)*(0.23)= 0.47 cfs
Q(25)=(0.9)*(2.55)*(0.23)= 0.53 cfs

AREA B:
A=0.06 ac
Q(10)=(0.9)*(2.25)*(0.06)= 0.12 cfs
Q(25)=(0.9)*(2.55)*(0.06)= 0.14 cfs

AREA C:
A=0.01 ac
Q(10)=(0.9)*(2.25)*(0.01)= 0.02 cfs
Q(25)=(0.9)*(2.55)*(0.01)= 0.02 cfs

AREA D:
A=0.19 ac
Q(10)=(0.9)*(2.25)*(0.19)= 0.38 cfs
Q(25)=(0.9)*(2.55)*(0.19)= 0.44 cfs

AREA E:
A=0.05 ac
Q(10)=(0.9)*(2.25)*(0.05)= 0.10 cfs
Q(25)=(0.9)*(2.55)*(0.05)= 0.11 cfs

AREA F:
A=0.02 ac
Q(10)=(0.9)*(2.25)*(0.02)= 0.04 cfs
Q(25)=(0.9)*(2.55)*(0.02)= 0.05 cfs

AREA DISCHARGE DESCRIPTIONS

AREA 'A' IS PUMPED TO AN EXISTING STORM DRAIN BOX IN FRONT STREET.

AREA 'B' IS PUMPED TO AN EXISTING STORM DRAIN BOX IN FRONT STREET.

AREA 'C' PERCOLATES INTO PERVIOUS FINISHED SURFACE.

AREA 'D' DISCHARGES TO FIRST STREET VIA TWO STORM DRAINS AND SIDEWALK UNDERDRAINS.

AREA 'E' DISCHARGES TO SAN FRANCISCO STREET VIA ROOF DRAINS AND SURFACE RUNOFF.

AREA 'F' DISCHARGES TO FIRST STREET VIA ROOF DRAINS AND SURFACE RUNOFF.

LEGEND

DRAINAGE BOUNDARY

E / 0.25 — AREA DESIGNATION / AREA IN ACRES

N.T.S.

Cannon ASSOCIATES
ENGINEERS
PLANNERS
SURVEYORS
3M Pacific Drive
San Luis Obispo, CA 93401
(805) 544-7407

EXHIBIT 3 – DRAINAGE MAP
ON-SITE POST-DEVELOPED CONDITIONS

THE LANDING, AVILA BEACH
COUNTY OF SAN LUIS OBISPO, CALIFORNIA

DRAWN BY	DATE	CA JOB NO.
LAR	APRIL 2006	040834
CHECKED BY	SCALE	SHEET
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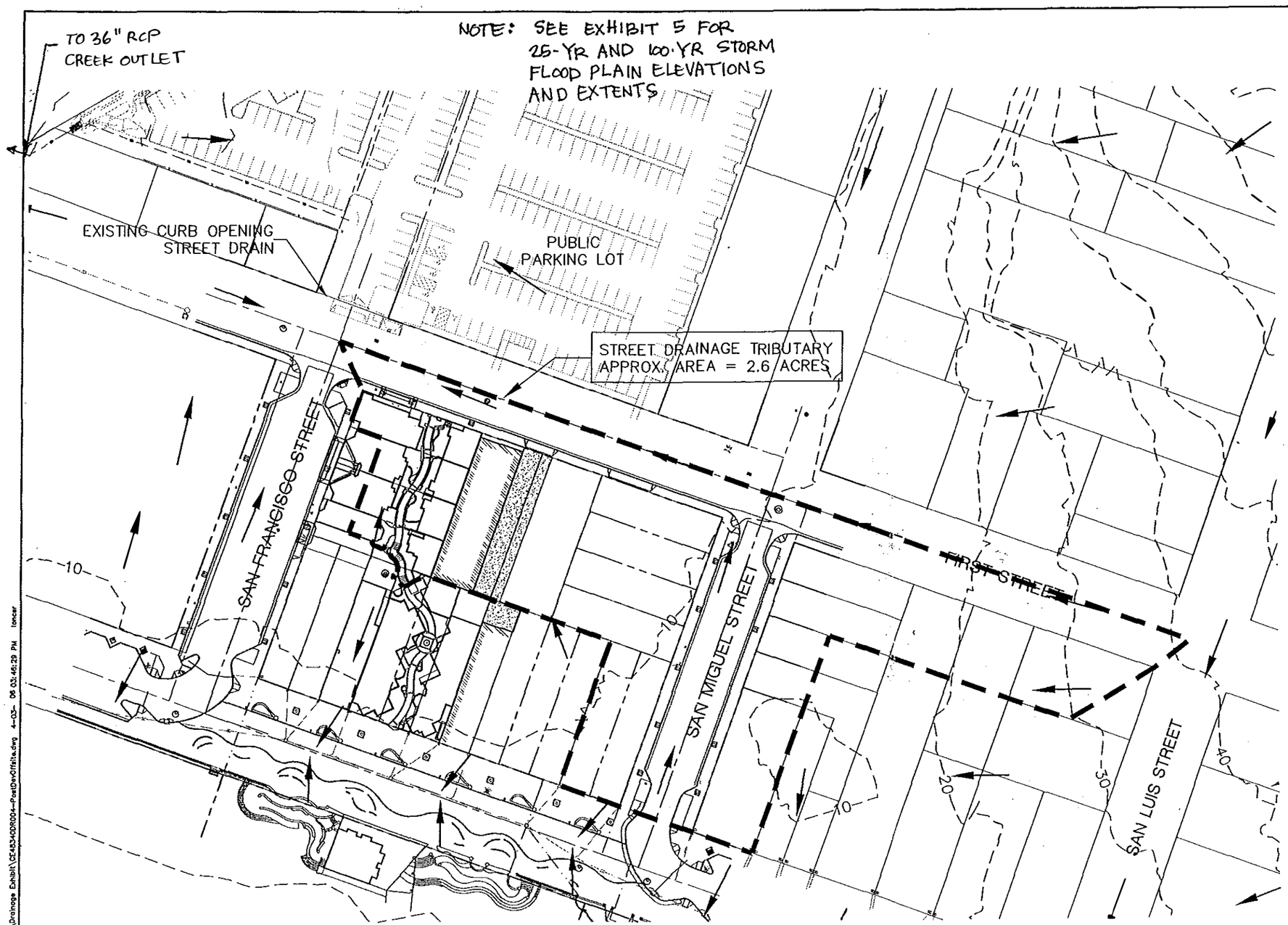

POST-DEVELOPED RUNOFF CALCULATIONS

USE Q=CiA

FROM SLO CO. I-D-F CURVE, D-6:
i(10)=2.25 in/hr
i(25)=2.5 in/hr

STREET DRAINAGE:
A=2.6 ac
C=0.9
Q(10)=(0.9)*(2.25)*(2.6)= 5.3 cfs
Q(25)=(0.9)*(2.5)*(2.6)= 5.9 cfs

LEGEND

LIMITS OF SUB-BASIN AREA

RUNOFF FLOW ARROWS

1 INCH = 40 FEET

REVISIONS		
NO.	DATE	DESCRIPTION

Cannon ASSOCIATES
ENGINEERS
PLANNERS
SURVEYORS

EXHIBIT 4 – DRAINAGE MAP POST-DEVELOPED CONDITIONS (NON-INUNDATED CONDITIONS)

THE LANDING, AVILA BEACH
COUNTY OF SAN LUIS OBISPO, CALIFORNIA

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LAR	APRIL 2006	040834
CHECKED BY	SCALE	SHEET
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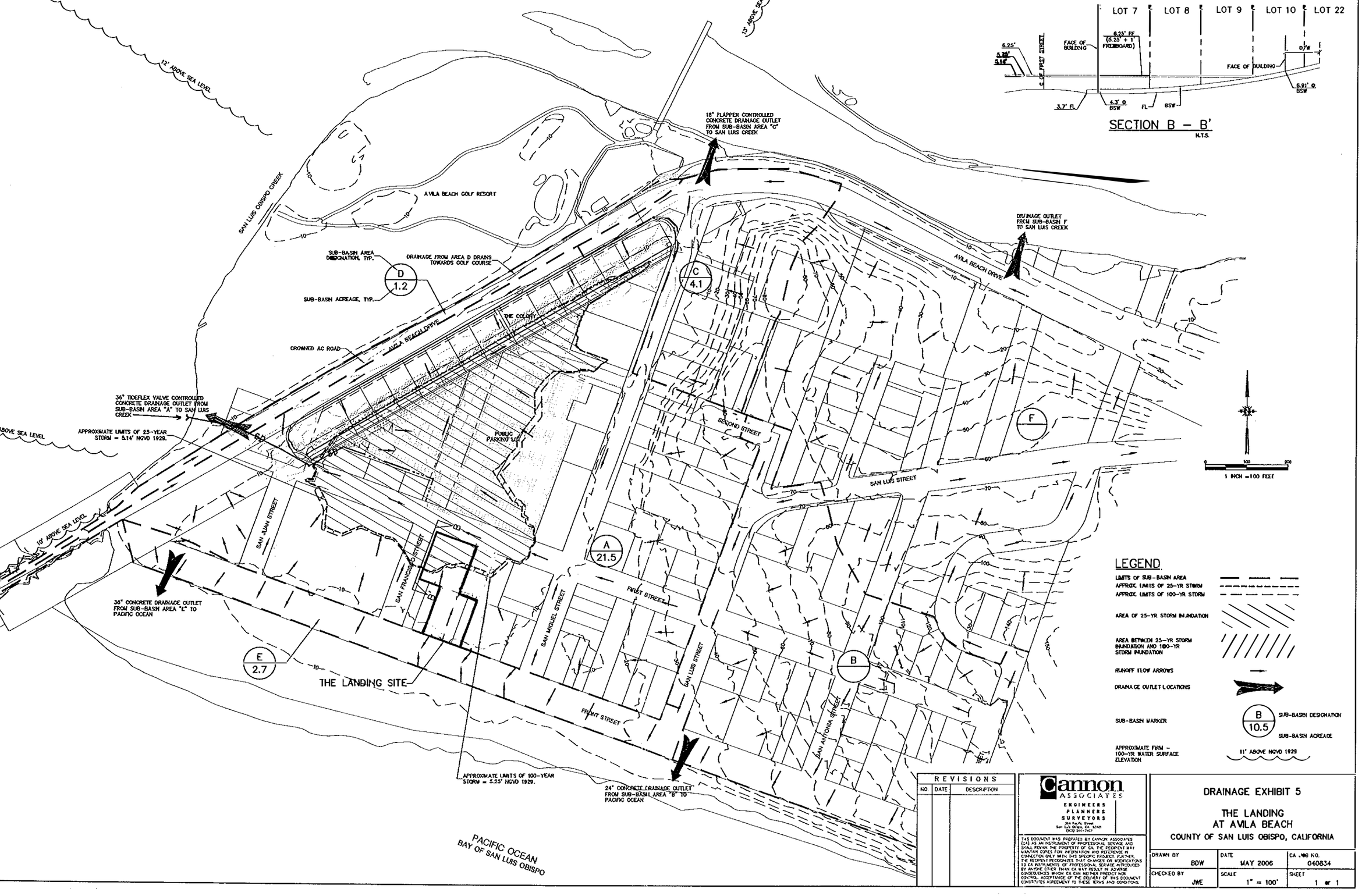

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REVISIONS		
NO.	DATE	DESCRIPTION

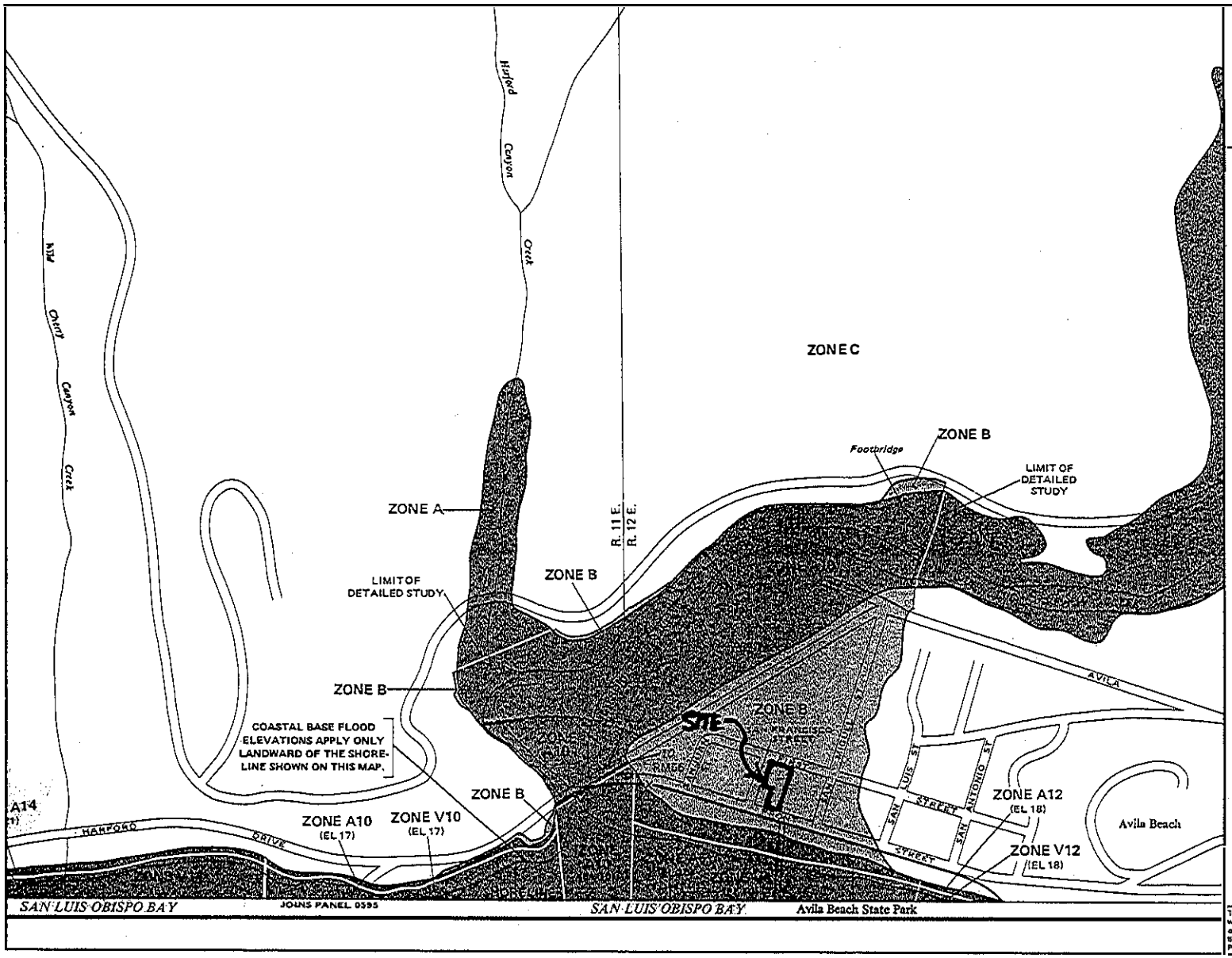
Cannon ASSOCIATES
ENGINEERS
PLANNERS
SURVEYORS
264 Pacific Street
San Luis Obispo, CA. 93401
(805) 541-7421

DRAINAGE EXHIBIT 5

THE LANDING AT AVILA BEACH

COUNTY OF SAN LUIS OBISPO, CALIFORNIA

DRAWN BY: BDW	DATE: MAY 2006	CA JOB NO.: 040834
CHECKED BY: JWE	SCALE: 1" = 100'	SHEET: 1 of 1



APPROXIMATE SCALE

500 0 500 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

SAN LUIS OBISPO COUNTY, CALIFORNIA

(UNINCORPORATED AREAS)

PANEL 592 OF 975

(SEE MAP INDEX FOR PANELS NOT PRINTED)

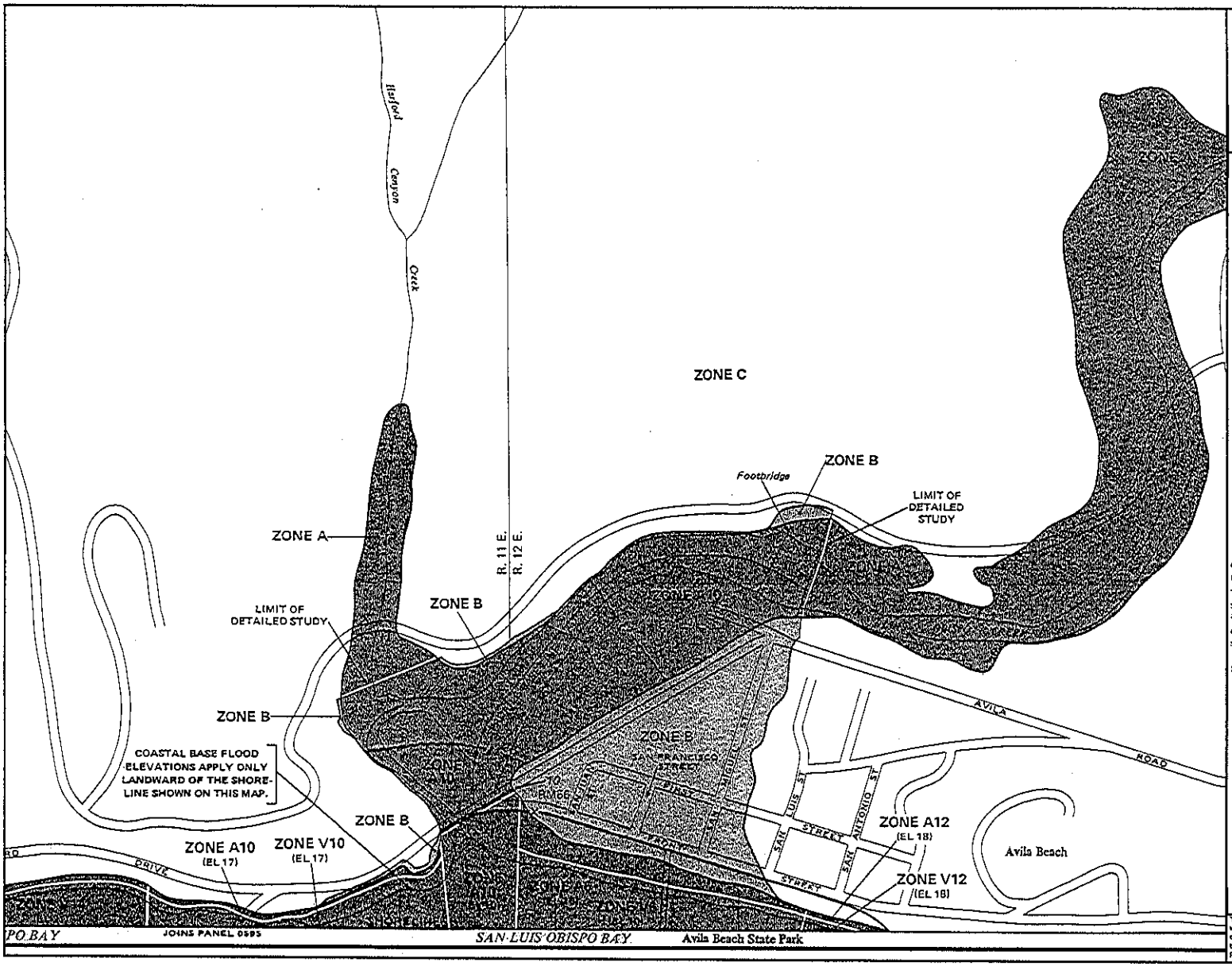
COMMUNITY-PANEL NUMBER
060304 0592 C

MAP REVISED:
JULY 18, 1985

Federal Emergency Management Agency

This is an official copy of a portion of the above-referenced flood map. It was obtained using FIRMETTE On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

EXHIBIT 5A



APPROXIMATE SCALE

500 0 500 FEET

A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
AO	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

Coastal base flood elevations apply only landward of the shoreline shown on this map.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION:
JANUARY 3, 1975

FLOOD HAZARD BOUNDARY MAP REVISIONS:
NOVEMBER 22, 1977

FLOOD INSURANCE RATE MAP EFFECTIVE:
JULY 5, 1982

FLOOD INSURANCE RATE MAP REVISIONS:
Map revised July 18, 1985 to change flood plain boundaries, zone designations, base flood elevations, corporate limits, scale,

EXHIBIT SB

Appendix B: Calculations

Cannon ASSOCIATES
364 Pacific Street
San Luis Obispo, CA
93401
805-544-7407
FAX 805-544-3863

PROJECT: The Landing, Avila Beach

Runoff Calculations

BY: LDP

DATE: 4.3.06

DETERMINE THE PEAK RUNOFFS FOR PRE-DEVELOPED AND POST-DEVELOPED CONDITIONS.

USE $Q = CiA$, SLO COUNTY STANDARDS + SPECS

$i_{10} = 2.25$ in/hr $\quad i_{25} = 2.5$ in/hr.

I. PRE-DEVELOPED RUNOFF

A. ON-SITE:

A: 0.6 ac
C = 0.35

$Q_{10} = (0.35)(2.25)(0.6) = 0.47$ cfs

$Q_{25} = (0.35)(2.5)(0.6) = 0.53$ cfs

B. STREET DRAINAGE:

Az. 3.0 ac

$$C_{comp} = \frac{(0.6)(0.35) + (2.4)(0.85)}{3.0} = 0.75$$

$Q_{10} = (0.75)(2.25)(3.0) = 5.1$ cfs

$Q_{25} = (0.75)(2.5)(3.0) = 5.6$ cfs

II. POST-DEVELOPED RUNOFF (SEE EXHIBIT 3 - ON-SITE POST DEV. DRAINAGE MAP)

A. ON-SITE:

AREA A $\quad Q_{10} = (0.9)(2.25$ in/hr$)(0.23$ ac$) = 0.47$ cfs
$Q_{25} = (0.9)(2.5$ in/hr.$)(0.23$ ac$) = 0.52$ cfs

AREA B $\quad Q_{10} = (0.9)(2.25$ in/hr.$)(0.06$ ac$) = 0.12$ cfs
$Q_{25} = (0.9)(2.5$ in/hr.$)(0.06$ ac$) = 0.14$ cfs

AREA C $\quad Q_{10} = (0.9)(2.25$ in/hr.$)(0.01) = 0.02$ cfs
$Q_{25} = (0.9)(2.5$ in/hr$)(0.01) = 0.02$ cfs

AREA D $\quad Q_{10} = (0.9)(2.25$ in/hr.$)(0.19$ ac$) = 0.38$ cfs
$Q_{25} = (0.9)(2.5$ in/hr$)(0.19$ ac$) = 0.43$ cfs

AREA E $\quad Q_{10} = (0.9)(2.25$ in/hr$)(0.05$ ac$) = 0.10$ cfs
$Q_{25} = (0.9)(2.5$ in/hr$)(0.05$ ac$) = 0.11$ cfs

AREA F $\quad Q_{10} = (0.9)(2.25$ in/hr$)(0.02$ ac$) = 0.04$ cfs
$Q_{25} = (0.9)(2.5$ in/hr$)(0.02$ ac$) = 0.05$ cfs

Cannon
ASSOCIATES
364 Pacific Street
San Luis Obispo, CA
93401
805-544-7407
FAX 805-544-3863

PROJECT: _____ PAGE: 2/2.

BY:

DATE:

II. (cont'd) POST-DEVELOPED CONDITIONS

B. STREET DRAINAGE

AREA TRIBUTARY TO GUTTER ALONG FIRST STREET AT PROJECT SITE IS 2.6 ac.

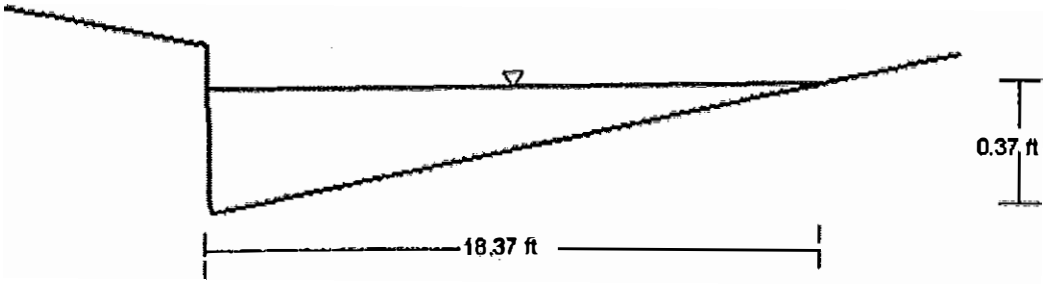
$Q_{10} = (0.9)(2.2\text{ in/hr})(2.6\text{ ac}) = 5.3$ cfs

$Q_{25} = (0.9)(2.5\text{ in/hr})(2.6\text{ ac}) = 5.9$ cfs

10-yr Runoff in First Street
Cross Section for 10-yr Street Flow

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Section Data		
Roughness Coefficient:	0.015	
Channel Slope:	0.00250	ft/ft
Normal Depth:	0.37	ft
Elevation Range:	0.00 to 0.62 ft	
Discharge:	5.30	ft^3/s



V: 10
H: 1

Worksheet for 10-yr Street Flow

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data		
Channel Slope:	0.00250	ft/ft
Discharge:	5.30	ft³/s

Options		
Current Roughness Weighted Meth	ImprovedLotters	
Open Channel Weighted Roughnes	ImprovedLotters	
Closed Channel Weighted Roughne	Hortons	

Results		
Roughness Coefficient:	0.015	
Water Surface Elevation:	0.37	ft
Elevation Range:	0.00 to 0.62 ft	
Flow Area:	3.36	ft²
Wetted Perimeter:	18.68	ft
Top Width:	18.37	ft
Normal Depth:	0.37	ft
Critical Depth:	0.31	ft
Critical Slope:	0.00625	ft/ft
Velocity:	1.58	ft/s
Velocity Head:	0.04	ft
Specific Energy:	0.40	ft
Froude Number:	0.65	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(-0+06, 0.62)	(0+23, 0.45)	0.015

Section Geometry

Station	Elevation
-0+06	0.62
0+00	0.50

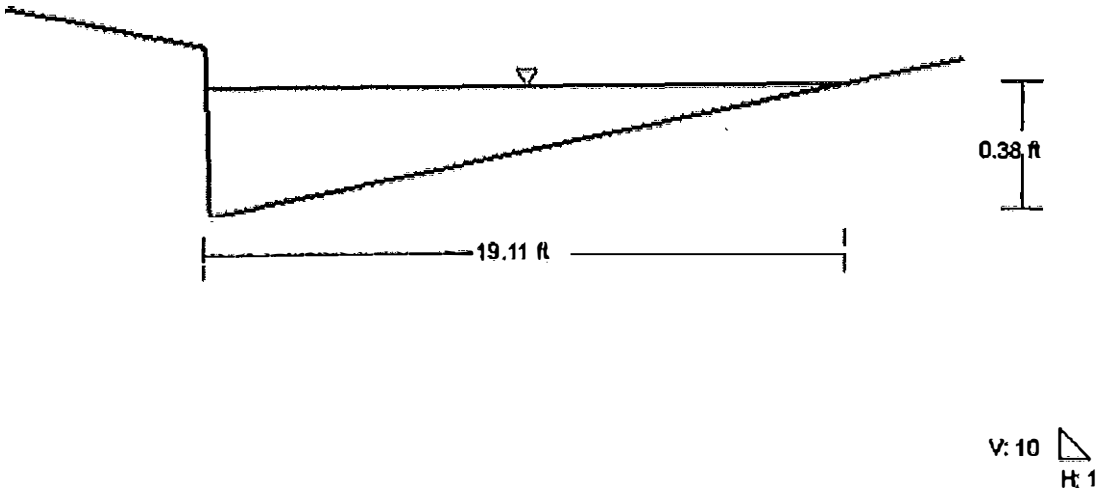
Worksheet for 10-yr Street Flow

Station	Elevation
0+00	0.00
0+23	0.45

25-yr Runoff in First Street
Cross Section for 25-yr Street Flow

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Section Data		
Roughness Coefficient:	0.015	
Channel Slope:	0.00250	ft/ft
Normal Depth:	0.38	ft
Elevation Range:	0.00 to 0.62 ft	
Discharge:	5.90	ft^3/s



Worksheet for 25-yr Street Flow

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data		
Channel Slope:	0.00250	ft/ft
Discharge:	5.90	ft³/s

Options		
Current Roughness Weighted Meth	ImprovedLotters	
Open Channel Weighted Roughnes	ImprovedLotters	
Closed Channel Weighted Roughne	Hortons	

Results		
Roughness Coefficient:	0.015	
Water Surface Elevation:	0.38	ft
Elevation Range:	0.00 to 0.62 ft	
Flow Area:	3.64	ft²
Wetted Perimeter:	19.42	ft
Top Width:	19.11	ft
Nonnal Depth:	0.38	ft
Critical Depth:	0.32	ft
Critical Slope:	0.00616	ft/ft
Velocity:	1.62	ft/s
Velocity Head:	0.04	ft
Specific Energy:	0.42	ft
Froude Number:	0.66	
Flow Type:	Subcritical	

Segment Roughness

Start Station	End Station	Roughness Coefficient
(-0+08, 0.62)	(0+23, 0.45)	0.015

Section Geometry

Station	Elevation
-0+06	0.62
0+00	0.50

Worksheet for 25-yr Street Flow

Station	Elevation
0+00	0.00
0+23	0.45

Worksheet for Sidewalk Underdrain Alhambra A-470 3"x12.5"

Project Description		
Flow Element:	Box Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	

Input Data		
Roughness Coefficient:	0.012	
Channel Slope:	0.02000	ft/ft
Normal Depth:	0.21	ft
Height:	0.21	ft
Bottom Width:	1.00	ft

Results		
Discharge:	0.71	ft^3/s
Flow Area:	0.21	ft^2
Wetted Perimeter:	2.42	ft
Top Width:	1.00	ft
Critical Depth:	0.25	ft
Critical Slope:	0.00572	ft/ft
Velocity:	3.41	ft/s
Velocity Head:	0.18	ft
Specific Energy:	0.39	ft
Froude Number:	1.32	
Flow Type:	Supercritical	

GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	

GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s
Upstream Velocity:	Infinity	ft/s
Normal Depth:	0.21	ft
Critical Depth:	0.25	ft

Worksheet for Sidewalk Underdrain Alhambra A-470 3"x12.5"

Channel Slope:	0.02000	ft/ft
Critical Slope:	0.00572	ft/ft

Notes:

Existing 6" PVC S.D
In Front Street

040834 Landing
7.26.05

Worksheet for Exist 6-in PVC

Project Description		
Flow Element:	Circular Pipe	
Friction Method:	Manning Formula	
Solve For:	Discharge	
Input Data		
Roughness Coefficient:	0.012	
Channel Slope:	0.02000	ft/ft
Normal Depth:	0.50	ft
Diameter:	0.50	ft
Results		
Discharge:	0.86	ft^3/s
Flow Area:	0.20	ft^2
Wetted Perimeter:	1.57	ft
Top Width:	0.00	ft
Critical Depth:	0.45	ft
Percent Full:	100.0	%
Critical Slope:	0.01747	ft/ft
Velocity:	4.38	ft/s
Velocity Head:	0.30	ft
Specific Energy:	0.80	ft
Froude Number:	0.00	
Maximum Discharge:	0.92	ft^3/s
Discharge Full:	0.86	ft^3/s
Slope Full:	0.02000	ft/ft
Flow Type:	SubCritical	
GVF Input Data		
Downstream Depth:	0.00	ft
Length:	0.00	ft
Number Of Steps:	0	
GVF Output Data		
Upstream Depth:	0.00	ft
Profile Description:		
Profile Headloss:	0.00	ft
Average End Depth Over Rise:	0.00	%
Normal Depth Over Rise:	1.00	%
Downstream Velocity:	Infinity	ft/s

Worksheet for Exist 6-in PVC

Upstream Velocity:	Infinity	ft/s
Normal Depth:	0.50	ft
Critical Depth:	0.45	ft
Channel Slope:	0.02000	ft/ft
Critical Slope:	0.01747	ft/ft

The Landing
Storm Water Pump Design

ONE-PAGE SUMMARY

Branch Number: 2

FLUID DESCRIPTION

Asmpt:	Incompressible	
Fluid:	Water	
Temperature:	70.00	Fahrenheit
Pressure:	14.70	PSIA
Density:	62.31	lb/cu ft
Specific Volume:	0.016	cu ft/lb
Specific Gravity:	0.998	
Abs. Viscosity:	0.980	centipoise
Kin. Viscosity:	0.982	centistokes

HARDWARE DESCRIPTION

Number of Components:	8	
Branch Inlet Diameter:	3.998	inches
Branch Outlet Diameter:	3.998	inches
Branch Elevational Change:	17.0	feet
Branch K Factor:	10.53	

FLOW DESCRIPTION

Mass Flow Rate:	119,937.19	lb/hr
Volumetric Flow Rate:	240.00	US gal/min
Velocity:	6.13	ft/sec (FPS)
Differential Pressure:	10.02	PSID
Head Loss:	6.15	feet
Head Loss:	2.663	PSID

ITT

Wastewater

Goulds Pumps

WS_D3 Series Model 3888D3

Submersible Sewage Pump

FEATURES

- **Impeller:** Cast iron, ASTM A48, Class 30, two vane semi-open, non-clog design with pump out vanes for mechanical seal protection. Balanced for smooth operation. Silicon bronze impeller is an option.
- **Casing:** Heavy duty gray cast iron, ASTM A48, Class 30. Volute type casing with 3", 125#, ANSI flanged, horizontal discharge. Compatible with A10-30 cast iron or A10-30B cast iron and brass (non-sparking) guide rail assembly.
- **Dual Mechanical Seals:** Silicon carbide vs. silicon carbide outer seal and ceramic vs. carbon inner seal, stainless steel metal parts, BUNA-N elastomers. Upper and lower shaft seals are positioned independently and are separated by an oil-filled chamber.
- **Shaft:** 300 series stainless steel keyed design.
- **Fasteners:** 300 series stainless steel.
- Capable of running dry temporarily without damage to seals or motor.

GOULDS PUMPS

Goulds Pumps is a brand of ITT Water Technology, Inc.
- a subsidiary of ITT Industries, Inc.

www.goulds.com

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GOULDS PUMPS
Wastewater

APPLICATIONS

Used in a variety of residential, commercial and industrial applications such as:

- Sewage systems, Flood and Pollution Control, Dewatering/Effluent, Farms, Hospitals, Trailer Courts, Motels

SPECIFICATIONS

Pump:

- Maximum solid size: 2.5"
- Discharge size: 3", 125 # ANSI flange
- Maximum capacity: 470 GPM
- Maximum total head: 65 feet
- 300 Series stainess steel fasteners
- 20' Power cord
- Standard silicon carbide/silicon carbide outer seal

Motor:

- Maximum ambient temperature: 104° F (40° C) continuous duty, 140° F (60° C) intermittent duty
- Rated for continuous duty when fully submerged
- Insulation: Class F
- 60 Hertz
- Single row ball bearings
- 300 Series stainless steel keyed shaft

Single Phase:

- 1.5 - 5 HP; 208 and 230 volts
- Built-in thermal overloads with automatic reset
- Built-in capacitors

Three Phase:

- 1.5 - 5 HP; 200, 230, 460 and 575 volts
- Class 10 overload protection must be provided in control panel

MOTORS

- Fully submerged in oil-filled chamber. High grade turbine oil surrounds motor for more efficient heat dissipation, permanent lubrication of bearings and mechanical seal for complete protection against outside environment.
- Class F insulation.
- **Designed for Continuous Operation:** Pump ratings are within the motor manufacturer's recommended working limits and can be operated continuously without damage when fully submerged.
- **Bearings:** Upper and lower heavy duty ball bearing construction for precision positioning of parts and to carry thrust loads.
- **Power Cable:** Severe duty rated, oil and water resistant. Epoxy seal on motor end provides secondary moisture barrier in case of outer jacket damage and to prevent oil wicking. 20 foot standard with optional lengths available.
- **O-ring:** Assures positive sealing against contaminants and oil leakage.

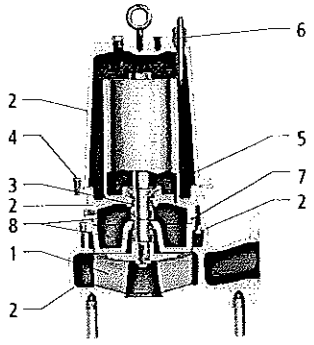
AGENCY LISTINGS

Tested to UL 778 and CSA 22.2 108 Standards
By Canadian Standards Association File #LR38549
Goulds Pumps is ISO 9001 Registered.

MODEL AND MOTOR INFORMATION

Order No.	HP	Phase	Volts	RPM	Impeller Dia. (in.)	Maximum Amps	L.R. Amps	KVA Code	Power Cable	F.L. Motor Efficiency %	Resistance Start	Resistance Line-Line	Wt. (lbs.)
WS1518D3M	1.5	1	208	1750	5.25	15.0	50.8	B	14/3	80	1.1	0.9	192
WS1512D3M			230			12.5	29.5	E		70	1.4	1.8	
WS1538D3M		3	200			11.5	40.9	H	14/4	81	NA	1.7	190
WS1532D3M			230			10.0	40.0	F		83		2.3	
WS1534D3M			460			5.0	20.0	F		83		9.3	
WS1537D3M			575			4.0	14.4	H		74		14.8	
WS1518D3	1.5	1	208	1750	6.50	15.0	50.8	B	14/3	80	1.1	0.9	192
WS1512D3			230			12.5	29.5	E		70	1.4	1.8	
WS1538D3		3	200			11.5	40.9	H	14/4	81	NA	1.7	190
WS1532D3			230			10.0	40.0	F		83		2.3	
WS1534D3			460			5.0	20.0	F		83		9.3	
WS1537D3			575			4.0	14.4	H		74		14.8	
WS2018D3	2	1	208	1750	7.00	19.0	50.8	8	14/3	80	1.1	0.9	196
WS2012D3			230			16.0	36.9	D		75	1.4	1.5	
WS2038D3		3	200			11.5	40.9	H	14/4	81	NA	1.7	194
WS2032D3			230			10.0	40.0	F		83		2.3	
WS2034D3			460			5.0	20.0	F		83		9.3	
WS2037D3			575			4.0	14.4	H		74		14.8	
WS3018D3	3	1	208	1750	7.25	25.5	50.8	B	10/3	80	1.1	0.9	205
WS3012D3			230			21.5	46.4	C		79	1.0	1.0	
WS3038D3		3	200			15.2	53.8	G	10/4	85	NA	1.3	200
WS3032D3			230			12.0	49.5	H	14/4	83		1.9	
WS3034D3			460			6.0	24.8	H		83		7.5	
WS3037D3			575			4.8	17.3	G		78		11.6	
WS5012D3	5	1	230	1750	8.00	26.5	57.7	A	10/3	80	1.0	0.8	210
WS5038D3		3	200			18.8	73.9	F	10/4	84	NA	0.9	205
WS5032D3			230			16.4	63.6	E		85		1.2	
WS5034D3			460			8.2	31.8	E	14/4	85		4.8	
WS5037D3			575			6.8	22.8	E		80		7.4	

MATERIALS OF CONSTRUCTION



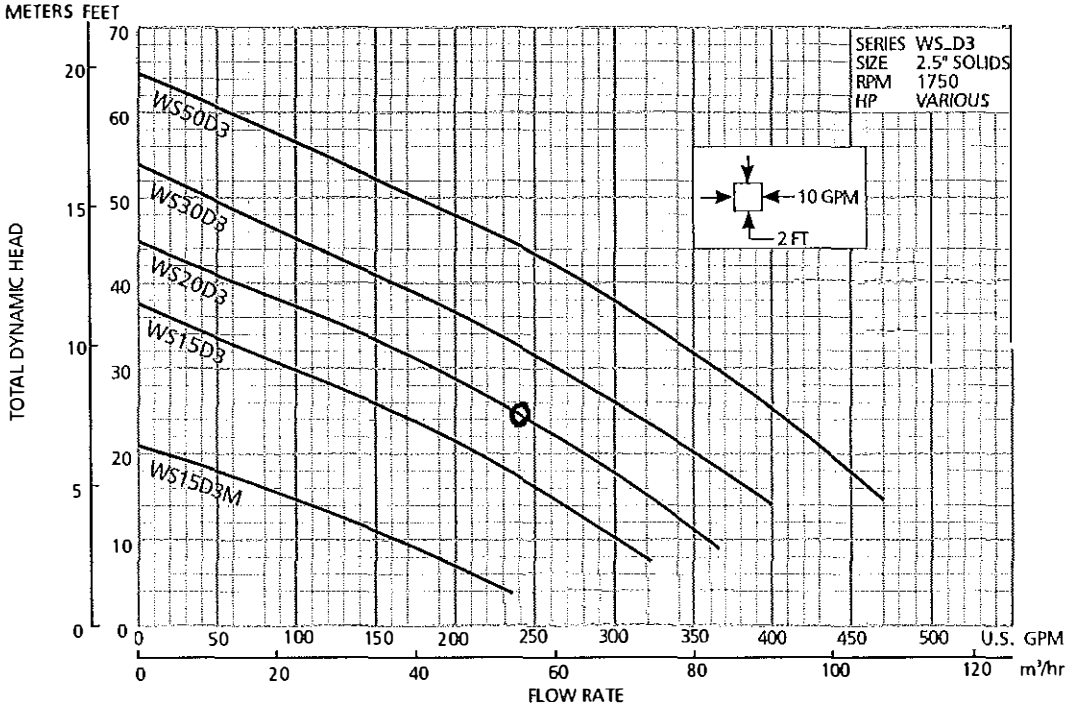
Item No.	Part Name	Material	
		Standard	Optional
1	Impeller, non-clog	1003	1179
2	Castings	1003	
3	Shaft-keyed	300 Series SS	
4	Fasteners	300 Series SS	
5	Ball bearings	Steel	
6	Power cable	STOW, 20 feet	Additional lengths
7	O-ring	BUNA-N	

Item No.	Outer Mech. Seal	Service	Rotary	Stationary	Elastomers	Metal Parts
8	OPT	Heavy duty	Silicon Carbide	Tungsten Carbide	BUNA-N	300 Series SS
	STD	Mild abrasives	Silicon carbide		BUNA-N	300 Series SS

Material Code	Engineering Standard
1003	Cast iron — ASTM A48 Class 30
1179	Silicon bronze — ASTM C87600

PERFORMANCE RATINGS (Gallons Per Minute)

Series No. ▶		WS15D3M	WS15D3	WS20D3	WS30D3	WS50D3
HP ▶		1¼	1½	2	3	5
RPM ▶		1750				
Total Head Feet of Water	10	160	300			
	15	90	260	320		
	20		210	280	350	435
	25		160	235	310	400
	30		100	185	265	360
	35			130	210	325
	40			60	160	280
	45				100	230
	50					170
	55					115
	60					60



ITT

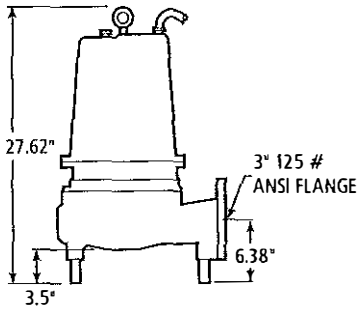
Wastewater

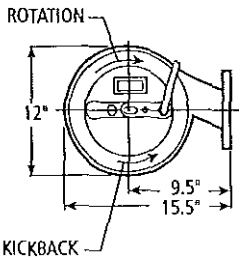
APPLICATION DATA AND CONSTRUCTION DETAILS

Maximum Solid Size		2.5"
Minimum Casing Thickness		5/16"
Casing Corrosion Allowance		1/8"
Maximum Working Pressure		30 PSI
Maximum Submergence		50 feet
Minimum Submergence		Fully submerged for continuous operation
		6" below top of motor for intermittent operation
Maximum Environmental Temperature		40° C (104° F) continuous operation, 60° C (140° F) intermittent operation
Power Cable – Type (See Motor Information for AWG data/size.)		Type SJTOW: single phase, 1 1/2 and 2 HP
		Type STOW: single phase, 1 1/2 – 3 HP and 5 HP, 460 V
		Type STOW: single phase, 3 and 5 HP, three phase 5 HP, 230 V
Motor Cover, Bearing Housing, Seal Housing, Casing		Gray Cast Iron – ASTM A48, Class 30
Impeller – Standard, Optional		Gray Cast Iron – ASTM A48 or Cast Bronze – ASTM B584 C87600
Motor Shaft		AISI 300 Series Stainless Steel
Motor Design		NEMA 56 Frame, oil filled with Class F Insulation
Motor Overload Protection		Single phase: on winding thermal overload protection auto reset
		Three phase: requires Class 10 overloads in control panel
External Hardware		300 Series Stainless Steel
Impeller Type		Semi-open with pump out vanes on back shroud
Oil Capacity – Seal Chamber		1.5 quarts
Oil Capacity – Motor Chamber		1 1/2-5 HP single and three phase: 7 quarts
Mechanical Seals – Standard	Upper	Carbon/Ceramic; Type 21
	Lower	Silicon Carbide/Silicon Carbide; Type 31
Mechanical Seals – Optional Lower		Silicon Carbide/Tungsten Carbide; Type 31

DIMENSIONS

(All dimensions are in inches. Do not use for construction purposes.)





GOULDS PUMPS

B3888D3 March, 2006

Engineered for life

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Wastewater

Goulds Pumps

Wastewater Pumps

Dewatering, Effluent and Sewage

Installation, Operation and Maintainence Instructions

GOULDS PUMPS

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- a subsidiary of ITT Industries, Inc.

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Table of Contents

Owner's Information

Pump Model Number: _____

Pump Serial Number: _____

Control Model Number: _____

Dealer: _____

Dealer Phone No. _____

Date of Purchase: _____ Installation: _____

Current Readings at Startup:

1Ø	3Ø	L1-2	L2-3	L3-1
Amps: _____	Amps: _____	_____	_____	_____
Volts: _____	Volts: _____	_____	_____	_____

SAFETY INSTRUCTIONS

TO AVOID SERIOUS OR FATAL PERSONAL INJURY OR MAJOR PROPERTY DAMAGE, READ AND FOLLOW ALL SAFETY INSTRUCTIONS IN MANUAL AND ON PUMP.

THIS MANUAL IS INTENDED TO ASSIST IN THE INSTALLATION AND OPERATION OF THIS UNIT AND MUST BE KEPT WITH THE PUMP.

This is a SAFETY ALERT SYMBOL. When you see this symbol on the pump or in the manual, look for one of the following signal words and be alert to the potential for personal injury or property damage.

⚠ DANGER Warns of hazards that WILL cause serious personal injury, death or major property damage.

⚠ WARNING Warns of hazards that CAN cause serious personal injury, death or major property damage.

⚠ CAUTION Warns of hazards that CAN cause personal injury or property damage.

NOTICE: INDICATES SPECIAL INSTRUCTIONS WHICH ARE VERY IMPORTANT AND MUST BE FOLLOWED.

THOROUGHLY REVIEW ALL INSTRUCTIONS AND WARNINGS PRIOR TO PERFORMING ANY WORK ON THIS PUMP.

MAINTAIN ALL SAFETY DECALS.

⚠ WARNING All electrical work must be performed by a qualified technician. Always follow the National Electrical Code (NEC), or the Canadian Electrical Code, as well as all local, state and provincial codes. Code questions should be directed to your local electrical inspector. Failure to follow electrical codes and OSHA safety standards may result in personal injury or equipment damage. Failure to follow manufacturer's installation instructions may result in electrical shock, fire hazard, personal injury or death, damaged equipment, provide unsatisfactory performance, and may void manufacturer's warranty.

⚠ WARNING Standard units are not designed for use in swimming pools, open bodies of water, hazardous liquids, or where flammable gases exist. These fluids and gases may he present in containment areas. Tank or wetwell must be vented per local codes.

Only pumps specifically Listed for Class 1, Division 1 are allowable in hazardous liquids and where flammable gases may exist. *See specific pump catalog bulletins or pump nameplate for all agency Listings.*

⚠ WARNING Disconnect and lockout electrical power before installing or servicing any electrical equipment. Many pumps are equipped with automatic thermal overload protection which may allow an overheated pump to restart unexpectedly.

⚠ CAUTION All three phase (3Ø) control panels for submersible pumps must provide Class 10, quick-trip, overload protection.

PRE-INSTALLATION CHECKS

Open all cartons and inspect for shipping damage. Report any damage to your supplier or shipping carrier immediately.

Important: Always verify that the pump nameplate Amps, Voltage, Phase and HP ratings match your control panel and power supply.

Many of our sewage pumps are oil-filled. If there are any signs of oil leakage or if the unit has been stored for an extended period check the oil level in the motor dome and the seal housing, if so equipped.

Check the motor cover oil level through the pipe plug on top of the unit. The motor chamber oil should just cover the motor. Do not overfill, leave room for expansion!

To check the seal housing oil level, where used, lay the unit on its side with the fill plug at 12 o'clock. Remove the plug. The oil should be within ½" (13mm) of the top. If low, refill with an ASTM 150 turbine oil. Replace the plug.

Oil is available in 5 gallon cans through our distributors. You can also source oil locally at motor repair shops. Typical oil brands are: Shell Turbo 32, Sunoco Sunvis 932, Texaco Regal R&O 32, Exxon Nuto 32 and Mobil DTE Light.

Check the strain relief nut on power cable strain assemblies. Power cables should be torqued to 75 in. lbs. for #16 cables and 80 in. lbs. for all other cable assemblies. Seal/heat sensor cables, where used, should be torqued to 75 in. lbs.

Warranty does not cover damage caused by connecting pumps and controls to an incorrect power source (voltage/phase supply).

Record the model numbers and serial numbers from the pumps and control panel on the front of this instruction manual for future reference. Give it to the owner or affix it to the control panel when finished with the installation.

LIFTING OF PUMP

⚠ WARNING

DO NOT LIFT, CARRY OR HANG PUMP BY THE ELECTRICAL CABLES. DAMAGE TO THE ELECTRICAL CABLES CAN CAUSE SHOCK, BURNS OR DEATH.

Lift the pump with an adequately sized chain or cable attached to the lifting eye bolt. DO NOT damage electrical and sensor cables while raising and lowering unit.

OPTIONAL GUIDE RAIL OR LIFT-OUT SYSTEM

In many effluent and sewage basins or lift stations it is advisable to install the pump on a guide rail system or on a lift-out adapter to facilitate installation and removal for inspection and/or service. Most codes do not allow personnel to enter a wetwell without the correct protective equipment and training. Guide rails are designed to allow easy removal of the pump without the need for entry into the wetwell or need to disturb piping. The guide rail or lift-out adapter should locate the pump opposite the influent

opening preventing stagnate areas where solids can settle. The basin or pit must be capable of supporting the weight of the pump and guide rail. The pit floor must be flat.

NOTICE: FOLLOW THE INSTRUCTIONS THAT ARE PROVIDED WITH THE GUIDE RAIL ASSEMBLY.

PIPING

Discharge piping should be no smaller than the pump discharge diameter and kept as sbort as possible, avoiding unnecessary fittings to minimize friction losses.

Install an adequately sized check valve matched to the solids handling capability of the pump to prevent fluid backflow. Backflow can allow the pump ro "turbine" backwards and may cause premature seal and/or bearing wear. If the pump is turning backwards when it is called on to start the increased torque may cause damage to the pump motor and/or motor shaft and some single-phase pumps may actually run backwards.

Install an adequately sized gate valve AFTER the check valve for pump, plumbing and check valve maintenance.

Important – Before pump installation. Drill a 3/16" (4.8mm) relief hole in the discharge pipe. It should be located within the wetwell, 2" (51mm) above the pump discharge but below the check valve. The relief hole allows any air to escape from the casing. Allowing liquid into the casing will insure that the pump can start when the liquid level rises. Unless a relief hole is provided, a bottom intake pump could "air lock" and will not pump water even though the impeller turns.

All piping must be adequately supported, so as not to impart any piping strain or loads on the pump.

The pit access cover must be of sufficient size to allow for inspection, maintenance and crane or hoist service.

WIRING AND GROUNDING

Important notice: Read Safety Instructions before proceeding with any wiring.

⚠ Use only stranded copper wire to pump/motor and ground. The ground wire must be at least as large as the power supply wires. Wires should be color coded for ease of maintenance and troubleshooting.

⚠ Install wire and ground according to the Narional Electrical Code (NEC), or rhe Canadian Electrical Code, as well as all local, state and provincial codes.

⚠ Install an all leg disconnect switch where required by code.

⚠ Disconnect and lockout electrical power before performing any service or installation.

⚠ The electrical supply voltage and phase must match all equipment requirements. Incorrect voltage or phase can cause fire, motor and control damage, and voids the warranty.

⚠ All splices must be waterproof. If using splice kits follow manufacturer's instructions.

⚠ WARNING Select the correct type and NEMA grade junction box for the applicarion and location. The junction box musr insure dry, safe wiring connections.

⚠ WARNING Seal all controls from gases present which may damage electrical components.

⚠WARNING Hazardous voltage

FAILURE TO PERMANENTLY GROUND THE PUMP, MOTOR AND CONTROLS BEFORE CONNECTING TO POWER CAN CAUSE SHOCK, BURNS OR DEATH.

SELECTING AND WIRING PUMP CONTROL PANELS AND SWITCHES

FLOAT SWITCH TYPES

There are two basic float switch designs; single-action and wide-angle. Single-action switches operate over a range of 15° so they open and close quickly. Wide-angle floats operate over a 90° swing with the tether length between the float body and the pivot point controlling the On-Off range. The design determines how many floats are required with different systems or controls.

Floats may be normally open (NO) for pump down applications or to empty a tank. Normally closed (NC) switches are used to pump up or to fill a tank.

A single-action control switch may be used only with a control panel, never direct connected to a pump.

The wide-angle, pump down switches may be used as direct connected pump switches or as control switches.

SETTING THE FLOAT SWITCHES

There are no absolute rules for where to set the float switches, it varies from job to job.

Suggested Rules to Follow:
All floats should be set below the Inlet pipe!

Off Float: Best: set so the water level is always above the top of the pump (motor dome). Next Best: set so the water level is not more than 6" below the top of the pump.

On Float: set so the volume of water between the On and Off floats allows pumps of 1½ HP and under to operare for 1 minute minimum. Tvo (2) HP and larger pumps should run a minimum of 2 minutes. Basin literature states the gallons of storage per inch of basin height.

Lag/Alarm Float(s): should be staggered above the Off and On floats. Try to use most of rhe available storage provided by the basin, save some space for reserve storage capacity. *See Diagrams and Charts in Float Switch Chart Section.*

PANEL WIRING DIAGRAMS

Our control panels are shipped with instructions and wiring diagrams. Use those instructions in conjunction with this IOM. Electrical installation should be performed only by qualified technicians. Any problem or questions pertaining to another brand control must be referred to that control supplier or manufacturer. Our technical people have no technical schematics or trouble shooting information for other companies' controls.

ALARMS

We recommend the installation of an alarm on all Wastewater pump installations. Many standard control panels come equipped with alarm circuits. If a control panel is not used, a stand alone high liquid level alarm is available. The alarm alerts the owner of a high liquid level in the system so they can contact the appropriate service personnel ro investigate the situation.

SINGLE PHASE PUMPS
Single phase (1Ø) pumps may be operated using a piggyback or hard wired float switch, a contactor, or a Simplex or Duplex control panel. *See Figures 1, 2 and 5.*

All 1/3 and ½ HP, 115 or 230 volt pumps, and some ¾ and 1 HP pumps, are supplied with plug style power cords. They may be plugged into piggyback float switches for simple installations. It is allowable to remove the plugs in order to hardwire or connect to a Simplex or Duplex controller. Removing the plug neither voids the warranty nor violates the agency Listings. *See Figure 5.*

PLUG-CONNECTED UNITS MUST BE CONNECTED TO A PROPERLY GROUNDED, GROUNDING TYPE RECEPTACLE.

ON NON-PLUG UNITS, DO NOT REMOVE CORD AND STRAIN RELIEF. DO NOT CONNECT CONDUIT TO PUMP.

Pumps with bare lead power cords can be hard-wired to a float switch, wired to a 1Ø contactor, a Simplex controller or a Duplex controller. Always verify that the float switch is rated for the maximum run amperage, maximum starting amperage, and the HP rating on the pump. Single-phase wastewater pumps contain on-winding overloads, unless noted on the pump nameplate. *See Figures 1 and 2.*

THREE PHASE PUMPS:
As a Minimum a 3Ø pump requires a 3 pole circuit breaker/fused circuit, an across the line magnetic starter rated for the pump HP, and ambient compensated Quick Trip Class 10 overloads.

SINGLE AND THREE PHASE CONTROL PANELS:
Control panels are available as Simplex (controls 1 pump) or Duplex (controls 2 pumps). Our standard SES Series Panels are available with many standard features and can be built with our most popular options. We also custom build panels which offer many more design options than the SES panels. Custom control panels are available in many different configurations. Custom panel quote requests may be forwarded to Customer Service through any authorized distributor.

Our "SES" Duplex panels feature a solid-state printed circuit board design with standard high level alarm circuits. Other standard features are: an auxiliary dry alarm contact for signaling a remote alarm and float switch position indicator lights. Our 3Ø panels have built-in, adjustable, Class 10 overloads. The adjustable overloads on all our 3Ø panels mean less labor for the installer and no need to order specific overloads. Most SES panels are in stock for immediate delivery.

On pumps equipped with seal fail and/or heat (high temperature) sensors it is recommended that you use our control panel with the appropriate options. The pump sensors do not function without a seal fail relay or terminal connection in the control panel and a warning device such as a bell, horn or light.

Seal Failure Circuit - Some dual seal pumps are equipped with a standard, built-in seal failure circuit, which may also be called a moisture detection circuit. This circuit must be connected to a control panel with an optional seal fail relay. The panel must be special ordered with the seal fail relay and alarm. There are also stand alone seal fail panels such as the A4-3 or A4-4 available as standard items. The pumps can be identified by an extra control cable exiting the motor cover. The cable contains two wires, a black wire, connects to panel "terminal" going to "probe"; and a white wire, connects to the panel "terminal" going to the relay ground. Do not connect to the panel ground screw. Follow the wiring instructions supplied with the panel.

Heat Sensor and Seal Failure Circuit - Some pumps are equipped with a seal fail and normally closed, on-winding high temperature thermostats (heat sensors). The pumps have a control cable with four (4) leads, black (probe) and green (relay ground) for the seal fail circuit and red and white for the high temperature circuit. Connect the high temperature (heat sensor) circuit to the panel terminal strip as indicated on the panel drawing using the red and white wires. The high temperature panel circuit is also an optional item which you must specifically order when you order your control panel. The high temperature circuit is different from the Class 10 overloads which are always required on three phase pumps. *Follow the wiring instructions supplied with the panel.*

INSTALLATION

Connect the pump(s) to the guide rail pump adapters or to the discharge piping. Slide rail bases should be anchored to the wetwell floor.

Complete all wiring per the control panel wiring diagrams and NEC, Canadian, state, provincial and/or local codes. This a good time to check for proper rotation of the motors/impellers.

DO NOT PLACE HANDS IN PUMP SUCTION WHILE CHECKING MOTOR ROTATION. TO DO SO WILL CAUSE SEVERE PERSONAL INJURY.

Always verify correct rotation. Correct rotation is indicated on the pump casing. Three phase motors are reversible. It is allowable to bump or jog the motor for a few seconds to check impeller rotation. It is easier to check rotation before installing the pump. Switch any two power leads to reverse rotation.

Lower the pump(s) into the wetwell.

Check to insure that the floats will operate freely and not contact the piping.

OPERATION

Once the piping connections are made and checked you can run the pumps.

Piggyback Switch Operation – Plug the piggyback switch into a dedicated grounded outlet and then plug the pump into the switch. Test the pump by filling the wetwell until the pump goes On. If the pumps run but fail to pump, they are probably air locked, drill the relief holes per the instructions in the Piping Section.

Check the operating range to insure a minimum one minute run time and that the pump goes Off in the correct position.

Control Panel Operation – Fill the wetwell with clear water.

Use the pump H-O-A (Hand-Off-Automatic) switches in Hand to test the pumps. If they operate well in Hand proceed to test Automatic operation. If the pumps run but fail to pump, they are probably air locked, drill the relief holes per the instructions in the Piping Section.

Place Control Panel switch(es) in Automatic position and thoroughly test the operation of the ON, OFF, and Alarm floats by filling the wetwell with clear water. Important: Failure to provide a Neutral from the power supply to a 1Ø, 230 volt Control Panel will not allow the panel control circuit to operate. The Neutral is necessary to complete the 115 volt control circuit.

Check voltage and amperage and record the data on the front of this manual for future reference. Compare the amperage readings to the pump nameplate maximum amperage. If higher than nameplate amperage investigate cause. Operating the pump off the curve, i.e. with too little head or with high or low voltage will increase amperage. The motor will operate properly with voltage not more than 10% above or below pump nameplate ratings. Performance within this range will not necessarily be the same as the published performance at the exact rated nameplate frequency and voltage. Correct the problem before proceeding. Three phase unbalance is also a possible cause. *See Three Phase Power Unbalance and follow the instructions.*

Reset the Alarm circuit, place pump switch(es) in the Automatic position and Control Switch in ON position. The system is now ready for automatic operation.

Explain the operation of the pumps, controls and alarms to the end user. Leave the paperwork with the owner or at the control panel if in a dry, secure location.

FLOAT SWITCH AND PANEL CHART

The purpose of this chart is to show the required switch quantities and the function of each switch in a typical wastewater system. The quantities required vary depending on the switch type, single-action or wide-angle. Switch quantities also vary by panel type: simplex with and without alarms, and duplex with alarms.

Duplex Panels using single-action switches:

Three Float Panel Wiring

SW1	Bottom	Pumps Off
SW2	Middle	1st Pump On
SW3	Top	2nd Pump & Alarm On

Four Float Panel Wiring ②

SW1	Bottom	Pumps Off
SW2	2nd	1st Pump On
SW3	3rd	2nd Pump On
SW4	Top	Alarm On

Duplex Panels using wide-angle switches:

Three Float Panel Wiring

SW1	Bottom	1st Pump On/Both Off
SW2	Top	2nd Pump & Alarm On

Four Float Panel Wiring

SW1	Bottom	1st Pump On/Both Off
SW2	Middle	2nd Pump On
SW3	Top	Alarm On

Simplex Panel using single-action switches:

Simplex Panel with Alarm ①

SW1	Bottom	Pump Off
SW2	Middle	Pump On
	SW3	Top Alarm On/Off

Simplex Panel with No Alarm

SW1	Bottom	Pump Off
SW2	Top	Pump On

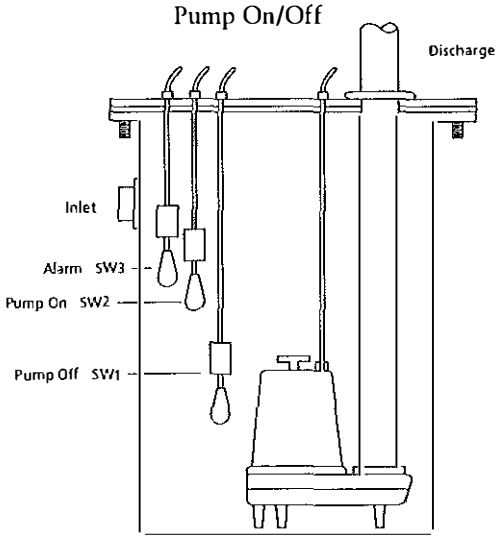
Simplex Panel using wide-angle switches:

Simplex Panel with Alarm

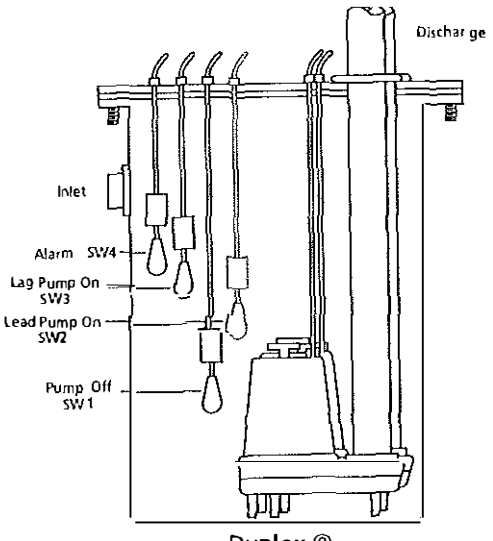
SW1	Bottom	Pump On/Off
SW2	Top	Alarm On/Off

Simplex Panel with No Alarm

SW1		Pump On/Off



Simplex ①



Duplex ②

THREE PHASE POWER UNBALANCE

A full three phase supply consisting of three individual transformers or one three phase transformer is recommended. "Open" delta or wye connections using only two transformers can be used, but are more likely to cause poor performance, overload tripping or early motor failure due to current unbalance.

Check the current in each of the three motor leads and calculate the current unbalance as explained below.

If the current unbalance is 2% or less, leave the leads as connected.

If the current unbalance is more than 2%, current readings should be checked on each leg using each of the three possible hook-ups. Roll the motor leads across the starter in the same direction to prevent motor reversal.

To calculate percent of current unbalance:

A. Add the three line amp values together.

B. Divide the sum by three, yielding average current.

C. Pick the amp value which is furthest from the average current (either high or low).

D. Determine the difference between this amp value (furthest from average) and the average.

E. Divide the difference by the average. Multiply the result by 100 to determine percent of unbalance.

Current unbalance should not exceed 5% at service factor load or 10% at rated input load. If the unbalance cannot be corrected by rolling leads, the source of the unbalance must be located and corrected. If, on the three possible hookups, the leg farthest from the average stays on the same power lead, most of the unbalance is coming from the power source.

Contact your local power company to resolve the imbalance.

	Hookup 1			Hookup 2			Hookup 3		
Starter Terminals	L1	L2	L3	L1	L2	L3	L1	L2	L3
	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥	⊥
	T	T	T	T	T	T	T	T	T
Motor Leads	R	B	W	W	R	B	B	W	R
	T3	T1	T2	T2	T3	T1	T1	T2	T3

Example:

T3-R = 51 amps	T2-W = 50 amps	T1-B = 50 amps
T1-B = 46 amps	T3-R = 48 amps	T2-W = 49 amps
T2-W = 53 amps	T1-B = 52 amps	T3-R = 51 amps
Total = 150 amps	Total = 150 amps	Total = 150 amps
÷ 3 = 50 amps	÷ 3 = 50 amps	÷ 3 = 50 amps
− 46 = 4 amps	− 48 = 2 amps	− 49 = 1 amps
4 ÷ 50 = .08 or 8%	2 ÷ 50 = .04 or 4%	1 ÷ 50 = .02 or 2%

INSULATION RESISTANCE READINGS

Normal Ohm and Megohm Values between all leads and ground

Condition of Motor and Leads	Ohm Value	Megohm Value
A new motor (without drop cable).	20,000,000 (or more)	20 (or more)
A used motor which can be reinstalled in well.	10,000,000 (or more)	10 (or more)
Motor in well. Readings are for drop cable plus motor.		
New motor.	2,000,000 (or more)	2 (or more)
Motor in good condition.	500,000 - 2,000,000	.5 - 2
Insulation damage, locate and repair.	Less than 500,000	Less than .5

Insulation resistance varies very little with rating. Motors of all HP, voltage and phase ratings have similar values of insulation resistance.

Insulation resistance values above are based on readings taken with a megohmmeter with a 500V DC output. Readings may vary using a lower voltage ohmmeter, consult factory if readings are in question.

ENGINEERING DATA

Engineering data for specific models may be found in your catalog and on our website (address is on the cover).

Control panel wiring diagrams are shipped with the control panels. Please use the control panel drawings in conjunction with this instruction manual to complete the wiring.

PUMP OPERATION			
Minimum Submergence		**Maximum Fluid Temperature**	
Continuous Duty	Fully Submerged	Continuous Operation	104° F 40° C
Intermittent Duty	6" Below Top of Motor	Intermittent Operation	140° F 60° C

Pumpmaster and Pumpmaster Plus - Hard Wired

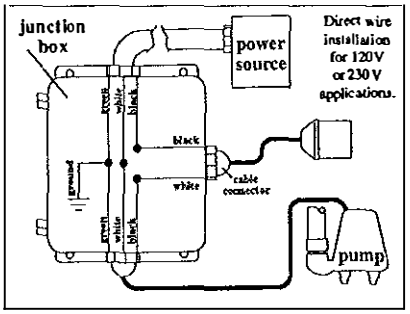


Figure 1

Single-Action Float Switch "Typical" Installation

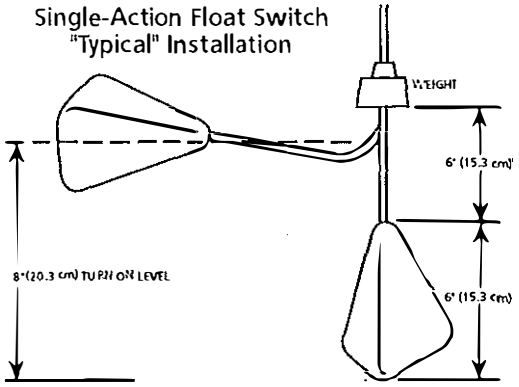


Figure 4

Double Float - Hard Wired

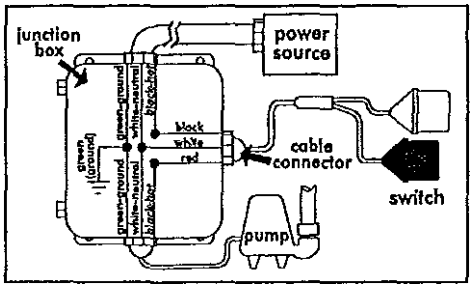


Figure 2

Wide-Angle Float Switch

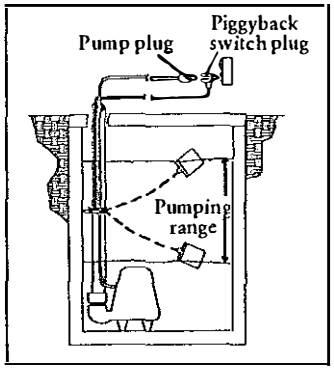


Figure 5

Determining Pumping Range

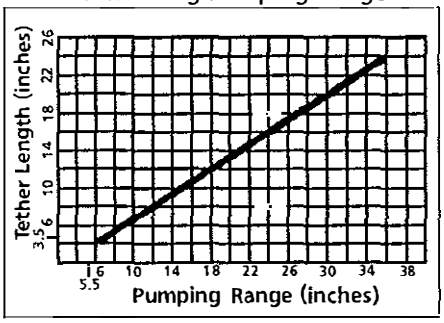


Figure 3

Three Phase Connection Diagram

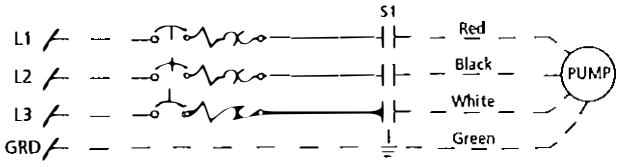


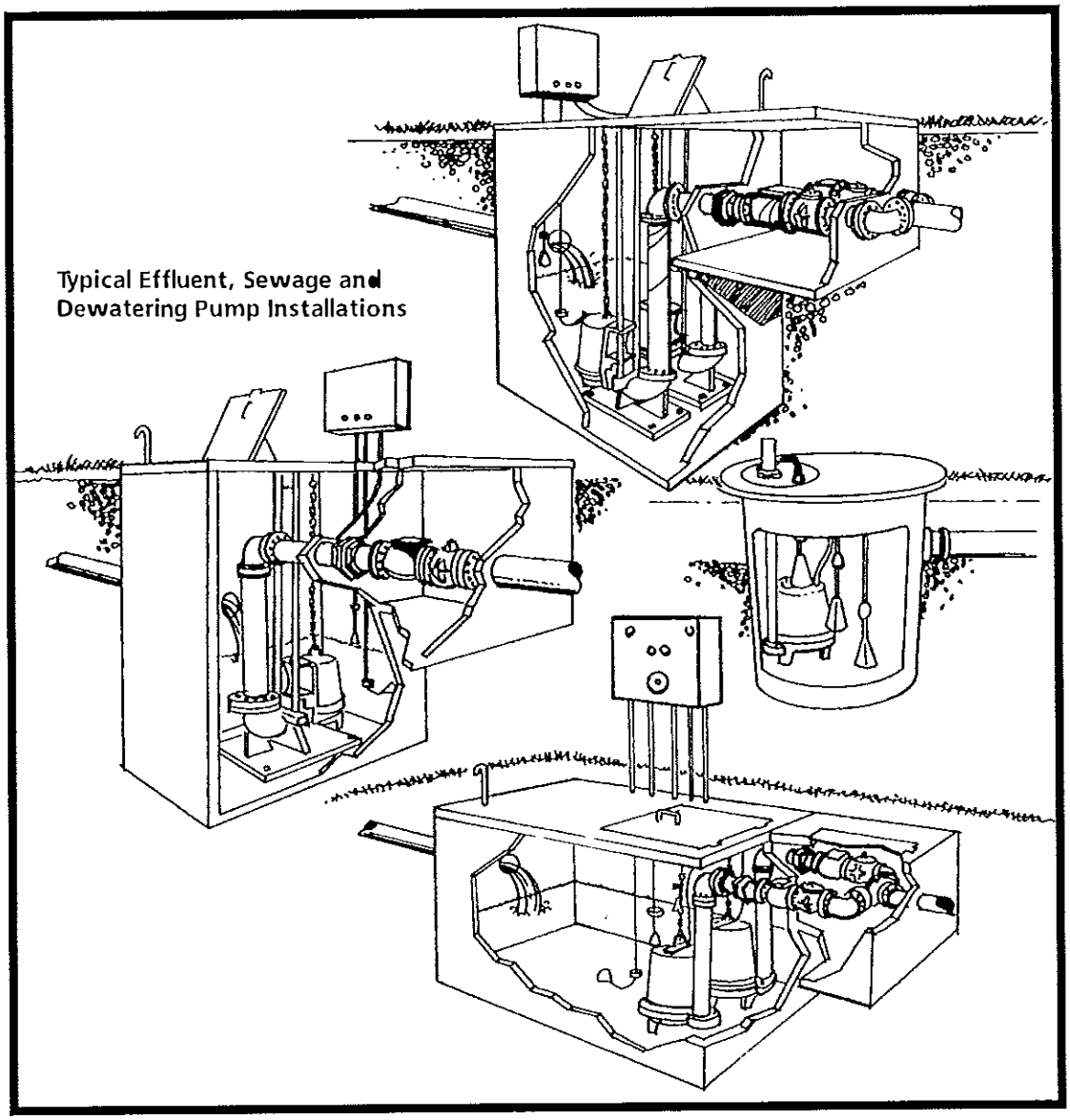
Figure 6

TROUBLESHOOTING

⚠WARNING Hazardous voltage

FAILURE TO DISCONNECT AND LOCKOUT ELECTRICAL POWER BEFORE ATTEMPTING ANY SERVICE CAN CAUSE SHOCK, BURNS OR DEATH.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
MOTOR NOT RUNNING	Motor thermal protector tripped.	Allow motor to cool. Insure minimum pump submergence. Clear debris from casing and impeller.
NOTE: If circuit breaker "OPENS" repeatedly, DO NOT reset. Call qualified electrician.	Open circuit breaker or blown fuse.	Determine cause, call a qualified electrician.
	Pump impeller binding or jammed.	Check motor amp draw. If two or more times higher than listed on pump nameplate, impeller is locked, motor bearings or shaft is damaged. Clear debris from casing and impeller, consult with dealer.
a) Manual operation	Power cable is damaged.	
	Inadequate electrical connection in control panel.	
b) Automatic operation	No neutral wire connected to control panel.	Resistance between power leads and ground should read infinity. If any reading is incorrect, call a qualified electrician.
	Inadequate electrical connection in control panel.	Inspect control panel wiring. Call a qualified electrician.
NOTE: Check the pump in manual mode first to confirm operation. If pump operates, the automatic control or wiring is at fault. If pump does not operate, see above.	Defective liquid level switch.	With switch disconnected, check continuity while activating liquid level switch. Replace switch, as required.
	Insufficient liquid level to activate controls.	Allow liquid level to rise 3" to 4" (76 mm - 101 mm) above turn-on level.
	Liquid level cords tangled.	Untangle cords and insure free operation.
PUMP WILL NOT TURN OFF	Liquid level cords tangled.	Unrangle cords and insure free operation.
	Pump is air locked.	Shut off pump for approximately one minute, then restart. Repeat until air lock clears. If air locking persists in a system with a check valve, a $\frac{3}{16}$" (4.8 mm) hole may be drilled in the discharge pipe approximately 2" (51 mm) above the discharge connection.
	Influent flow is matching pump's discharge capacity.	Larger pump may be required.
LITTLE OR NO LIQUID DELIVERED BY PUMP	Check valve installed backwards, plugged or stuck closed.	Check flow arrow on valve and check valve operation.
	Excessive system head.	Consult with dealer.
	Pump inlet plugged.	Inspect and clear as required.
	Improper voltage or wired incorrectly.	Check pump rotation, voltage and wiring. Consult with qualified electrician.
	Pump is air locked.	See recommended action, ahove.
	Impeller is worn or damaged.	Inspect impeller, replace as required.
	Liquid level controls defective or improperly positioned.	Inspect, readjust or replace as required.
PUMP CYCLES CONSTANTLY	Discharge check valve inoperative.	Inspect, repair or replace as required.
	Sewage containment area too small.	Consult with dealer.
	Liquid level controls defective or improperly positioned.	Inspect, readjust or replace as required.
	Influent excessive for this size pump.	Consult with dealer.



Typical Effluent, Sewage and Dewatering Pump Installations

GOULDS PUMPS LIMITED WARRANTY

This warranty applies to all water systems pumps manufactured by Goulds Pumps.

Any part or parts found to be defective within the warranty period shall be replaced at no charge to the dealer during the warranty period. The warranty period shall exist for a period of twelve (12) months from date of installation or eighteen (18) months from date of manufacture, whichever period is shorter.

A dealer who believes that a warranty claim exists must contact the authorized Goulds Pumps distributor from whom the pump was purchased and furnish complete details regarding the claim. The distributor is authorized to adjust any warranty claims utilizing the Goulds Pumps Customer Service Department.

The warranty excludes:

(a) Labor, transportation and related costs incurred by the dealer;
(b) Reinstallation costs of repaired equipment;
(c) Reinstallation costs of replacement equipment;
(d) Consequential damages of any kind; and,
(e) Reimbursement for loss caused by interruption of service.

For purposes of this warranty, the following terms have these definitions:

(1) "Distributor" means any individual, partnership, corporation, association, or other legal relationship that stands between Goulds Pumps and the dealer in purchases, consignments or contracts for sale of the subject pumps.
(2) "Dealer" means any individual, partnership, corporation, association, or other legal relationship which engages in the business of selling or leasing pumps to customers.
(3) "Customer" means any entity who buys or leases the subject pumps from a dealer. The "customer" may mean an individual, partnership, corporation, limited liability company, association or other legal entity which may engage in any type of business.

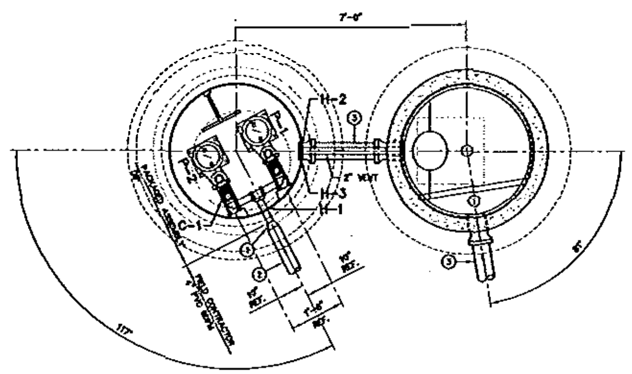
THIS WARRANTY EXTENDS TO THE DEALER ONLY.

GOULDS PUMPS

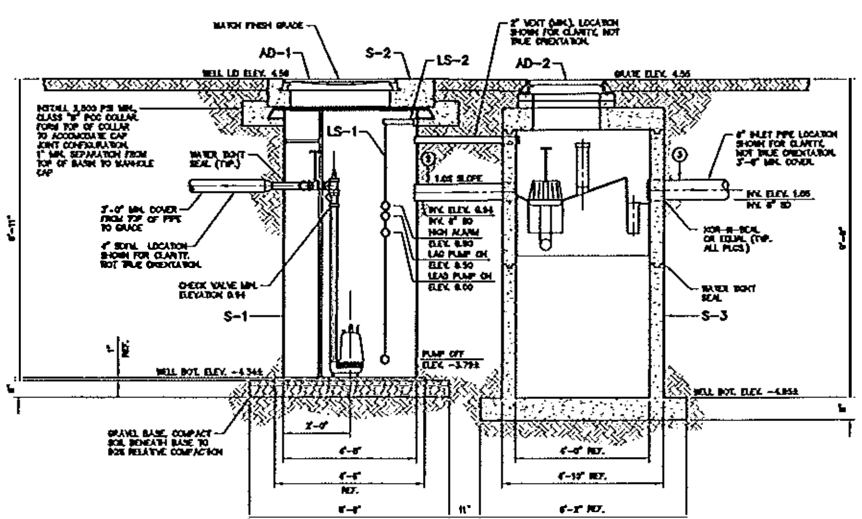
SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

IM107R03 March, 2006

Engineered for life



PLAN VIEW: STORM WATER LIFT STATION AND OIL/SEDIMENT SEPARATOR



CROSS SECTION: STORM WATER LIFT STATION AND OIL/SEDIMENT SEPARATOR

VALVE AND PIPING SCHEDULE

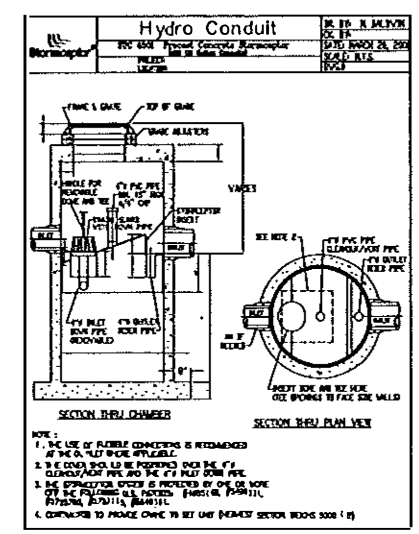
ITEM	QTY.	DESCRIPTION	CAPACITY	STANDARD
①	1	CONCENTRIC REDUCER, PVC	6" x 8"	ASTM D-3467
②	AS REQ'D	DISCHARGE PIPE, PVC, SCHEDULE 80	6"	ASTM D-1785, ASTM D-2672
③	AS REQ'D	EXISTING PIPE, PVC, SCHEDULE 80	6"	ASTM D-1785, ASTM D-2672

MECHANICAL AND EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	CAPACITY	STANDARD
P-1 & P-2	SUBMERSIBLE EFFLUENT PUMP	240 GPM @ 22' TDH	GOULDS MODEL 3888 BJ 2 HP, 208 VAC/1 PHASE/ 60 HERTZ 1750 RPM, ORDER NO. [illegible]
S-1	FIBERGLASS BASIN WITH ANTI-FLOATATION COLLAR	4'-0" D 8'-0" HEIGHT	GOULDS MODEL A7-4896 OR APPROVED EQUAL
S-2	ECCENTRIC FLAT TOP MANHOLE LID	60" OD WITH 36" Ø OPENING, 6" FROM EDGE	BY MID-STATE CONCRETE PRODUCTS OR APPROVED EQUAL
S-3	STORMCEPTOR	6'-0" Ø D	STORMCEPTOR HYDRO CONDUIT MODEL STC 4001
D-1	DISCHARGE SLIDE WITH DISCHARGE PIPING	3" DUPLEX SYSTEM WITH 6" DISCHARGE PIPING	GOULDS 3" DUPLEX SYSTEM (ORDER NO. A10-3D) WITH 6" DISCHARGE PIPING (ORDER NO. [illegible])
CP-1	PUMP CONTROL PANEL WITH NEMA 4X ENCLOSURE		DUPLEX PUMP CONTROL PANEL 2 HP, 230 VAC/1 PHASE/ 60 HERTZ, TELEMETRY DEVICE BY STAR DELTA OR APPROVED EQUAL
AD-1	WATER-TIGHT MANHOLE COVER & FRAME FOR TRAFFIC	44" Ø OVERALL BASE 36" Ø CLEAR OPENING 4" FRAME HEIGHT	ALHAMBRA FOUNDRY CO. LTD. MODEL [illegible] COMPOSITE COVERS BY CONCRETE UTILITIES PRODUCTS MAY BE USED INSTEAD OF CAST IRON, H/20 LOADING, OR APPROVED EQUAL
AD-2	STORM DRAIN GRATE & FRAME FOR TRAFFIC	2 4" x 24" GRATE	ALHAMBRA FOUNDRY CO. LTD. MODEL A-2812 OR APPROVED EQUAL H20 RATED
LS-1	LEVEL SWITCHES (4 REQUIRED)	PUMP OFF, LEAD PUMP ON, LAG PUMP ON, HIGH ALARM	GOULDS MODEL A2-7 OR APPROVED EQUAL
LS-2	LEVEL SWITCH BRACKET		GOULDS MODEL F3PT OR APPROVED EQUAL
H-1 & H-2	DISCHARGE HUB FOR BASIN	3" Ø PIPING 4" x 4" PLATE	GOULDS MODEL AB-20 OR APPROVED EQUAL
H-3	INLET HUB FOR BASIN	6" Ø PIPING	GOULDS MODEL AB-4 OR APPROVED EQUAL

NOTES:

1. CONTRACTOR SHALL SUBMIT SHOP DRAWINGS (AND ELECTRICAL DETAILS, WHERE APPLICABLE) ON PUMPING UNITS AND APPURTENANCES, PUMP CONTROL PANEL AND APPURTENANCES, PRE-CAST R.C. MANHOLES, SHAFTS AND JOINTS, MANHOLE FRAMES AND COVERS, WALL PENETRATION SLEEVES, VALVES AND PIPING, PORTLAND CEMENT CONCRETE, ANCHOR BOLTS, PUMP BASES, SLIDE-RAILS AND CABLES, FIBERGLASS BASIN, MANHOLE CAP, AND LEVEL SWITCHES.
2. CONTRACTOR SHALL VERIFY ALL DIMENSIONS FOR PIPING AND EQUIPMENT LOCATION AND SUPPORT PRIOR TO PROCEEDING WITH RELATED WORK.
3. ALL EXPOSED METAL SURFACES SHALL BE PRIMED AND COATED WITH TWO (2) 8 MIL COATS OF [illegible] EPOXY COATING OR APPROVED EQUAL. ALL HARDWARE TO BE STAINLESS STEEL.
4. CONTRACTOR TO PROVIDE THREE SETS OF SPECIFICATIONS, AS-BUILT DRAWINGS, AND OPERATION & MAINTENANCE MANUALS FOR THE STATION.
5. CONTRACTOR TO USE ADEQUATE SHORING METHOD TO PRESERVE THE INTEGRITY OF ANY SURROUNDING BUILDING FOUNDATIONS DURING CONSTRUCTION OF STORM WATER LIFT STATION.
6. FOR ADDITIONAL STORMCEPTOR INFORMATION SEE DETAIL 1, THIS SHEET. THIS STORMCEPTOR DETAIL IS FOR REFERENCE PURPOSES ONLY. CONTRACTOR TO CONTACT RINKER MATERIALS AT 1-[illegible]-7763 FOR PRODUCT SPECIFICATIONS.



DETAIL 1

Cunningham Group
Cunningham Group Architecture, P.A.

Consultant

Cannon Associates

Revisions

Project Title
THE LANDING

FRONT ST /
FIRST ST /
SAN FRANCISCO ST
AVILA BEACH CA

Sheet Title
STORM PUMP AND OIL/SEDIMENT SEPARATOR

Sheet Number
C004

Appendix C: Flood Protection Measures

23.05.040 - Drainage:

Standards for the control of drainage and drainage facilities provide for designing projects to minimize harmful effects of storm water runoff and resulting inundation and erosion on proposed projects, and to protect neighboring and downstream properties from drainage problems resulting from new development. The standards of Sections 23.05.042 through 23.05.050 are applicable to projects and activities required to have land use permit approval.

23.05.042 - Drainage Plan Required:

No land use or construction permit (as applicable) shall be issued for a project where a drainage plan is required, unless a drainage plan is first approved pursuant to Section 23.05.046. Drainage plans shall be submitted with or be made part any land use, building or grading permit application for a project that:

a. Involves a land disturbance (grading, or removal of vegetation down to duff or bare soil, by any method) of more than 40,000 square feet; or

b. Will result in an impervious surface of more than 20,000 square feet; or

c. Is subject to local ponding due to soil conditions and lack of identified drainage channels; or

d. Is located in an area identified by the County Engineer as having a history of flooding or erosion that may be further aggravated by or have a harmful effect on the project; or

e. Is located within a Flood Hazard (FH) combining designation; or

f. Involves land disturbance or placement of structures within 50 feet of any watercourse shown on the most current USGS 7-1/2 minute quadrangle map; or

g. Involves hillside development on slopes steeper than 10 percent.

h. May, by altering existing drainage, cause an on-site erosion or inundation hazard, or change the off-site drainage pattern, including but not limited to any change in the direction, velocity, or volume of flow.

i. Involves development on a site adjacent to any coastal bluff.

[Amended 1995, Ord. 2715]

23.05.043 - Environmental Determination Required.

In any case where a drainage plan is required by Section 23.05.042 and an environmental determination is not otherwise required by Section 23.02.033 (Minor Use Permit), Section 23.02.034 (Development Plan), Chapter 23.07 (Combining Designations), or Section 23.05.030 (Grading Permit Review and Approval), the project application is to be subject to an environmental determination as set forth in Section 23.02.034b(1) before a decision to approve the application, except for single-family residences which are exempt from the provisions of CEQA.

[Amended 1995, Ord. 2715]

23.05.044 - Drainage Plan Preparation and Content:

Drainage plans shall be neatly and accurately drawn, at an appropriate scale that will enable ready identification and recognition of submitted information. The County Engineer may require drainage plans to be prepared by a registered civil engineer.

a. **Basic drainage plan contents:** Except where an engineered drainage plan is required, a drainage plan is to include the following information about the site:

   (1) Flow lines of surface waters onto and off the site.

   (2) Existing and finished contours at two-foot intervals or other topographic information approved by the County Engineer.

   (3) Building pad, finished floor and street elevations, existing and proposed.

   (4) Existing and proposed drainage channels including drainage swales, ditches and berms.

   (5) Location and design of any proposed facilities for storage or for conveyance of runoff into indicated drainage channels, including sumps, basins, channels, culverts, ponds, storm drains, and drop inlets.

   (6) Estimates of existing and increased runoff resulting from the proposed improvements.

   (7) Proposed erosion and sedimentation control measures.

   (8) Proposed flood-proofing measures where determined to be necessary by the County Engineer.

b. **Engineered plan content:** Engineered drainage plans are to include an evaluation of the effects of projected runoff on adjacent properties and existing drainage facilities and systems in addition to the information required by subsection a of this section.

23.05.046 - Drainage Plan Review and Approval:

All drainage plans are to be submitted to the County Engineer for review, and are subject to the approval of the County Engineer, prior to issuance of a land use or construction permit, as applicable. Actions of the County Engineer on drainage plans may be appealed to the Board of Supervisors in accordance with the procedure set forth in Section 21.01.042a of this title; except that where the site is within a Flood Hazard combining designation, the procedure described in Section 23.07.066d shall be used.

23.05.048 - Plan Check, Inspection and Completion:

Where required by the County Engineer, a plan check and inspection agreement is to be entered into and the drainage facilities inspected and approved before a certificate of occupancy is issued.

23.05.050 - Drainage Standards: *[The submitted amendment does not correspond with the update to the same ordinance approved by the California Coastal Commission in March 2002 as SLO LCP Amendment No. 1-01 Part C. Since the County has not yet acted to accept or reject the California Coastal Commission's suggested modifications to LCP Amendment 1-01 Part C, it is premature to propose alternative changes to this section. Therefore, the currently proposed amendment to Section 23.05.050 shall only take effect after September 5, 2004, if the County declines to accept the California Coastal Commission suggested modifications to LCP Amendment 1-01 Part C.]*

a. **Design and construction.** Drainage systems and facilities subject to drainage plan review and approval that are to be located in existing or future public rights-of-way are to be designed and constructed as set forth in the county Engineering Department Standard Improvement Specifications and Drawings. Other systems and facilities subject to drainage plan review and approval are to be designed in accordance with good engineering practices.

b. **Natural channels and runoff.** Proposed projects are to include design provisions to retain off-site natural drainage patterns and, when required, limit peak runoff to predevelopment levels.

c. **Areas subject to flooding.** Buildings or structures are not permitted in an area determined by the County Engineer to be subject to flood hazard by reason of inundation, overflow, high velocity or erosion, except where such buildings or structures are in conformity with the standards in Section 22.07.066 of this title and provisions are made to eliminate identified hazards to the satisfaction of the County Engineer. Such provisions may include providing adequate drainage facilities, protective walls, suitable fill, raising the floor level of the building or by other means. The placement of the building and other structures (including walls and fences) on the building site shall be such that water or mudflow will not be a hazard to the building or adjacent property. The County Engineer in the application of this standard shall enforce as a minimum the current federal flood plain management regulations as defined in the National Flood Insurance Program, authorized by U.S. Code Sections 4001-4128 and contained in Title 44 of the Code of Federal Regulations Part 59 et seq., which are hereby adopted and incorporated into this title by reference as though they were fully set forth here.

d. **Development adjacent to coastal bluffs.** The drainage plan shall incorporate measures to minimize increased erosion to the coastal bluff as a result of development.

e. **Water Runoff.**

(1) **Best Management Practices - Residential development.** All new residential development subject to discretionary review shall use Best Management Practices (BMPs) to address polluted runoff. BMPs shall be consistent with the guidance found in documents such as the *California Storm Water Best Management Practices Handbook (Municipal).* Such measures shall include, but not be limited to: minimizing the use of impervious surfaces (e.g., installing pervious driveways and walkways); directing runoff from roofs and drives to vegetative strips before it leaves the site; and/or managing runoff on the site (e.g., percolation basins). The installation of vegetated roadside drainage swales shall be encouraged and, if used, calculated into BMP requirements. The combined set of BMPs shall be designed to treat and infiltrate storm water runoff up to and including the 85th percentile storm event. The Best Management Practices shall include measures to minimize post-development loadings of total suspended solids.

(2) **Best Management Practices - Non-Residential development.** All new non-residential development subject to discretionary review shall use Best Management Practices (BMPs) to control and prevent pollutants from entering the storm drain system. BMPs shall be consistent with the guidance found in documents such as the *California Storm Water Best Management Practices Handbook (Industrial/Commercial).* Such measures shall include both source control and treatment control practices to ensure that contaminants do not leave the site. Stormwater runoff from commercial development shall be filtered through BMPs that treat storm water runoff up to and including the 85th percentile storm event. Restaurant and other commercial cleaning practices that can impact water quality (such as floor mat rinsing and vehicle cleaning) by introducing chemicals to storm drain systems (detergents, oils and grease and corrosive chemicals) shall provide designated areas that collect and dispose of this runoff through the sanitary septic system. Street sweeping and cleaning shall use best management practices outlined in the above referenced handbook or the Model Urban Runoff Program to keep contaminants and cleaning products from entering the storm drain system. The Best Management Practices shall include measures to minimize post-development loadings of total suspended solids.

[Amended 2004, Ord. 2999]

23.05.060 - Tree Removal.

The purpose of these standards is to protect existing trees and other coastal vegetation from indiscriminate or unnecessary removal consistent with Local Coastal Plan policies and pursuant to Section 30251 of the Coastal Act which requires protection of scenic and visual qualities of coastal areas. Tree removal means the destruction or displacement of a tree by cutting, bulldozing, or other mechanical or chemical methods, which results in physical transportation of the tree from its site and/or death of the tree.

23.07.060 - Flood Hazard Area (FH):

A Flood Hazard combining designation is applied to specific parcels by the Official Maps (Part III) of the Land Use Element to areas where terrain characteristics would present new developments and their users with potential hazards to life and property from potential inundation by a 100-year frequency flood or within coastal high hazard areas. These standards are also intended to minimize the effects of development on drainage ways and watercourses. The areas of special flood hazard identified by the Federal Insurance Administration, through the Federal Emergency Management Agency in a scientific and engineering report entitled "The Flood Insurance Study for the San Luis Obispo County," dated July 18, 1985, with accompanying flood insurance rate maps, and any subsequent revisions to the flood insurance rate maps or flood area boundary maps, is hereby adopted and incorporated into this title by reference as though it were fully set forth here. The flood insurance study is on file in the office of the County Engineer.

[Amended 1992, Ord. 2570]

23.07.062 - Applicability of Flood Hazard Standards:

All uses proposed within a Flood Hazard combining designation are subject to the standards of Sections 23.07.064 through 23.07.066, except:

a. **Temporary uses:** With the approval of the County Engineer, the Planning Department may authorize construction or placement of a temporary structure or use within a Flood Hazard area pursuant to the required land use permit without meeting these standards, provided that the structure or use will not be in place from October 15, to April 15.

b. **Emergency work:** Emergency work may be undertaken where necessary to preserve life or property. Within 48 hours after commencement of such work, the County Engineer is to be notified and an application filed with the Planning Department in compliance with the provisions of Section 23.07.064.

c. **Existing uses:** The continuance, operation, repair, or maintenance of any lawful use of land existing on the effective date of this title is permitted. Any expansion or alteration of an existing structure or use, or grading of a site, shall be conducted in accordance with all applicable provisions of this title.

23.07.064 - Flood Hazard Area Permit and Processing Requirements:

Drainage plan approval is required where any portion of the proposed site is located within a Flood Hazard combining designation, in addition to all other permits required by this title, state and federal law. In addition to the information called for in Section 23.05.042 (drainage plan required) the drainage plan shall include:

a. Federal Insurance Administration flood data, including base flood elevations, flood hazard areas and floodway locations.

b. In areas where water surface elevation data has not been provided by the Federal Insurance Administration, a normal depth analysis or other equivalent engineering analysis that identifies the location of the floodway and demonstrates to the satisfaction of the County Engineer that the structure will not be located within the floodway or be subject to inundation by a 100-year storm. The following information is required to determine the location of flood elevation and the floodway, except where waived or modified by the County Engineer:

(1) Plans drawn to scale showing the location, dimensions, and elevation of the lot, existing or proposed structures, fill, storage of materials, flood-proofing measures, and the relationship of the above to the location of the floodway.

(2) Typical valley cross-sections showing the normal channel of the stream, elevation of the land areas adjoining each side of the channel, cross-sections of areas to be occupied by the proposed development, and high-water information sufficient to define the 100-year storm flood pro- file level.

(3) A profile showing the slope of the bottom of the channel or flow line of the stream.

(4) Any previously determined flood data available from any state, federal or other source.

23.07.066 - Construction Standards:

New structures or an increase of 65 percent in the square footage of any existing structures (including manufactured homes) or other construction activities within a Flood Hazard Area combining designation are subject to the following:

a. Construction, general:

(1) No construction or grading is to limit the capacity of the floodway or increase flood heights on existing structures unless the adverse effect of the increase is rectified to the satisfaction of the County Engineer. In no case shall flood heights be increased above that allowed under the Federal Flood Insurance Program.

(2) Structures shall be anchored to prevent collapse, lateral movement or flotation that could result in damage to other structures or restriction of bridge openings and narrow sections of the stream or river.

(3) Service facilities such as electrical and heating equipment are to be floodproofed or constructed at minimum of one-foot above the 100-year storm flood profile level for the site.

(4) Water supply and sanitary sewage systems shall be designed to minimize infiltration of flood waters into the system and discharge from systems into flood waters.

(5) On-site waste disposal systems shall be located to avoid their being impaired or contaminated during flooding.

(6) All buildings or structures shall be located landward of mean high tide.

(7) Residential, commercial and industrial development shall be prohibited outside of urban and village reserve lines.

(8) Whenever a watercourse is to be altered or relocated, the Department of Planning and Building shall notify adjacent communities and the California Department of Water Resources and evidence of such notification shall be sent to the Federal Insurance Administration.

(9) Fully enclosed areas below the lowest floor that are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or meet or exceed the following minimum criteria:

(i) A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding.

(ii) The bottom of all openings shall be no higher than one foot above grade.

(iii) Openings may be equipped with screens, louvers, valves or other coverings or devices provided that they permit the automatic entry and exit of flood waters.

(10) On the basis of structural plans and the depth analysis, the ground floor of all structures is to be constructed at a minimum of one-foot above the 100-year storm flood profile level. Within any AO zone on the Flood Insurance Rate maps, this elevation shall be determined by adding one foot to the depth number specified. If no depth is specified, structures shall be elevated a minimum of two feet above adjacent natural grade.

(11) Non-residential construction shall either be elevated in conformance with Section 23.07.066a(10) above, or together with attendant utility and sanitary facilities, be elevated a minimum of two feet above the highest adjacent grade and be floodproofed to a minimum of one-foot above the 100-year storm flood profile level. Examples of floodproofing include, but are not limited to:

(i) Installation of watertight doors, bulkheads, and shutters.

(ii) Reinforcement of walls to resist water pressure.

(iii) Use of paints, membranes, or mortars to reduce seepage through walls.

(iv) Addition of mass or weight to structure to resist flotation.

(v) Armor protection of all fill materials from scour and/or erosion.

b. **Storage and processing:** The storage or processing of materials that in time of flooding are buoyant, flammable, or explosive; that could be injurious to human, animal, or plant life; or that may unduly affect the capacity of the floodway or unduly increase flood heights is not permitted. Storage of other material or equipment may be allowed if not subject to major damage by floods and if firmly anchored to prevent flotation, or if readily removable from the area within the time available after flood warning.

c. **Coastal High Hazard areas.** The following requirements shall apply in areas identified as having special flood hazards associated with high velocity waters from coastal and tidal inundation or tsunamis:

(1) All buildings or structures shall be elevated so that the lowest supporting member is located no lower than the base flood elevation level, with all space below the lowest supporting member open so as not to impede the flow of water, except for breakaway walls.

(2) All buildings or structures shall be securely anchored on pilings or columns designed and anchored to withstand all impact forces and buoyancy factors of the base flood.

(3) No fill shall be used for structural support.

(4) Sand dunes shall not be altered in a way that would increase potential flood damage.

d. **Certification of Compliance.** The following certifications shall be filed with the Building Official prior to final building inspection:

(1) Upon completion of any structure within a flood hazard combining designation, compliance with elevation requirements shall be certified by a registered civil engineer or licensed land surveyor. Such certification shall include as a minimum the elevation of the lowest floor. If the structure has been floodproofed in conformance with Section 23.07.066a(11) above, the certification shall include the elevation to which the structure has been floodproofed. Elevations shall be based on the National Geodetic Vertical Datum of 1929.

(2) Where floodproofing is used, a registered civil engineer or architect shall certify that the floodproofing methods are adequate to withstand the flood depths, pressures, velocities, impact and uplift forces and other factors associated with the 100-year flood.

(3) Compliance with the structural design requirements within Coastal High Hazard areas stated in Section 23.07.066c shall be certified by a registered civil engineer or architect.

e. **Exceptions to construction standards.** The standards of this section may be waived or modified by the Board of Supervisors through the variance procedure set forth in Code of Federal Regulations, Title 44, Chapter 1, Section 60.6, instead of through the adjustment process described in Section 23.01.044 of this title. Requests for such waivers or modifications shall be filed with the County Engineer for processing. Procedures for the granting of variances under Title 14 are available from the County Engineering Department.

[Amended 1995, Ord. 2715; 1995, Ord. 2740]

Appendix I

The Colony Drainage Study

July 2004

DRAINAGE STUDY

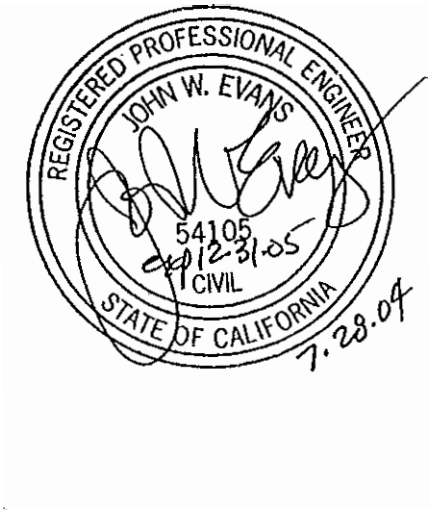
For

The Colony at Avila Beach

County of San Luis Obispo, California

Prepared by:

Cannon Associates
364 Pacific Street
San Luis Obispo, CA
93401



July 2004

Prepared for:

Rossi Trading Company, LLC
750 Pismo Street
San Luis Obispo, CA
93401

Executive Summary This report analyzes The Colony at Avila Beach to determine the 25-year and 100-year flood water elevations within the town of Avila Beach and the 100-year flood water elevations of the San Luis Creek. Both flood water elevations are presented in graphic form on the Drainage Exhibit, found as Figure 2 of this report. The grading plans will state that all future garage structures will have an elevation above the 25-year flood water elevation and property owners are required to store any contaminate above the 100-year storm flood water elevation.

Introduction It is the intent of this report to determine the storm water runoff and drainage patterns of the town of Avila Beach, the San Luis Creek, and the Pacific Ocean to the extent that said entities influence the safety of future structures located within Lots 1 through 14 of COAL 96-112 in Avila Beach, County of San Luis Obispo, California. This report presents the information, methods, and results generated from studying the aforementioned storm water runoff and drainage. The developer, Rossi Trading Company, proposes to construct an access drive and utilities suitable for residential buildings. To reduce review time and maximize clarity, this report will refer to figures, tables, and appendices whenever possible.

Location of Property Lots 1 through 14 of COAL 96-112 are located adjacent to and southeast of Avila Beach Drive between First Street and San Miguel Street (see Reference Map, Figure 1) in the conununity of Avila Beach, County of San Luis Obispo, State of California. The project is bound by Avila Beach Drive to the northwest and by a public parking lot to the southeast. It is bound by First Street on the south end and by San Miguel Street on the north end (see Drainage Exhibit, Figure 2). The property is legally defined as:

> *Lots 1-14 of Parcel Map COAL 96-112, County of San Luis Obispo, State of California, according to map recorded May 15, 2000 in book 54, page 73 of parcel maps.*

Description of Property The property is presently undeveloped and there are no existing buildings,

slabs, or trees located anywhere within the project boundary. The property can generally be described as having a higher and a lower side with a steep bank in between. The higher portion of the property lies along Avila Beach Drive and slopes away from the road approximately 2% for 50 feet. A 2:1 to 3:1 bank joins the higher portion of the property to the lower portion of the property. The lower portion also slopes away from Avila Beach Drive at 2% to 4%.

At present, most of the runoff from the site surface flows to the southeast side of the property. It is collected in a swale that lies in between the property and the public parking lot immediately southeast of the project site. The swale begins near San Miguel Street, flows parallel to Avila Beach Drive, and ends in a drainage structure located near First Street. The swale is constructed of concrete for a short section at its beginning, but then transitions into a well defined gabion lined channel. From the terminus of the swale, storm water runoff is conveyed though a sub-surface drainage system to the San Luis Creek. Likewise, runoff from Avila Beach Drive surface flows to existing storm drain inlet structures at both ends of the property where it is conveyed through the sub-surface drainage system.

Proposed Development COAL 96-112 consists of 2.2 total acres and 14 separate parcels. The primary use of the parcels will be for residential use. A gated common driveway is proposed within the existing 20' wide access easement along the southeast side of the project. Wet and dry utilities to serve the 14 parcels are proposed as part of this project. Avila Beach Drive will receive improvements consisting of replacing existing asphalt berm with new concrete curb, gutter and sidewalk as well as upgrading two existing storm drain inlet structures with new county standard inlet structures. Storm drain runoff will be concentrated in the new curb and gutter or it will sheet flow across the project and driveway into the existing swale.

While no buildings are proposed with this current project, this report anticipates the future buildings developed on site will consist of garages on the lower portion of the project and residential units constructed over the garages and the higher portion of the project. The flood water elevations established in this report and the safe minimum elevations generated as a result of this report were predicated by the assumption of a typical future structure. Any structure other than a garage proposed in the future to be constructed on the lower portion of this project site will not be included

in the scope of this report.

Flood Plain Information. The FEMA Flood Insurance Rate Map (FIRM) Community Panel Number 060304 0592 C, effective July 18, 1985, Appendix E, indicates that most of the project site is within Zone B. Zone B is defined as: an area between limits of the 100-year flood and 500-year flood; or an area subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or an area protected by levees from the base flood. The original topographic survey information, as well as, the FIRM are based on a NGVD29 benchmark.

San Luis Creek lies to the north of The Colony on the opposite side of Avila Beach Drive. The creek is in an area of 100-year flooding with base flood elevations. Along the section of creek that fronts The Colony, flood elevations range from 11 feet above sea level to 13 feet above sea level.

Existing Drainage Conditions The most important aspects of the existing drainage conditions in Avila Beach are the stream depths of San Luis Creek and the tidal influence of the Pacific Ocean. All of the runoff from the Avila Beach community makes its way into the ocean either directly or via the creek. Within the central part of the community of Avila (defined as the area bounded by the ocean, Avila Beach Drive and the Unocal Property) there are three drainage structures that convey runoff into San Luis Creek and two drainage structures that convey water directly onto the beach. The structures that convey water into San Luis Creek are protected with flapper valves that prevent rising tidal water from flowing into the storm drain system. The drainage structures located on the creek lie in an area of the creek that is affected by tidal action. During high tides the back water raises the level of the creek beyond the height of the flapper valves. The valves remain closed in this condition, preventing release of runoff from San Luis Creek. Front Street and Avila Beach Drive act as levees for the interior portion of Avila since it is lower than the high tide water level at times. When the tide recedes, any water that is stored in the pipes or other retention areas of the town flows out the drain lines and into the creek. The runoff from the existing project site flows through two of the three structures that are located along the creek. The majority of the runoff is channeled through

the structure that is furthest down stream along the creek and closest to the ocean.

Hydrologic Analysis The focus of this analysis is to determine flood levels within The Colony. During a major storm that will produce heavy runoff, it is reasonable to assume that either the river is running high or the tide levels are high. In either case the flapper valves that convey water out of the town will be closed, forcing one-hundred percent of the runoff generated in town to be detained until storm and tide levels subside. This is a conservative assumption because this analysis is based on a 24-hour storm and at some point in that 24-hour storm the tide will be low allowing some if not all of the ponded water to drain from the town. Nevertheless this analysis assumes all of the runoff produced by a storm will contribute to the ponding levels.

Several storms were considered in the analysis to calculate the flood volumes produced from the 10-year, 25-year, 50-year, and 100-year, 24-hour storm. For each storm a NOAA Atlas 2, Volume XI prepared by the U.S. Department of Commerce, Appendix D, was used to determine the isopluvials for the Avila Beach area (4" for the 10-yr, 24-hr; 5" for the 25-yr, 24-hr; 6" for the 50-yr, 24hr; and 6.5" for the 100-yr, 24hr). The Soil Survey of San Luis Obispo County, California coastal part, map no. 12 prepared by the U.S. Department, Appendix B, lead us to select a soil type D from the Haested Methods Runoff Curve Number (CN) table, Appendix C. (221-Xererts-Xerolis-Urban land complex, 0 to 15 percent slopes.) On the Haested CN table, Appendix C, the cover type most closely related to this area of Avila Beach is the Urban districts: Commercial and Business with a CN from soil group D of 95. This value is a conservative value that means that 95 percent of the area is impervious.

Using the above mentioned data and the SCS TR55 hydrologic method with a type one curve, Pond Pack software produced hydrologic volumes of runoff in acre-feet for each storm. With these volumes and the topography from the town of Avila, the water surface elevations for the 25-year and 100-year storms were determined using cad software. The spread of the ponding from the 25-year and 100-year storms has been graphically depicted on the Drainage Exhibit, Figure 2, prepared as part of this report. The volumes from each storm can be seen in the Pond Pack Summary, Appendix A. Additionally the inevitable future development of the town was also accounted for in figuring out the ponding elevations.

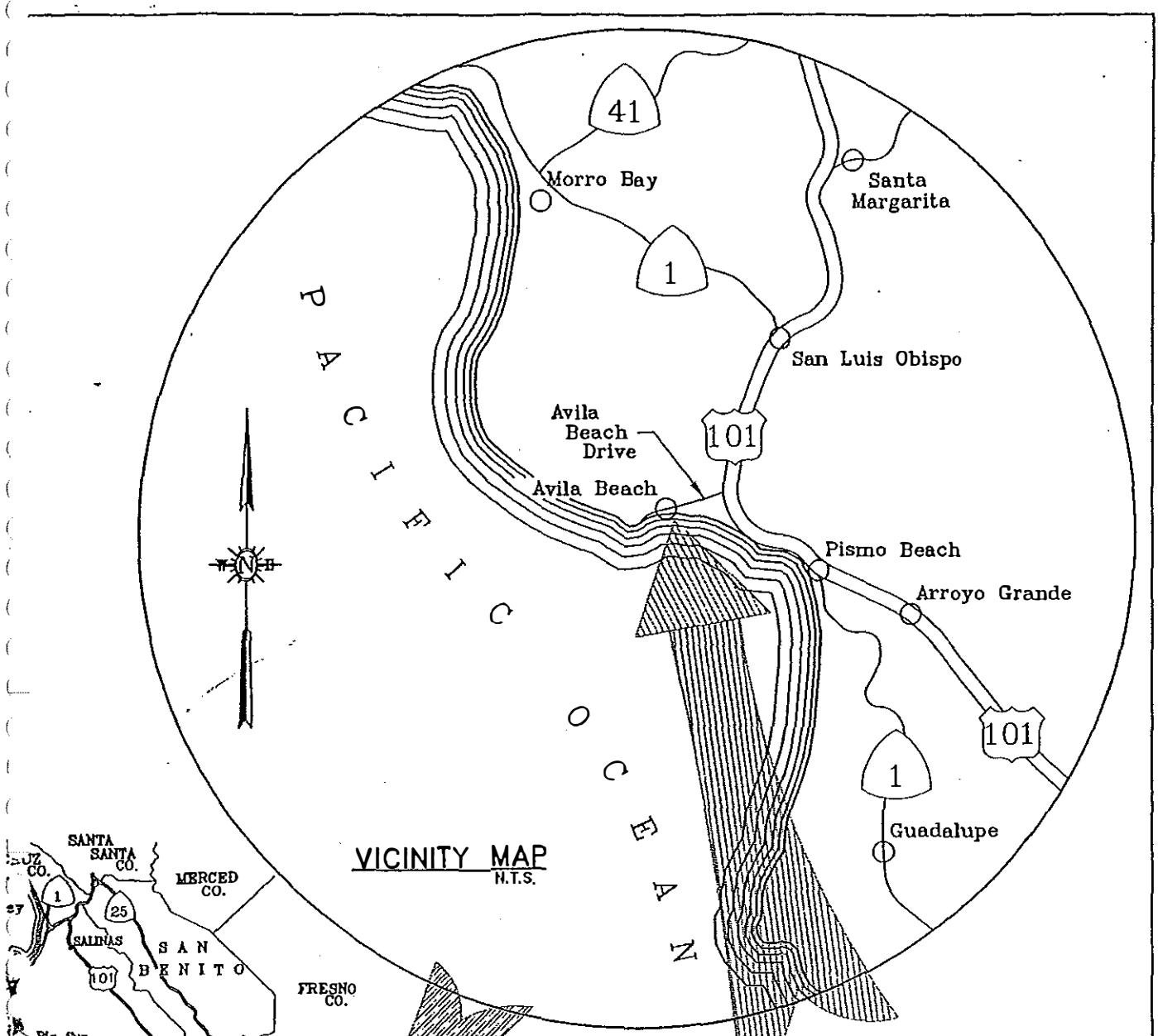
FEMA has calculated the San Luis Creek water surface elevations for the 100-year storm

event and those elevations have been added to the Drainage Exhibit, Figure 2, so that they can be seen graphically in comparison to The Colony project.

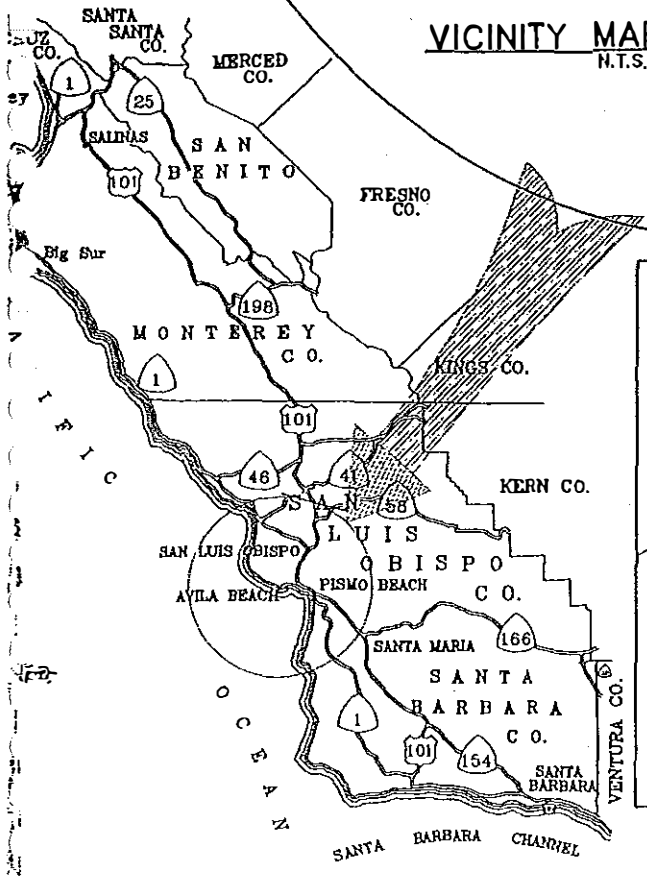
Hydraulic Analysis No hydraulic analysis was performed because it is assumed that one-hundred percent of the runoff will contribute to the ponding condition and will therefore cause any hydraulic system to be effectively inoperable at the time of the storm. The existing system has already been sized and we do not intend to make any changes to it. Once the tide and storm recedes the existing system will eventually discharge any stored water to the San Luis Creek.

Figure 1:

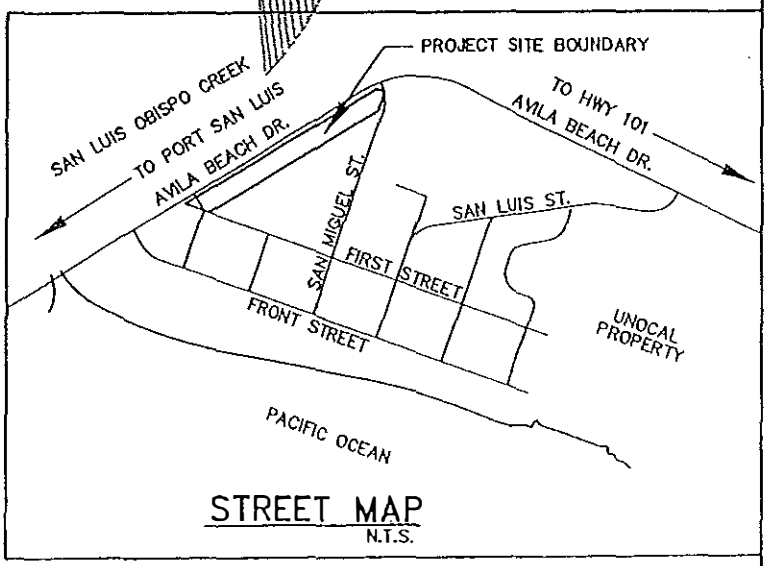
Reference Map



VICINITY MAP
N.T.S.



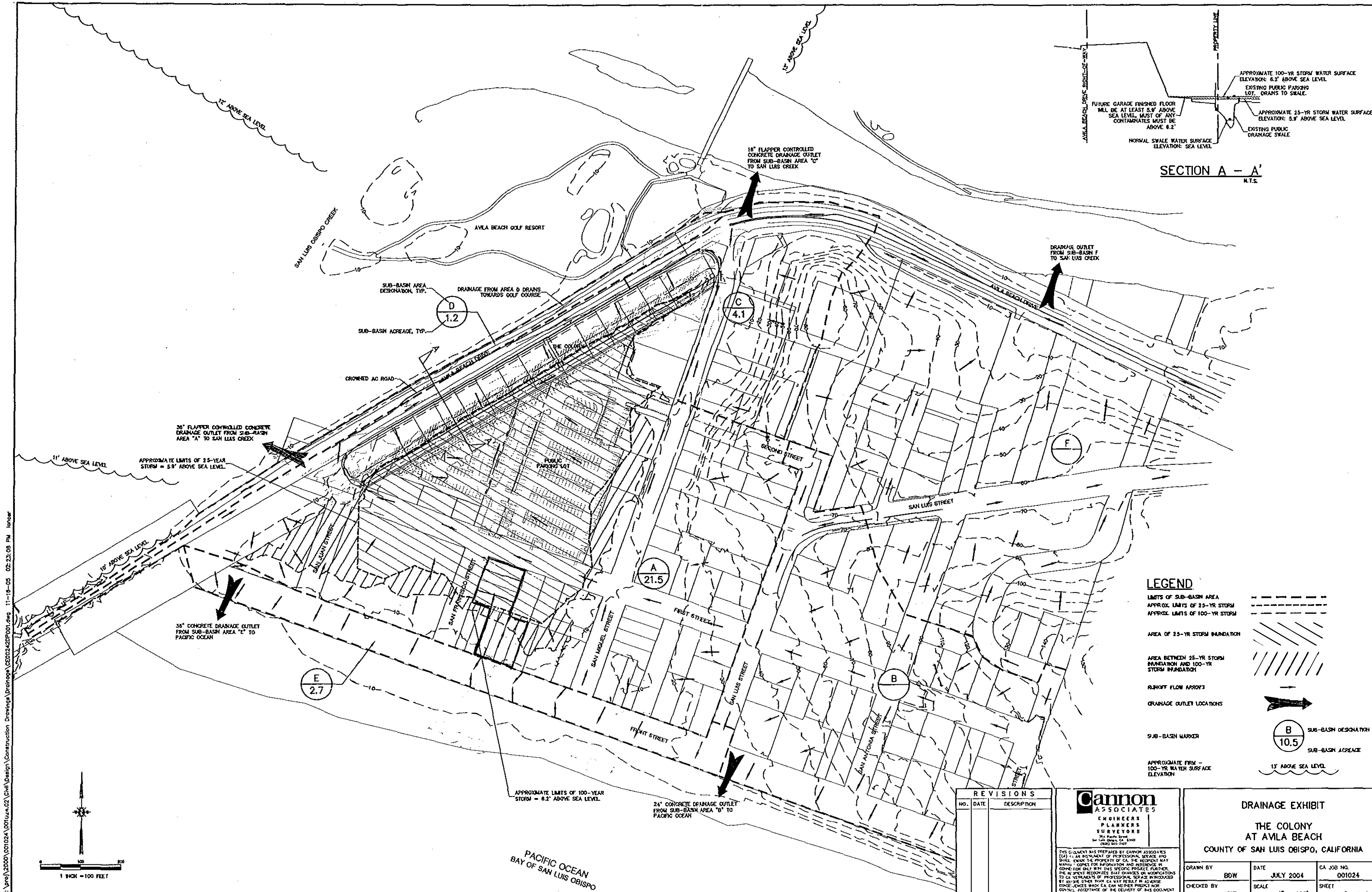
AREA MAP
N.T.S.



STREET MAP
N.T.S.

Figure 2:

Drainage Exhibit



SECTION A - A'
N.T.S.
AVILA BEACH DRIVE RIGHT-OF-WAY
PROPERTY LINE
APPROXIMATE 100-YR STORM WATER SURFACE ELEVATION: 6.2' ABOVE SEA LEVEL
EXISTING PUBLIC PARKING LOT, DRAINS TO SWALE
FUTURE GARAGE FINISHED FLOOR WILL BE AT LEAST 5.9' ABOVE SEA LEVEL, MUST OF ANY CONTAMINATES MUST BE ABOVE 6.2'
APPROXIMATE 25-YR STORM WATER SURFACE ELEVATION: 5.9' ABOVE SEA LEVEL
EXISTING PUBLIC DRAINAGE SWALE
NORMAL SWALE WATER SURFACE ELEVATION: SEA LEVEL
12' ABOVE SEA LEVEL
13' ABOVE SEA LEVEL
11' ABOVE SEA LEVEL
10' ABOVE SEA LEVEL
SAN LUIS OBISPO CREEK
AVILA BEACH GOLF RESORT
18" FLAPPER CONTROLLED CONCRETE DRAINAGE OUTLET FROM SUB-BASIN AREA "C" TO SAN LUIS CREEK
DRAINAGE OUTLET FROM SUB-BASIN F TO SAN LUIS CREEK
SUB-BASIN AREA DESIGNATION, TYP.
DRAINAGE FROM AREA D DRAINS TOWARDS GOLF COURSE
SUB-BASIN ACREAGE, TYP.
CROWNED AC ROAD
36" FLAPPER CONTROLLED CONCRETE DRAINAGE OUTLET FROM SUB-BASIN AREA "A" TO SAN LUIS CREEK
APPROXIMATE LIMITS OF 25-YEAR STORM = 5.9' ABOVE SEA LEVEL
36" CONCRETE DRAINAGE OUTLET FROM SUB-BASIN AREA "E" TO PACIFIC OCEAN
APPROXIMATE LIMITS OF 100-YEAR STORM = 6.2' ABOVE SEA LEVEL
24" CONCRETE DRAINAGE OUTLET FROM SUB-BASIN AREA "B" TO PACIFIC OCEAN
D 1.2
C 4.1
A 21.5
E 2.7
B
F
AVILA BEACH DRIVE
THE COLONY
PUBLIC PARKING LOT
SECOND STREET
SAN LUIS STREET
SAN JUAN STREET
SAN FRANCISCO STREET
SAN MIGUEL STREET
FIRST STREET
FRONT STREET
SAN ANTONIO STREET
PACIFIC OCEAN
BAY OF SAN LUIS OBISPO
1 INCH = 100 FEET
LEGEND
LIMITS OF SUB-BASIN AREA
APPROX. LIMITS OF 25-YR STORM
APPROX. LIMITS OF 100-YR STORM
AREA OF 25-YR STORM INUNDATION
AREA BETWEEN 25-YR STORM INUNDATION AND 100-YR STORM INUNDATION
RUNOFF FLOW ARROWS
DRAINAGE OUTLET LOCATIONS
SUB-BASIN MARKER
B 10.5
SUB-BASIN DESIGNATION
SUB-BASIN ACREAGE
APPROXIMATE FIRM - 100-YR WATER SURFACE ELEVATION
13' ABOVE SEA LEVEL
REVISIONS
NO.
DATE
DESCRIPTION
Cannon ASSOCIATES
ENGINEERS
PLANNERS
SURVEYORS
THIS DOCUMENT WAS PREPARED BY CANNON ASSOCIATES (CA) AS AN INSTRUMENT OF PROFESSIONAL SERVICE AND SHALL REMAIN THE PROPERTY OF CA. THE RECIPIENT MAY MAINTAIN COPIES FOR INFORMATION AND REFERENCE IN CONNECTION ONLY WITH THIS SPECIFIC PROJECT. FURTHER, THE RECIPIENT RECOGNIZES THAT CHANGES OR MODIFICATIONS TO CA INSTRUMENTS OF PROFESSIONAL SERVICE INTRODUCED BY ANYONE OTHER THAN CA MAY RESULT IN ADVERSE CONSEQUENCES WHICH CA CAN NEITHER PREDICT NOR CONTROL. ACCEPTANCE OF THE DELIVERY OF THIS DOCUMENT CONSTITUTES AGREEMENT TO THESE TERMS AND CONDITIONS.
DRAINAGE EXHIBIT
THE COLONY
AT AVILA BEACH
COUNTY OF SAN LUIS OBISPO, CALIFORNIA
DRAWN BY
BDW
DATE
JULY 2004
CA JOB NO.
001024
CHECKED BY
JWE
SCALE
1" = 100'
SHEET
1 OF 1

Appendix A:

Pond Pack Summary

MASTER DESIGN STORM SUMMARY

Default Network Design Storm File, ID AVILA.RNQ Storms 10

Return Event	Total Depth in	Rainfall Type	RNF File	RNF ID
10-yr	4.0000	Synthetic Curve	SCSTYPES	TypeI 24hr
25-yr	5.0000	Synthetic Curve	SCSTYPES	TypeI 24hr
50-yr	6.0000	Synthetic Curve	SCSTYPES	TypeI 24hr
100-yr	6.5000	Synthetic Curve	SCSTYPES	TypeI 24hr

MASTER NETWORK SUMMARY
SCS Unit Hydrograph Method

(*Node=Outfall; +Node=Diversion;)
(Trun= HYG Truncation: Blank=None; L=Left; R=Rt; LR=Left&Rt)

Storage Node ID	Type	Return Event	HYG Vol ac-ft	Trun	Qpeak hrs	Qpeak cfs	Max W5EL ft	Max Pond ac-ft
*OUT 10	JCT	10	6.148		9.9500	53.66		
*OUT 10	JCT	25	7.919		9.9500	68.42		
*OUT 10	JCT	50	9.697		9.9500	83.07		
*OUT 10	JCT	100	10.588		9.9500	90.36		
SCS UH 10	AREA	10	6.148		9.9500	53.66		
SCS UH 10	AREA	25	7.919		9.9500	68.42		
SCS UH 10	AREA	50	9.697		9.9500	83.07		
SCS UH 10	AREA	100	10.588		9.9500	90.36		

Appendix B:

Soil Survey

subject to frequent, brief periods of flooding from about December through March.

Most areas of this soil are used as rangeland. A few areas are used for small grains and hay crops.

This soil is not well suited to dryland farming because of the low water holding capacity and the potential for crop losses from flooding. Surface drainage ditches and water diversions help to relieve the flooding problem in some areas. Green manure crops and crop residue utilization help to improve soil tilth, structure, and water holding capacity. Crops commonly grown on this soil include barley and oats.

This soil is poorly suited to rangeland. The loamy sand surface layer is subject to soil deposition. The areas of silt and sand deposition tend to be very droughty because of their low available water capacity. Annual forage production is very low. Ground water is usually available on this soil. Deep-rooted, water-loving plants, such as mule fat, coyotebush, willows, and California sycamore, are common. The major forage is browse. Clumps of deergrass and purple needlegrass are common perennial forage grasses. Many areas are considered unique plant and wildlife areas; grazing should be controlled to preserve these areas. Undesirable plants include poison oak, cocklebur, and poison-hemlock. If the range is overgrazed, the proportion of preferred forage plants decreases and the proportion of less preferred plants increases. Livestock grazing should be managed so that the desired balance of plant species is maintained.

If this soil is used for urban development and other engineering practices, it should be protected from flooding. Embankments, dikes, and levees, if constructed from this material, are subject to seepage and piping. This can be corrected by mixing this soil with a more desirable material, careful placement of material, and maintaining a high degree of compaction and moisture control. Pond reservoir areas and sanitary landfill areas need to be sealed to prevent seepage. Pond reservoir areas should be located on lesser slopes to minimize the loss of storage potential. Because of the slope, droughtiness, and fast intake rate of the loamy sand surface layer, sprinkler or drip methods of irrigation are best suited. This soil has a high soil blowing hazard; a good plant cover should be maintained at all times.

This Tujunga soil is in capability subclasses VIw (14), irrigated and nonirrigated.

221—Xererts-Xerolls-Urban land complex, 0 to 15 percent slopes. This complex consists of nearly level to strongly sloping soils and miscellaneous areas that are covered by urban structures. Areas of this complex are irregular in shape and range from 5 to 350 acres. The soil materials have been modified by earthmoving equipment or covered by urban structures so that much of their original shape and physical characteristics have been altered. Average annual precipitation ranges from 15 to 30 inches, and the average annual air temperature is about 58 degrees F.

The Xererts of this complex are Cropley or Diablo soils. These are both clay soils that shrink and swell appreciably on changes in moisture content. The Xerolls are mainly Concepcion, Los Osos, Marimel, and Salinas soils. The Los Osos soils have a slowly permeable clay subsoil and Concepcion soils have a very slowly permeable clay subsoil that shrink and swell with changes in moisture. The Marimel soils are poorly drained alluvial soils. The Salinas soils are well drained, silty clay loam alluvial soils.

Most areas of these soils are used for urban development.

When used for urban development, the shrink-swell potential of the Xererts soil and the Xerolls subsoil and the very slow and slow permeability of the Xerolls subsoil need to be considered in the design and building of foundations, concrete structures, and paved areas. These limitations can be minimized by backfilling, using blankets of crushed rock and sand beneath concrete structures, using vapor barriers, and diverting runoff away from structures. Replanting disturbed areas as soon as possible helps to control erosion. If the soils are used as septic tank absorption fields, the poorly drained, alluvial Xerolls should be avoided. The very slow and slow permeability of these soils can be overcome by increasing the size of the absorption field and backfilling the trench with sand and gravel. If the density of housing is moderate or high, a community sewage system should be considered.

The percentage of the various soils in this complex and the degree of urbanization vary from place to place.

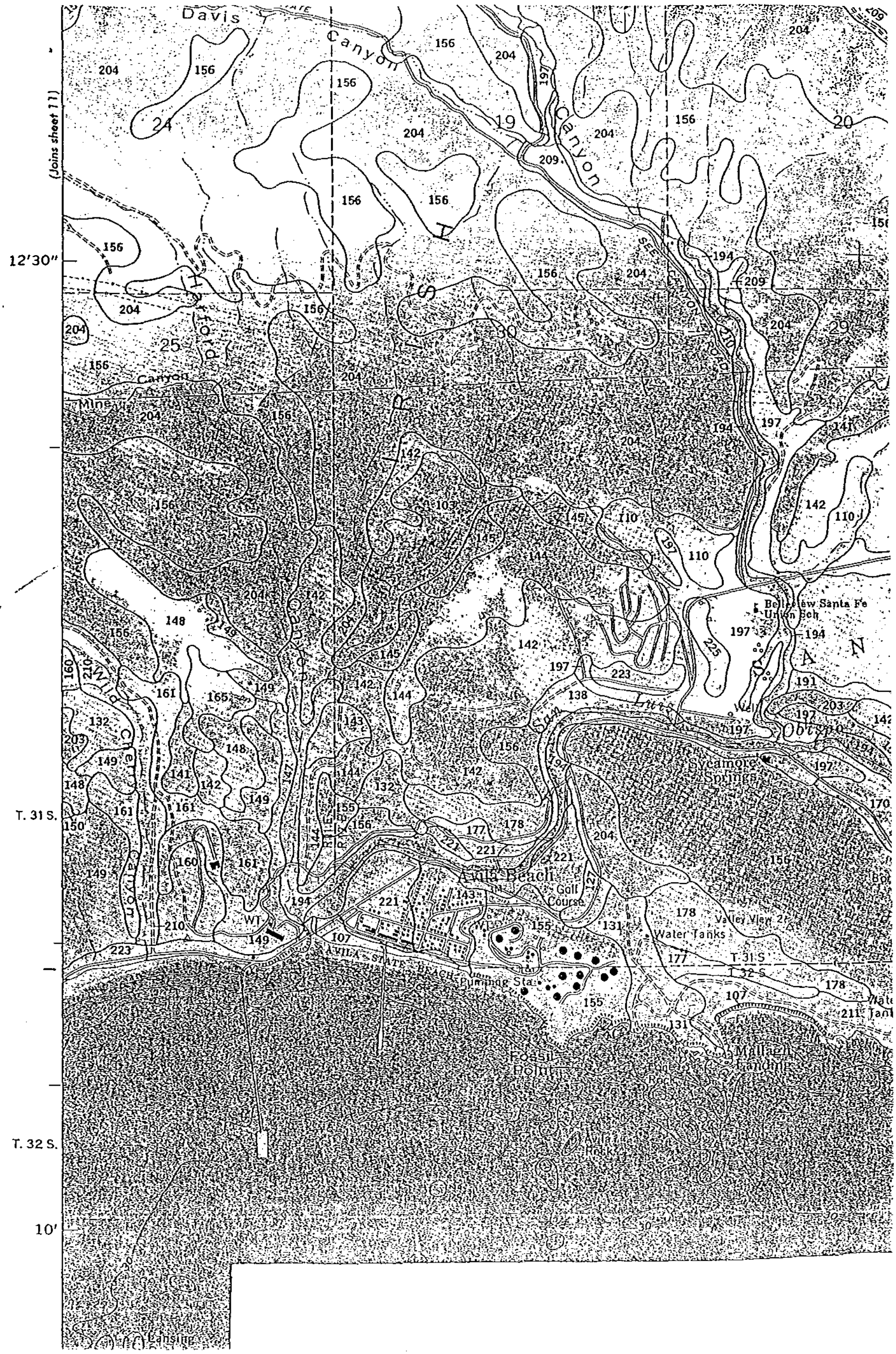
This complex is not assigned to a capability subclass.

222—Xerorthents, eroded. This map unit consists of steep through extremely steep, shallow soils on soft sandstone or semiconsolidated sediments. Slopes are commonly over 50 percent but range from 30 to 100 percent. A typical area is east of Lopez Canyon Reservoir in the Phoenix Creek area. Elevation ranges from near sea level to 1,500 feet. Natural vegetation is sparse brush, occasional small oak trees, and a very sparse understory of grass and forbs. The average annual rainfall ranges from 14 to 20 inches, and the average annual air temperature is about 59 degrees F.

These soils are light colored loamy sand, sandy loam, and loam 10 to 30 inches deep to soft rock. They are severely eroded and produce large amounts of sediment. Included are areas of Pismo, Briones, and Gaviota soils.

When the soil surface is bare, runoff is very rapid, and the hazard of erosion is very high. Permeability is rapid, and the available water capacity is low or very low.

These areas have no agricultural value. They are best suited to wildlife habitat and watershed. A good vegetative cover should be maintained to help prevent


12'30"
T. 31 S.
T. 32 S.
10'
(Joins sheet 11)
Davis Canyon
Canyon
Harford Canyon
Mine
Wild Cherry Canyon
San Luis Obispo
Bellevew Santa Fe Union Sch
Sycamore Springs
Avila Beach
Golf Course
Water Tanks
Valley View
Avila State Beach
Pumping Sta.
Fossil Point
Mallagh Landing
Lansing
WT
SEE CANYON ROAD
T. 31 S.
T. 32 S.

Appendix C:

Runoff CN Table

Runoff CN Tables

Table 2-2a - Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemetaries,etc.)[3]					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious area only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1 to 2 inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95 ←
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded area (pervious areas only no vegetation)[5]		77	86	91	94

Idle lands (CN's are determined using cover types similar to those in table 2-2c)

1. Average runoff condition, and Ia = 0.2s.

2. The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition.

Appendix D:

Isopluvials

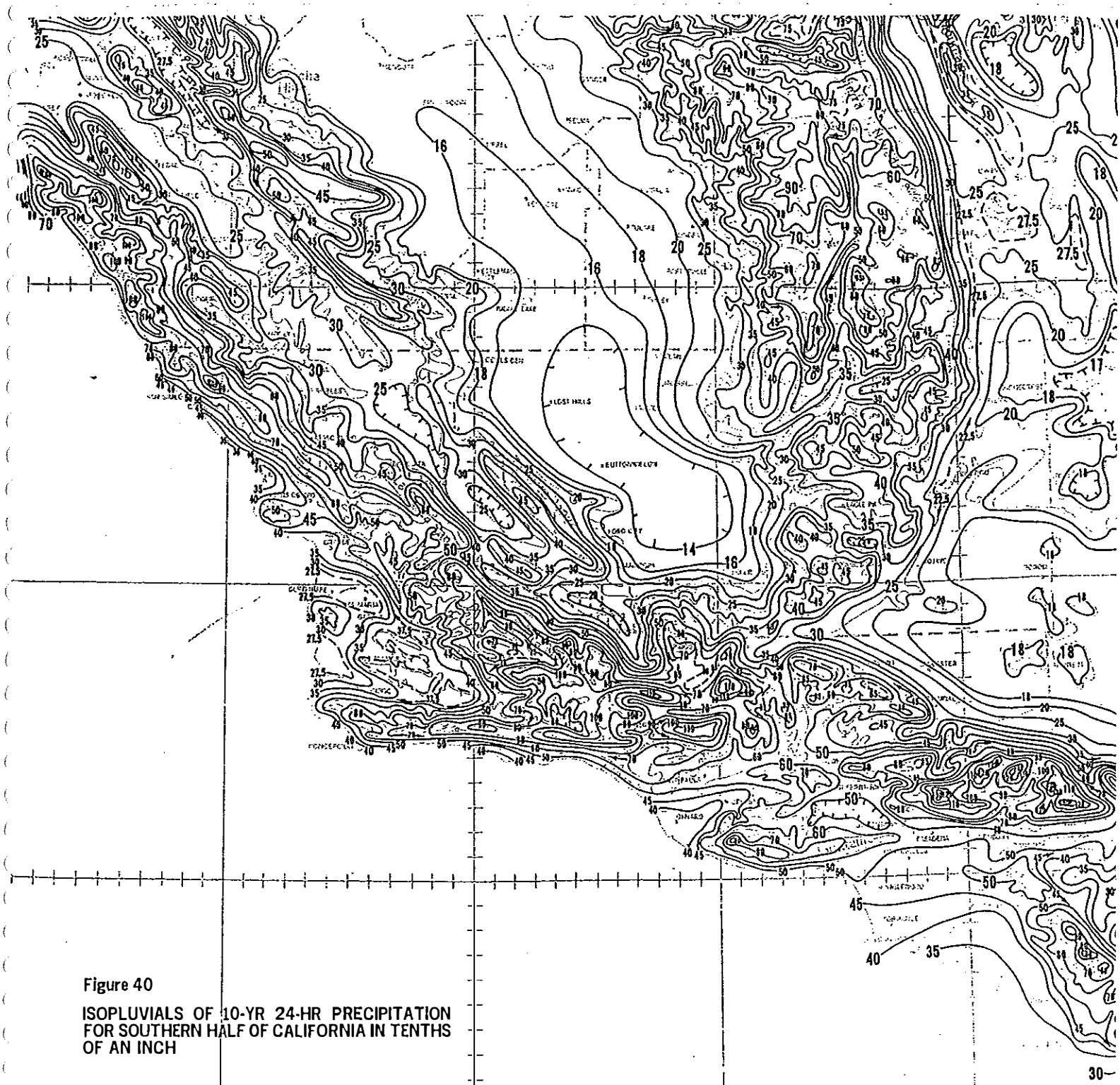


Figure 40

ISOPLUVIALS OF 10-YR 24-HR PRECIPITATION FOR SOUTHERN HALF OF CALIFORNIA IN TENTHS OF AN INCH

NOAA ATLAS 2, Volume XI

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

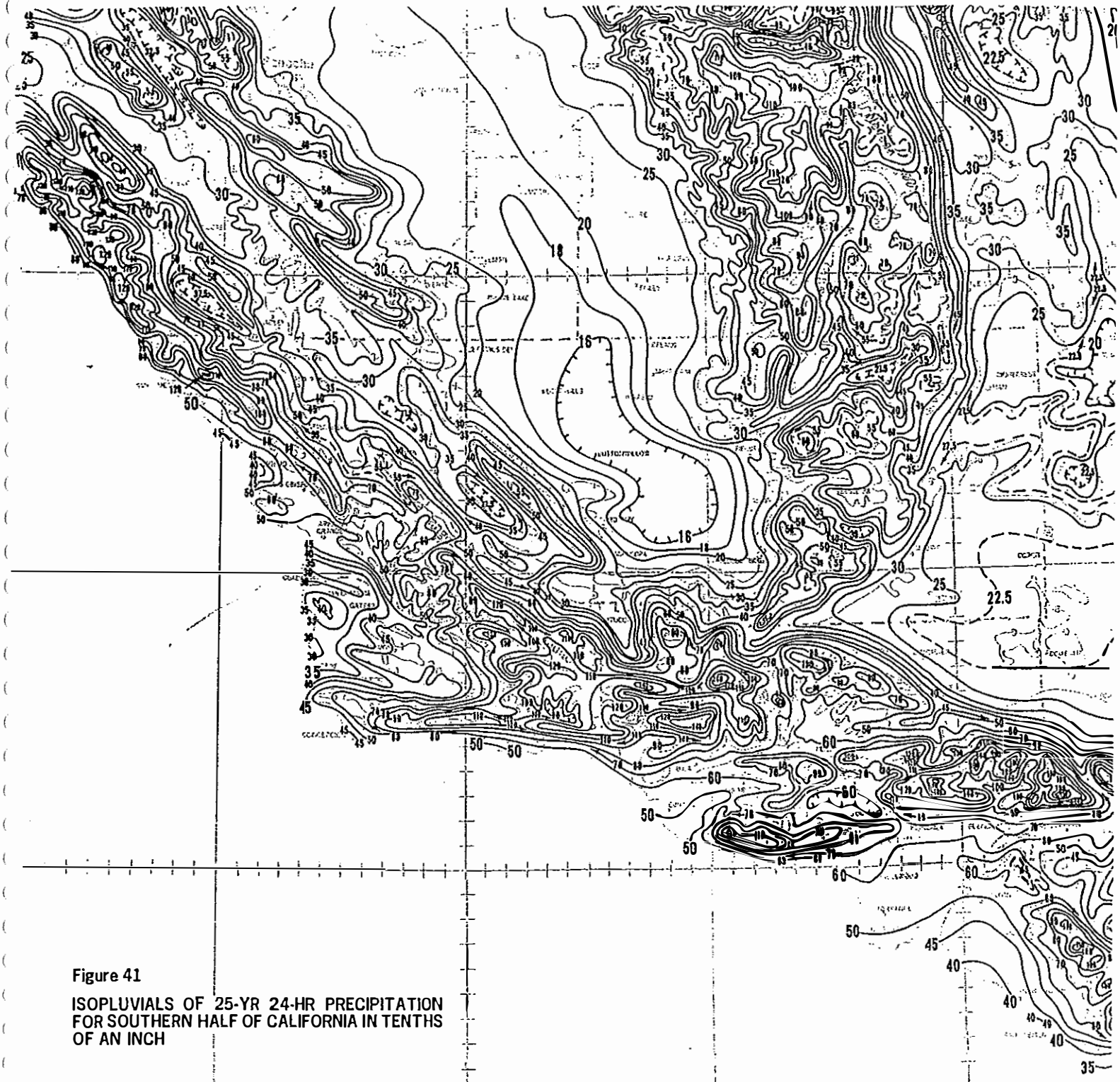


Figure 41

ISOPLUVIALS OF 25-YR 24-HR PRECIPITATION FOR SOUTHERN HALF OF CALIFORNIA IN TENTHS OF AN INCH

NOAA ATLAS 2, Volume XI

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

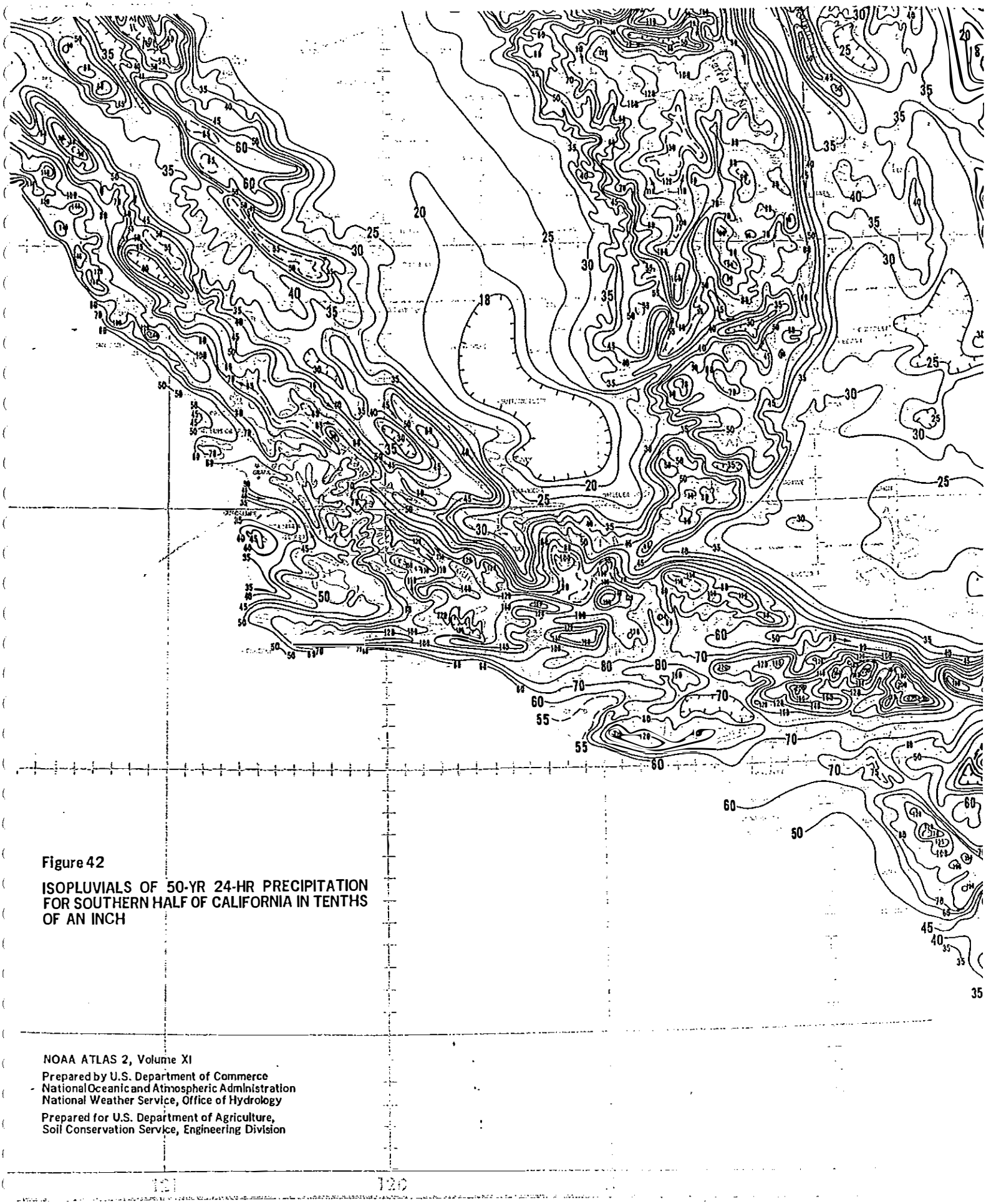


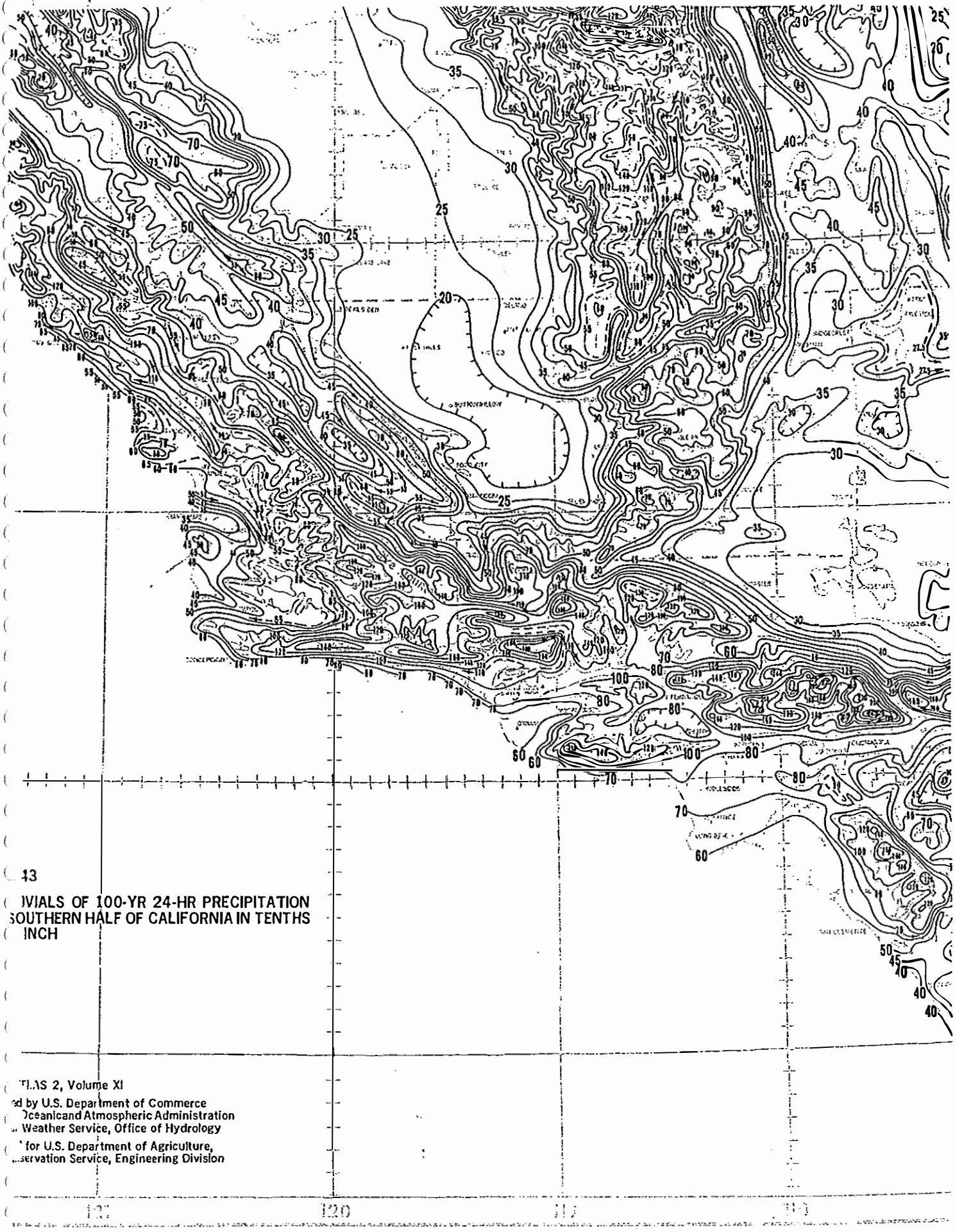
Figure 42

ISOPLUVIALS OF 50-YR 24-HR PRECIPITATION FOR SOUTHERN HALF OF CALIFORNIA IN TENTHS OF AN INCH

NOAA ATLAS 2, Volume XI

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division



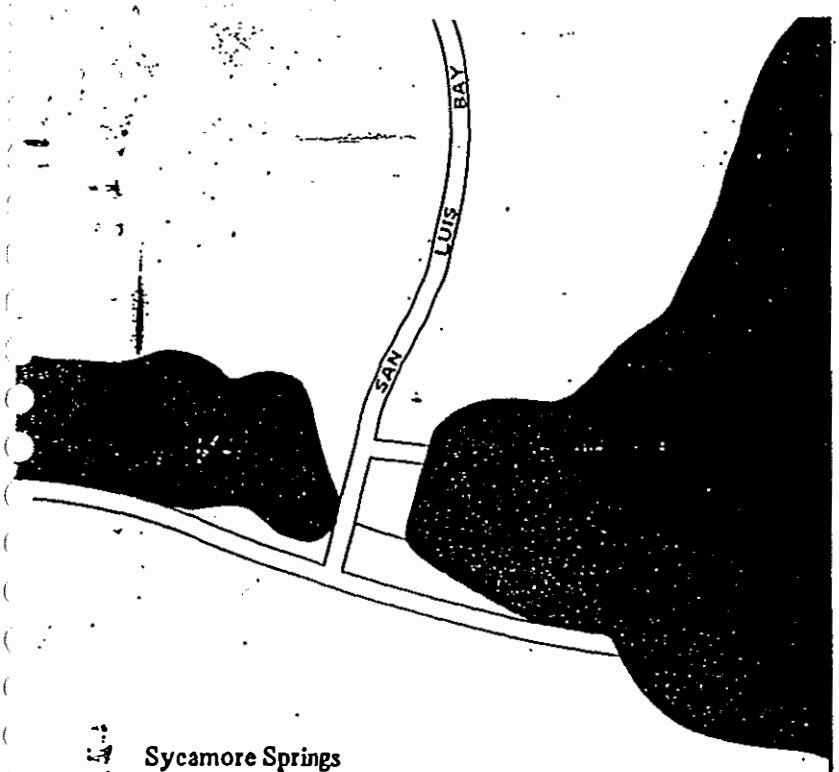
43

IVIALS OF 100-YR 24-HR PRECIPITATION
SOUTHERN HALF OF CALIFORNIA IN TENTHS
INCH

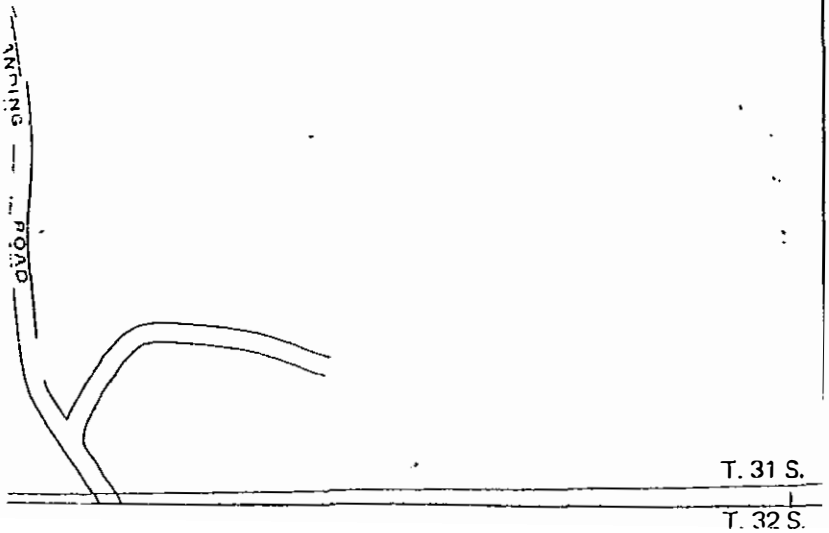
TLAS 2, Volume XI
ed by U.S. Department of Commerce
Oceanic and Atmospheric Administration
Weather Service, Office of Hydrology
for U.S. Department of Agriculture,
servation Service, Engineering Division

Appendix E:

Flood Insurance Rate Map



Sycamore Springs



To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

APPROXIMATE SCALE

500 0 500 FEET

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

SAN LUIS OBISPO COUNTY, CALIFORNIA

(UNINCORPORATED AREAS)

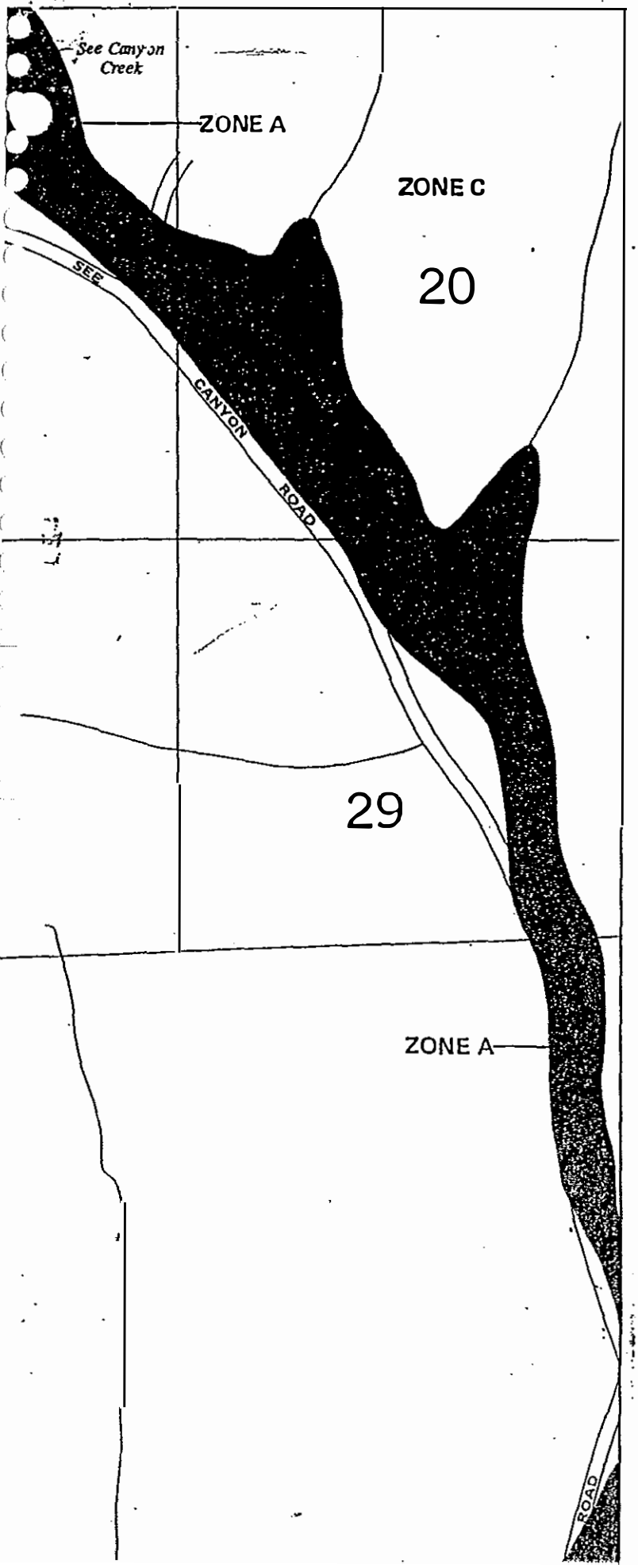
PANEL 592 OF 975

(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
060304 0592 C

MAP REVISED:
JULY 18, 1985

Federal Emergency Management Agency

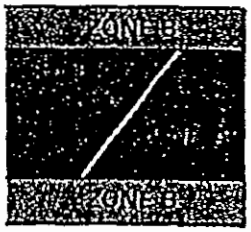


KEY TO MAP

500-Year Flood Boundary

100-Year Flood Boundary

Zone Designations



100-Year Flood Boundary

500-Year Flood Boundary

Base Flood Elevation Line With Elevation In Feet** — 513

Base Flood Elevation In Feet Where Uniform Within Zone** — (EL 987)

Elevation Reference Mark — RM7×

Zone D Boundary

River Mile — •M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

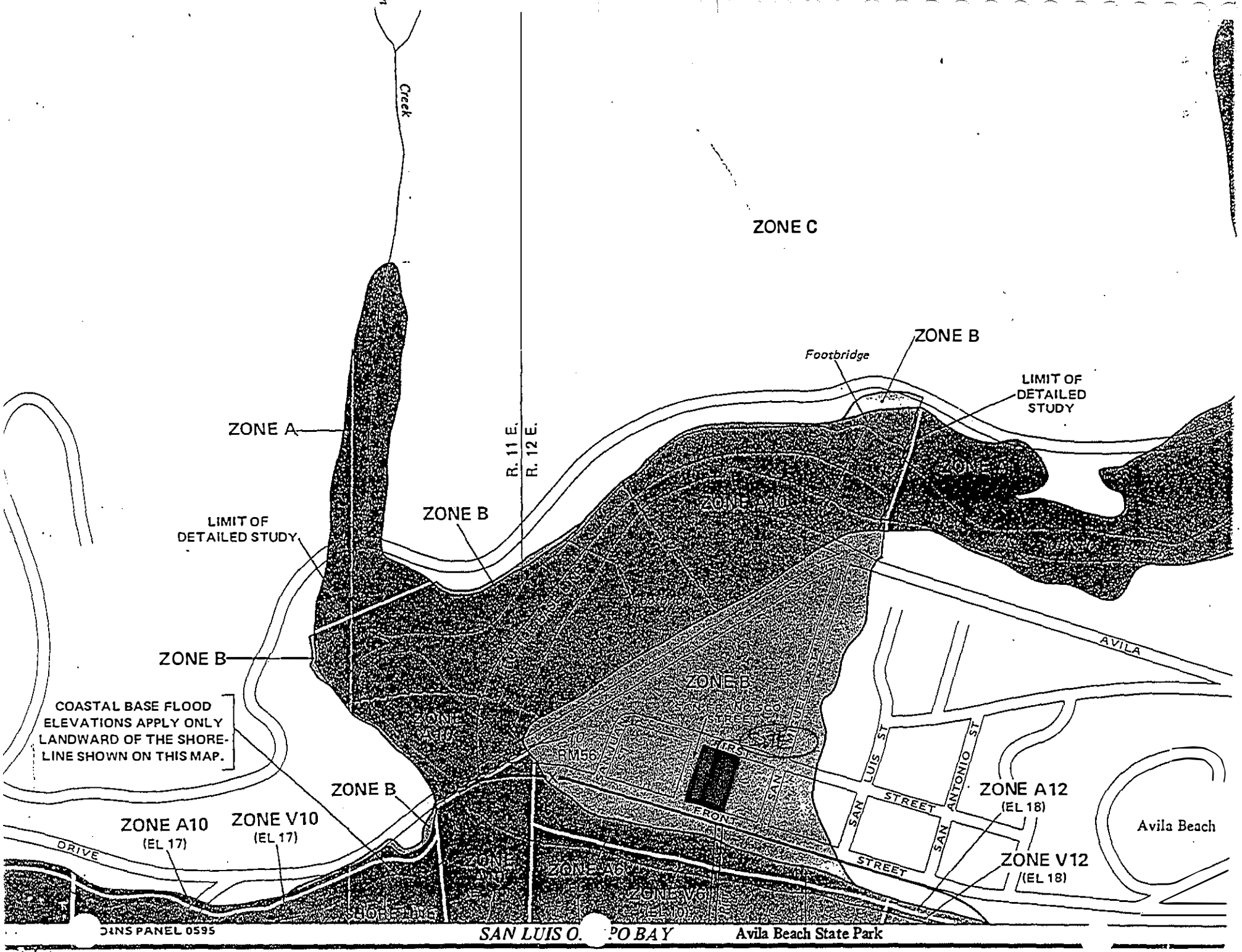
Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

Coastal base flood elevations apply only landward of the shoreline shown on this map.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION:
JANUARY 3, 1975


Creek
ZONE C
ZONE B
Footbridge
LIMIT OF DETAILED STUDY
ZONE A
R. 11 E.
R. 12 E.
ZONE A10
ZONE B
LIMIT OF DETAILED STUDY
ZONE B
AVILA
ZONE B
COASTAL BASE FLOOD ELEVATIONS APPLY ONLY LANDWARD OF THE SHORE-LINE SHOWN ON THIS MAP.
ZONE A10
ZONE B
RM56
FIRST
SAN LUIS ST
SAN ANTONIO ST
ZONE A12
(EL 16)
STREET
ZONE A10
(EL 17)
ZONE V10
(EL 17)
DRIVE
ZONE V12
(EL 18)
Avila Beach
ZONE V6
SAN LUIS O. PO BAY
Avila Beach State Park

Appendix II

Amendment to the Colony Drainage Study

Revised June 2006

Amendment to the DRAINAGE STUDY

For

The Colony at Avila Beach

County of San Luis Obispo, California

Prepared by:

Cannon Associates
364 Pacific Street
San Luis Obispo, CA
93401

Revised June 2006

Executive Summary This amendment to The Colony drainage report analyzes the 25-year and 100-year flood water elevations in the town of Avila Beach and affects the properties of both The Colony and The Landing projects. A previous drainage study was prepared in July of 2004 for The Colony project, and this amendment revises the previous flood elevations determined in that report. The revisions to the flood elevations are a result of further analysis of the existing storm drain system and of the effects of creek flow, wave setup and tidal cycles on that system.

This amended report has determined that the 25-year and 100-year flood water elevations are lower than those stated in the July 2004 report due to finding that the existing 36"-diameter outfall drain pipe will flow during portions of a 25-year and 100-year 24-hour storm event.

Introduction The July 2004 Colony Drainage Report determines storm water runoff and drainage patterns for the town of Avila Beach, and the data used in that report is used for this amendment unless otherwise noted. The location and description of the Colony project, as well as the existing drainage conditions in that area are also included in the July 2004 report and will not be restated here.

Methodology of Flood Elevation Determination As stated previously, the original drainage study for The Colony, dated July 2004, assumed that there would be no outflow from the existing 36" diameter outfall drain pipe during a 25-year and 100-year, 24 hour storm event. This assumption was made because the effects of anticipated tide levels, creek flow and wave setup on the outfall pipe were not studied at that time. Therefore a very conservative detention basin volume was used. This amended drainage study also uses a very conservative approach to determining detention volume, but also includes the results of the analysis of the anticipated creek levels at the 36" diameter pipe outlet.

The conservative assumptions used in determining creek elevations include using 100-year flood elevations for San Luis Obispo Creek, per FEMA's Flood Insurance Study (applicable portions included in Appendix 6A), 100-year wave setup elevations at the mouth of San Luis Creek, also per FEMA, and the maximum observed water level (on January 18, 1973) per NOAA data for Port San Luis (as shown in Appendix 7A). These 100-year and maximum water elevations were then layered on one another to determine the highest water elevation for the longest anticipated period at the outlet of the 36" diameter pipe. A graph of the anticipated water levels over a 24 hour period was

prepared and is included in Figure 3A. This graph was then used to determine when the outfall pipe can fully or partially flow. The graph was also used to determine that the maximum period of time of no pipe flow is 4.5 hours and that the resulting 100-year storm detention period is 5 hours rather than the previously assumed 24 hour period.

Elevation Datum The elevation datum used for the project is the NGVD 1929 datum with the 1960 adjustment.

In 1991, at least one nearby Tidal Benchmark (Tidal 6) was resurveyed by differential leveling and the benchmark height was adjusted by the National Geodetic Survey. The adjustment of this benchmark did not affect the base elevation of 0 feet (NGVD29) for the area and to which the base flood elevations determined in this study are referenced. Key elevations in this report are FEMA's 100-year wave setup elevation of 9.9 feet (NGVD29), FEMA's 100-year maximum San Luis Creek height of 11.5 feet (NGVD29) at the 36-inch diameter pipe outlet, and the highest observed water level in Avila Bay of 7.68 feet (MLLW datum, observed 1/18/73), all of which are unaffected by the 1991 adjustment of Tidal 6.

Wave Setup Elevation Based upon discussions in April 2006 with Rea Strange of Pacific Weather Analysis in Santa Barbara, CA and Mark Mesiti-Miller, Coastal Engineer with Mesiti-Miller Engineering in Santa Cruz, CA, both coastal experts agreed that a very conservative approach for determining the maximum wave setup height is 2-feet above still water. This 2-feet above still water height would be dependant upon coincident worst case scenarios of extreme wave height, wind direction and low atmospheric pressure. Given the highest observed water level near the outlet of San Luis Creek was 7.68' (MLLW) or 4.67' (NGVD29) at Port San Luis on January 18, 1973 (see NOAA Tidal Datum, Appendix 7A), the highest resulting wave setup elevation would be 6.67' (NGVD29). FEMA uses a maximum wave setup elevation of 9.9' (NGVD29) (see Appendix 6A), so 9.9' was used for the purposes of this report.

Detention Volumes The detention volumes resulting from 10-year, 25-year and 100-year storms were calculated from the data used and referenced in the "Hydrologic Analysis" section of the July 2004 Colony drainage study, and supplemented with NOAA 6-hour isopluvials (see Appendix 5A).

The 6-hour and 24-hour detention volumes were used to interpolate 5-hour detention volumes. A conservative run-off coefficient of 0.95 was used and assumes future total urban buildout. The calculated detention volumes are:

10-year, 5-hour: 21.5 acres x 0.173' depth x 0.95 = 3.55 acre-feet
25-year, 5-hour: 21.5 acres x 0.208' depth x 0.95 = 4.26 acre-feet
100-year, 5-hour: 21.5 acres x 0.242' depth x 0.95 = 4.94 acre-feet

These detention volumes were then plotted on a graph developed from the Avila Beach topographic contours which shows the detention volume versus water level elevation (see Figure 4A).

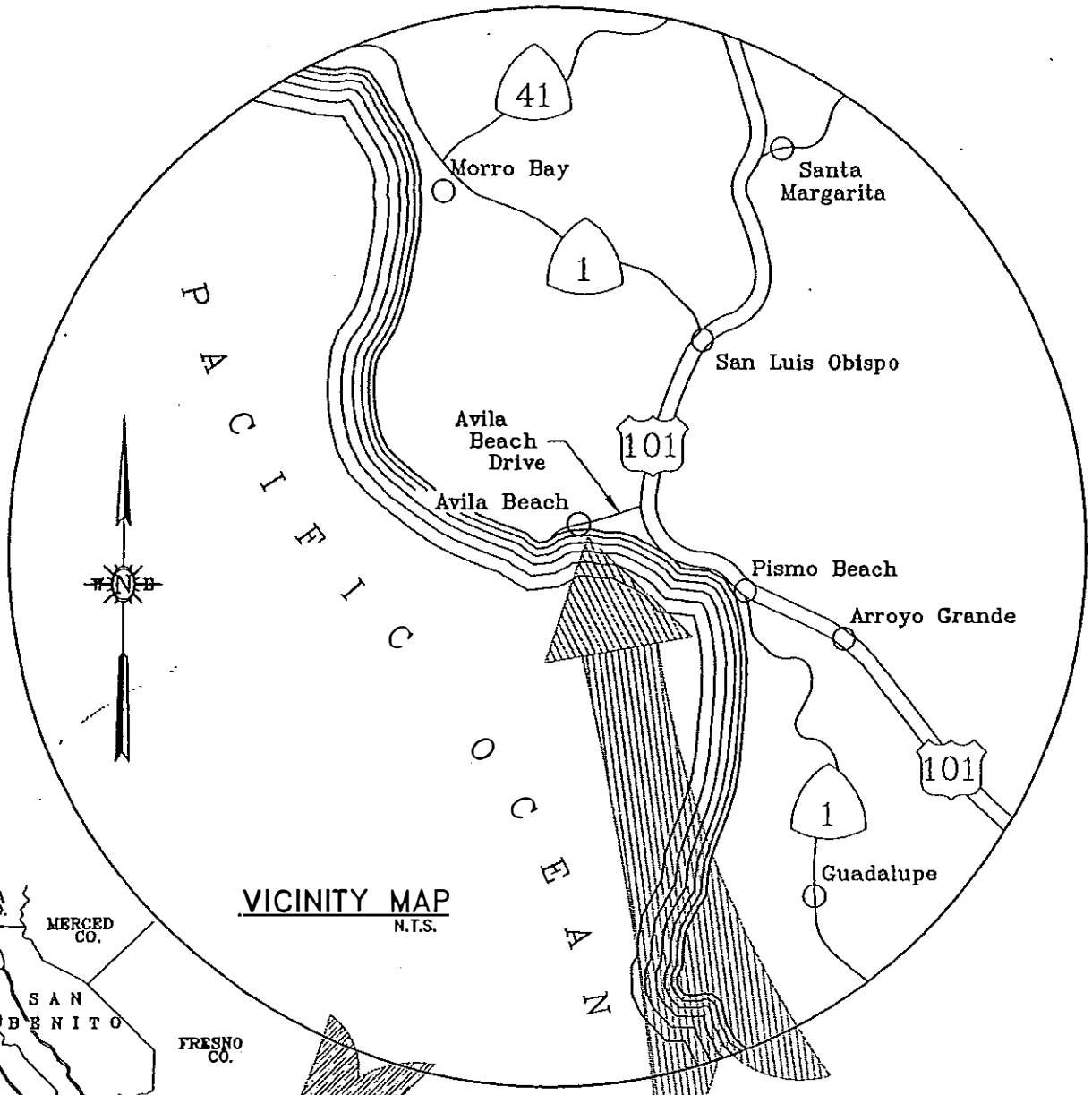
The resulting water level elevations for 10-year, 25-year, and 100-year storms are 5.00', 5.14' and 5.25' respectively (all NGVD 1929).

Creek Level and Outfall Pipe Hydraulics The graph showing the San Luis Creek elevations at the 36"-diameter storm drain outfall pipe (see Figure 3A) is used to determine the operation of the outfall valve. As the 5-hour storm duration fills the detention area, a point is reached when the creek height creates a backpressure that exceeds the 36"-diameter Tideflex valve's ability to continue to flow. After the maximum creek height is reached and prior to the end of the 5-hour detention period, the creek height drops sufficiently to allow the valve to open and the pipe to begin to flow.

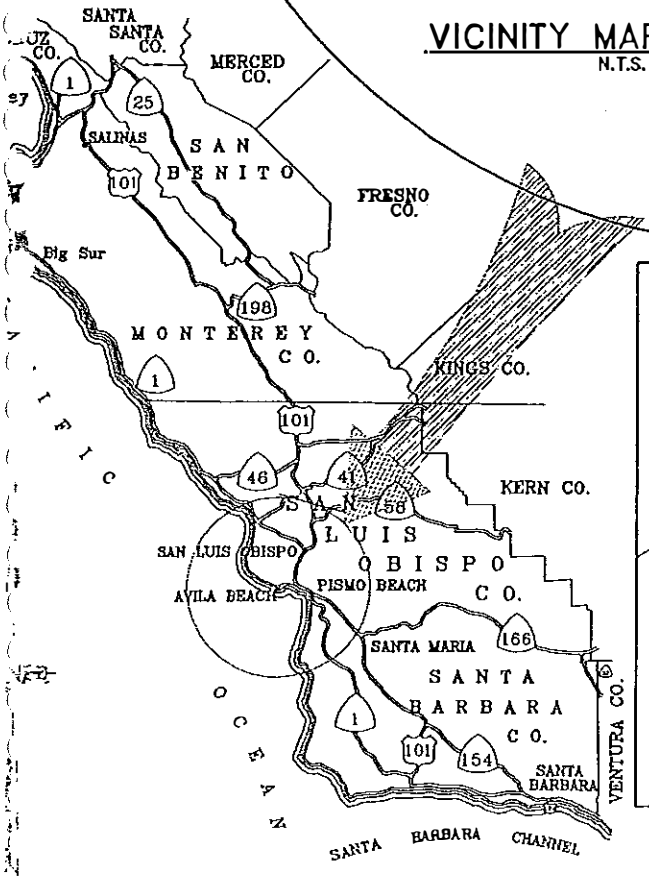
The creek level then drops rapidly and eventually falls below the invert elevation (-0.6 NGVD 1929) of the outfall pipe, even while assuming that wave setup will be affecting the creek level (at two feet above the tide level). As the creek drops, the pipe flow rate rapidly increases up to its full flow rate of 39 cfs. By the time the creek reaches its lowest elevation at MLLW (approximately 9.5 hours from the start of the cycle), the detention area has completely drained.

Following the first 12-hour period, where creek levels do not exceed the MHHW elevation, the output of the 36"-diameter pipe is able to keep closer pace with the storm inflow and the detention area flood levels will not exceed those reached in the first 12-hour period.

It is important to note that per the NOAA isopluvials, five inches of the total 6.5 inches (or 77%) of rainfall for a 100-year storm falls in the first 12 hours of the 24-hour period.



VICINITY MAP
N.T.S.



AREA MAP
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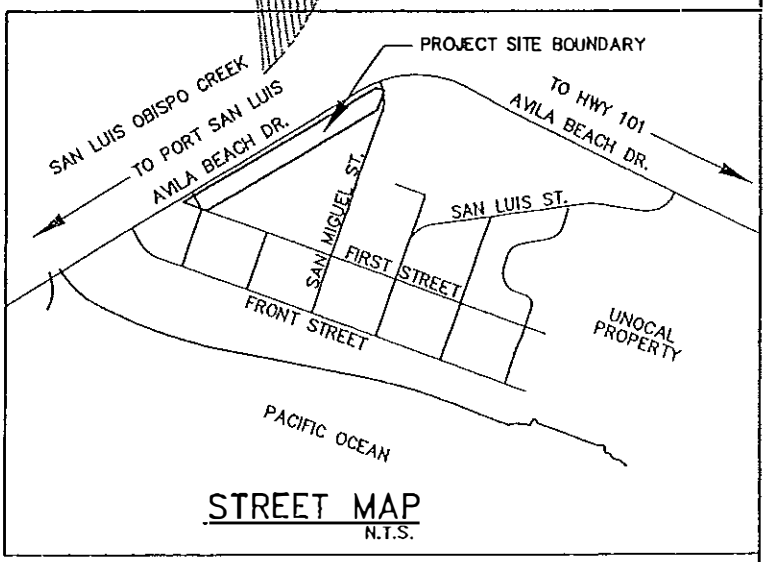
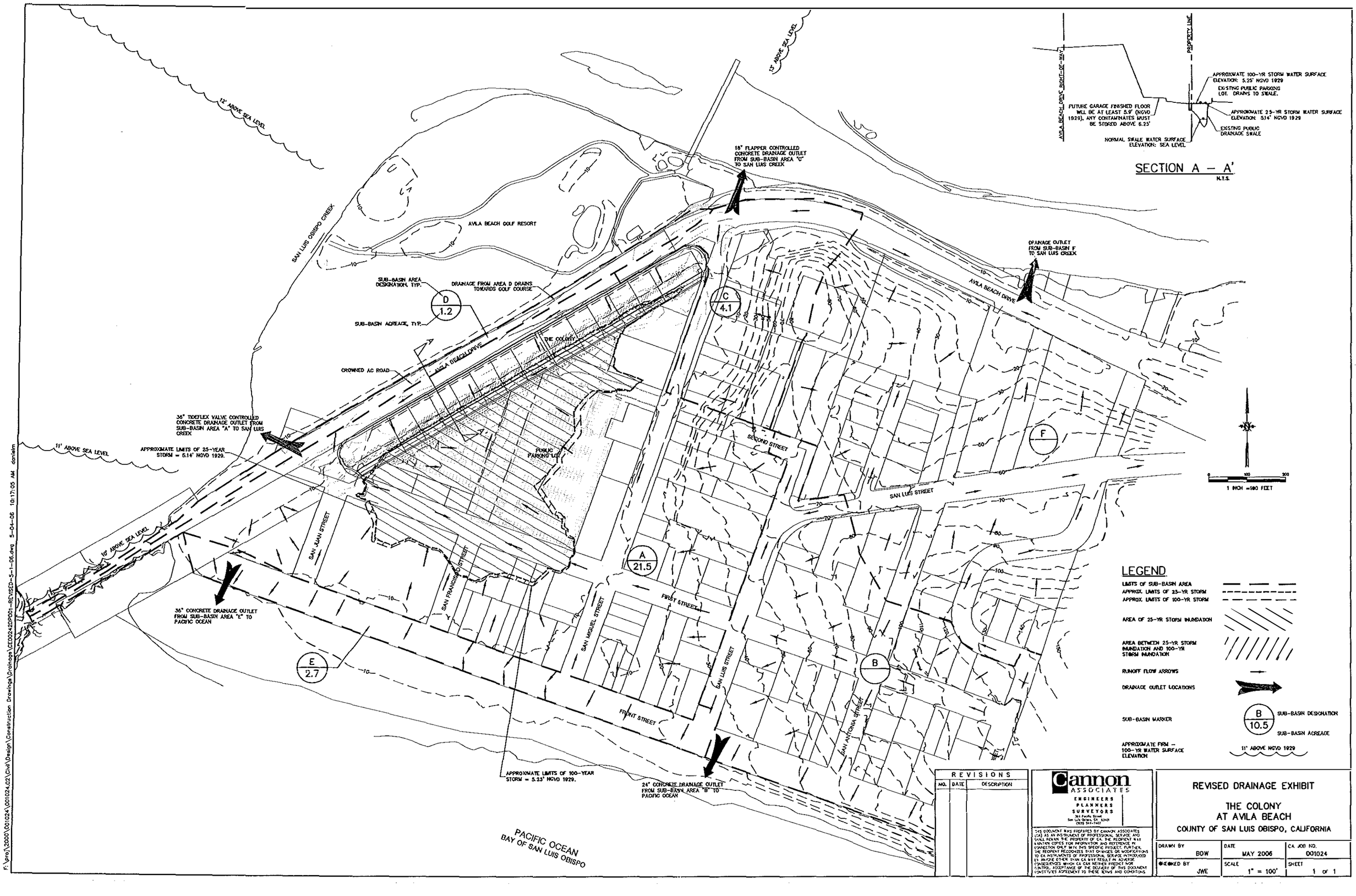


STREET MAP
N.T.S.

Figure 2A

Revised Drainage Exhibit



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REVISIONS		
NO.	DATE	DESCRIPTION

Cannon ASSOCIATES
ENGINEERS PLANNERS SURVEYORS
361 Pacific Street San Luis Obispo, CA 93401 (805) 541-7681

REVISED DRAINAGE EXHIBIT

THE COLONY AT AVILA BEACH

COUNTY OF SAN LUIS OBISPO, CALIFORNIA

DRAWN BY	DATE	CA JOB NO.
BDW	MAY 2006	001024
CHECKED BY	SCALE	SHEET
JWE	1" = 100'	1 OF 1

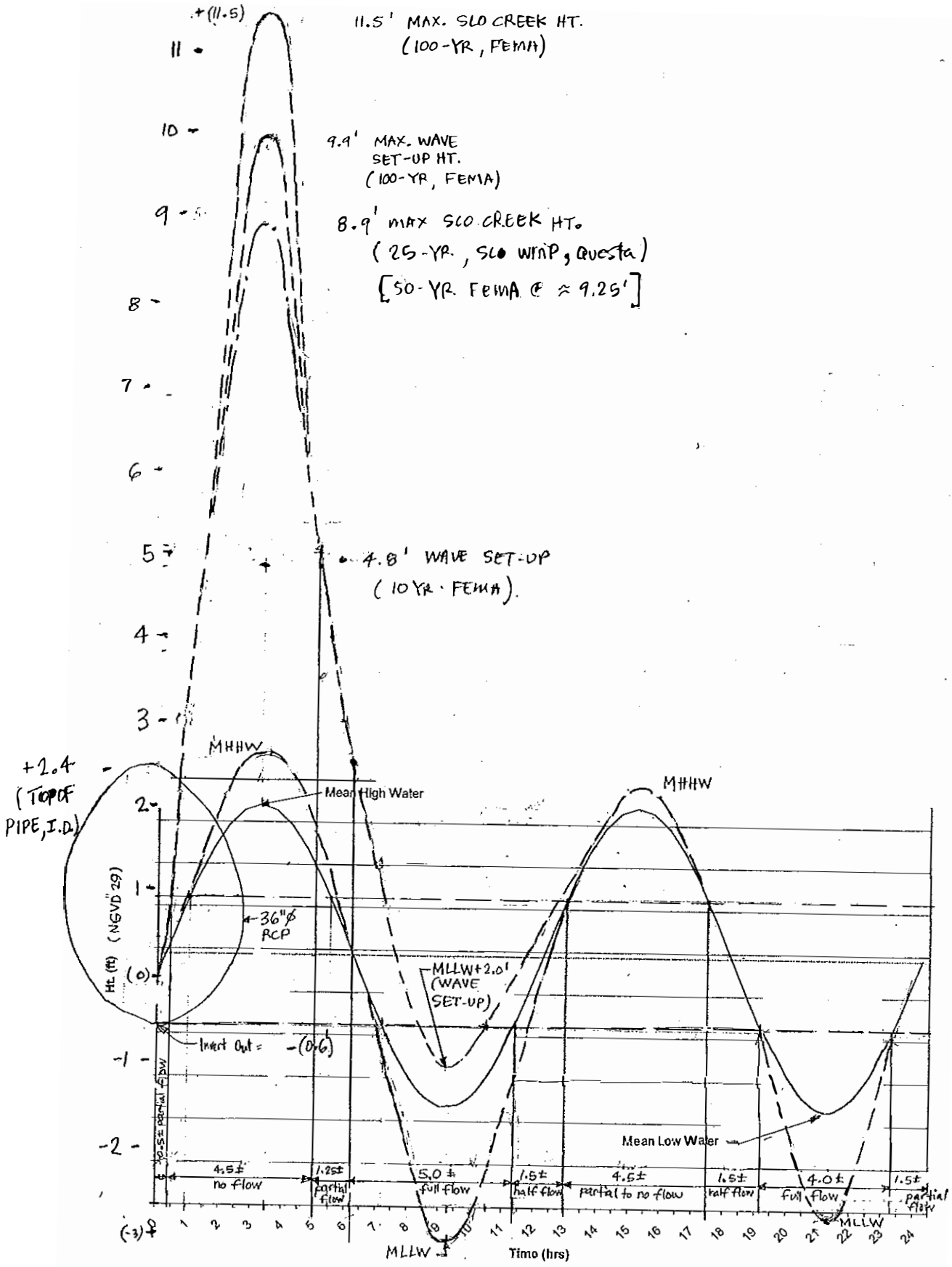
Figure 3A

San Luis Creek

Elevations for a 100-year Storm,

24-hour Period

at 36”-diameter Outfall Pipe



SLO CREEK ELEVATIONS
FOR 24 hr. PERIOD
DURING 100-YR STORM
AT 36"ø RCP OUTLET

Port San Luis, CA
040884 The Landing

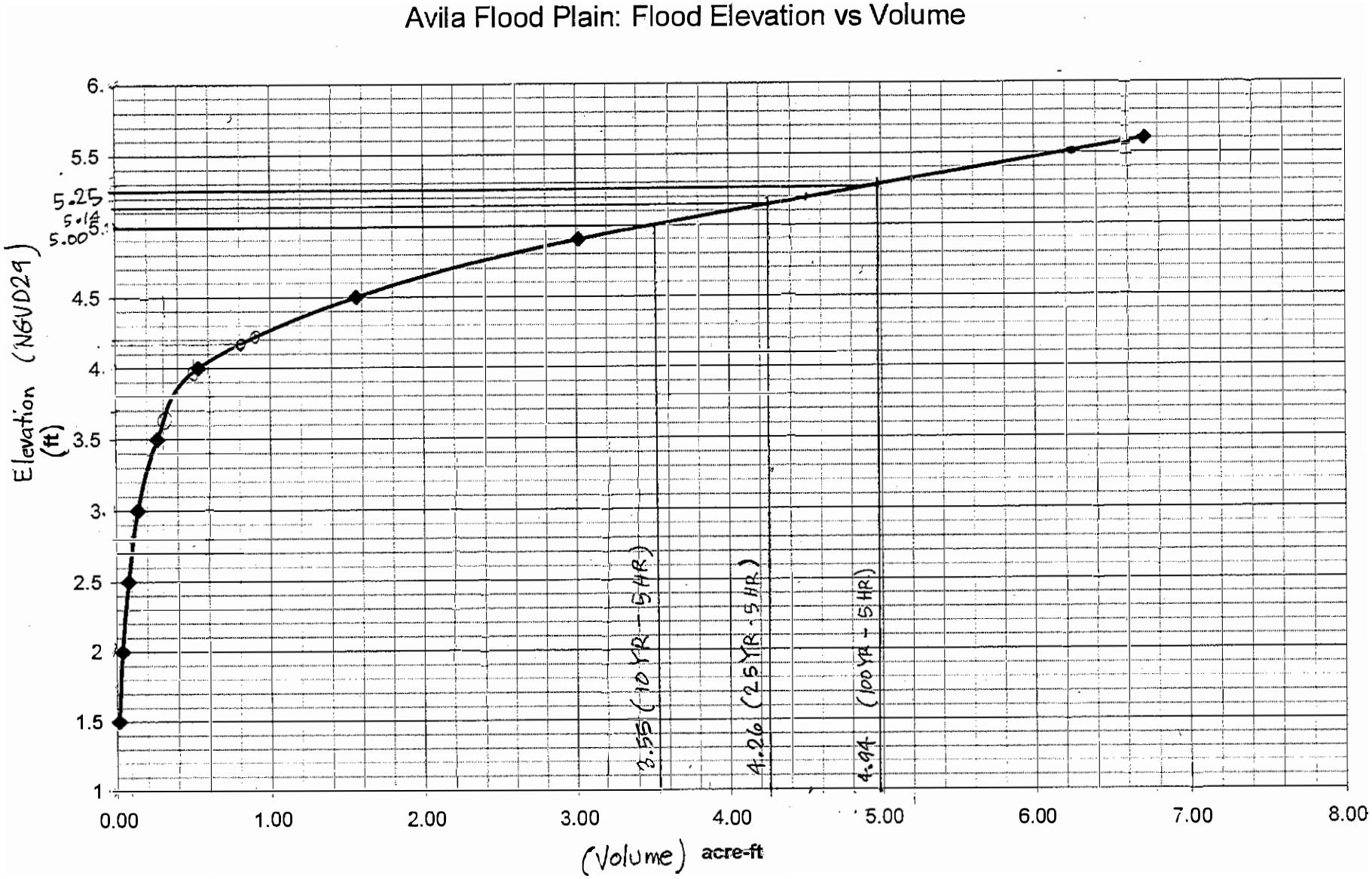
LAR
3.24.06

JWE
4.20.06

Figure 4A

Avila Flood Plain Elevations vs. Volume

Avila Flood Plain: Flood Elevation vs Volume



The Landing

C 10 C 24 -12-16

Appendix 5A

Isopluvials

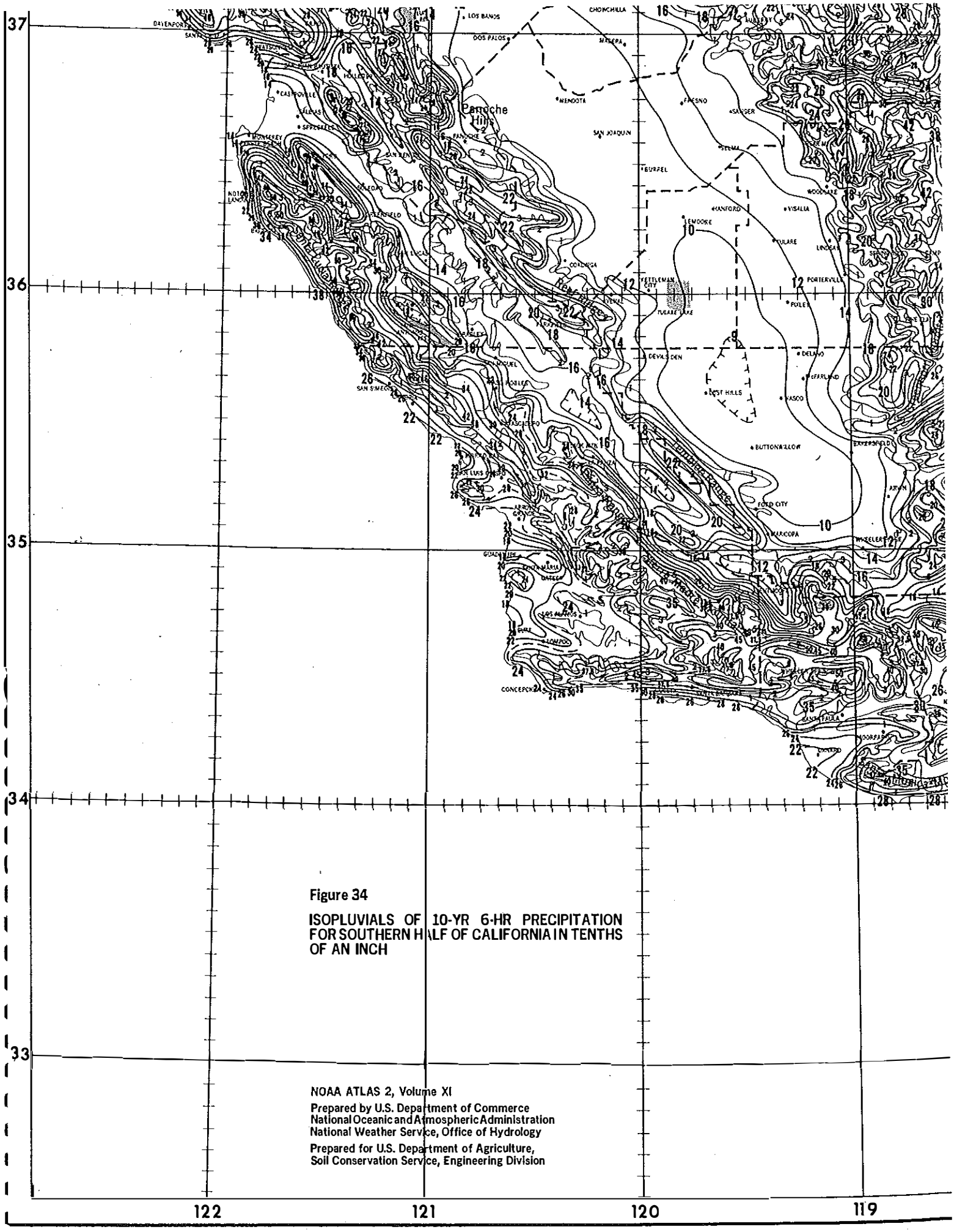


Figure 34

ISOPLUVIALS OF 10-YR 6-HR PRECIPITATION FOR SOUTHERN HALF OF CALIFORNIA IN TENTHS OF AN INCH

NOAA ATLAS 2, Volume XI

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

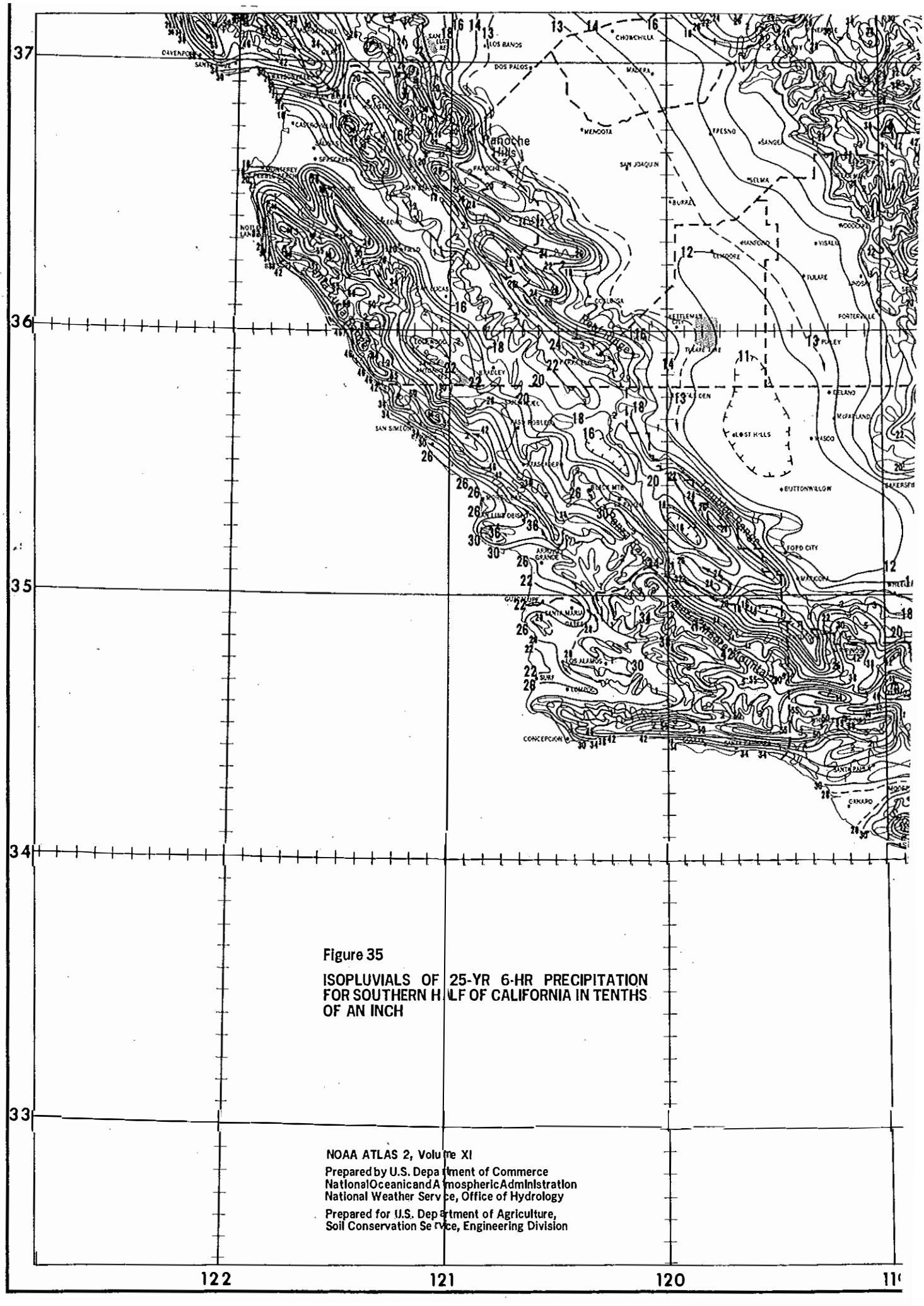


Figure 35

ISOPLUVIALS OF 25-YR 6-HR PRECIPITATION FOR SOUTHERN HALF OF CALIFORNIA IN TENTHS OF AN INCH

NOAA ATLAS 2, Volume XI

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

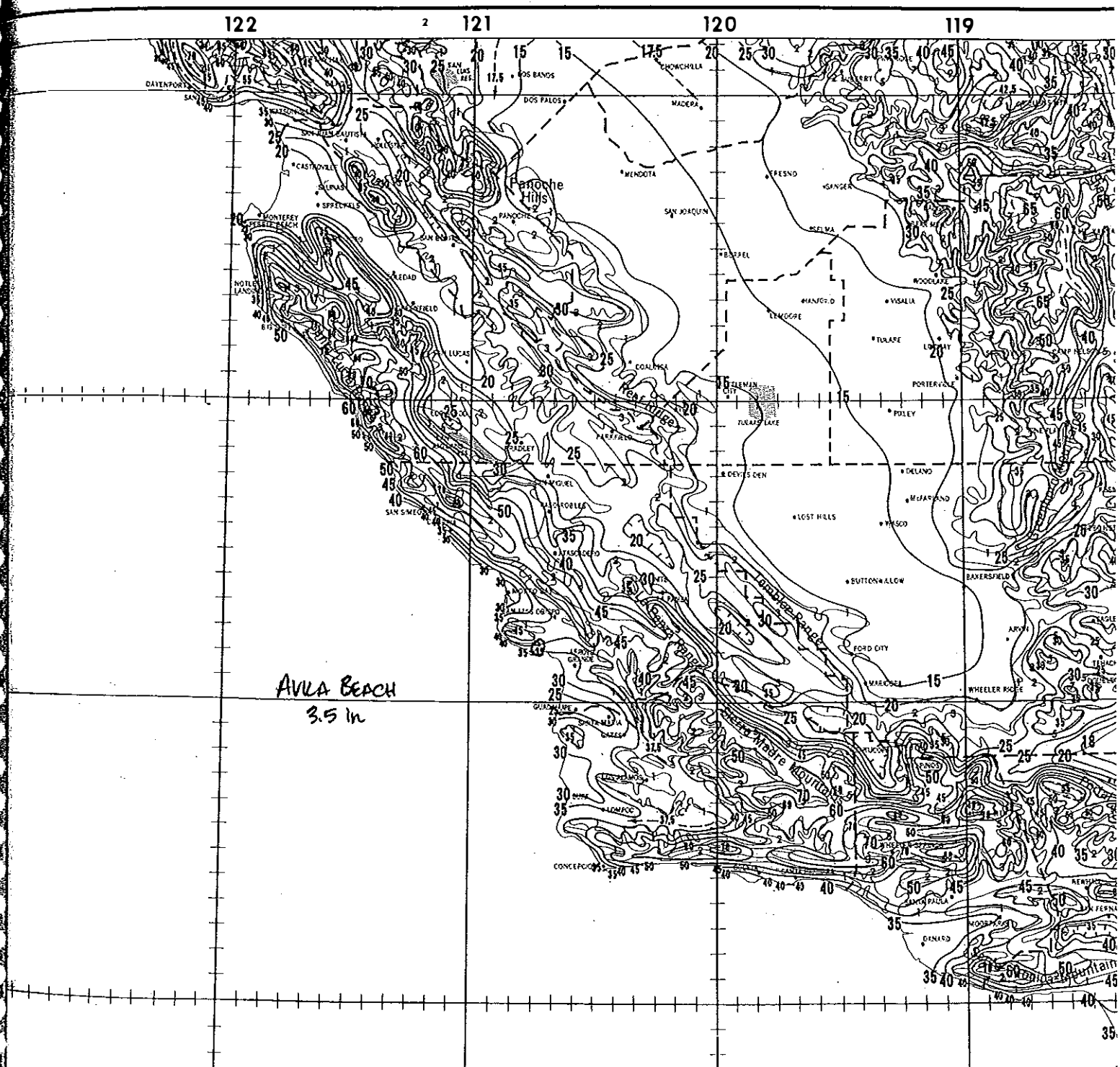


Figure 37

ISOPLUVIALS OF 100-YR 6-HR PRECIPITATION FOR SOUTHERN HALF OF CALIFORNIA IN TENTHS OF AN INCH

NOAA ATLAS 2, Volume XI

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

Appendix 6A

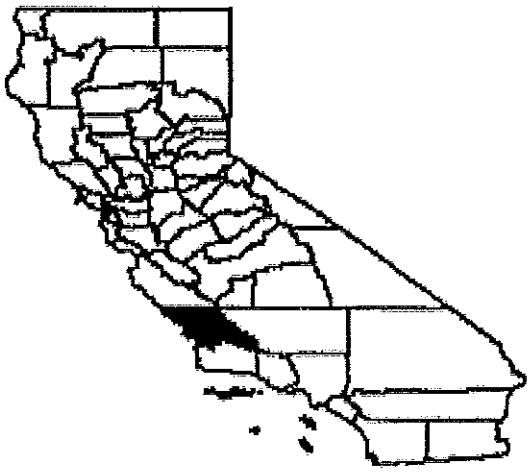
FEMA Report Data

FLOOD INSURANCE STUDY

SAN LUIS OBISPO COUNTY, CALIFORNIA

UNINCORPORATED AREAS

VOLUME 1 OF 2



REVISED:
FEBRUARY 4, 2004

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
060304V001A

Table 2. Summary of Elevations (Cont'd)

Flooding Source and Location	Wave Runup[1] Elevation (Feet) 10-Year	100-Year	500-Year	Wave Setup Elevation (Feet) 10-Year	100-Year	500-Year
Pacific Ocean (cont'd)						
0.5 Mile West of San Luis Obispo Creek	14.2	21.1	24.5			
Just West of San Luis Obispo Creek	11.7	16.9	20.0			
At San Luis Obispo Creek				4.8	9.9 (1929 NGVD)	20.0
150 Feet South of the Intersection of Front Street and San Miguel Street, Avila Beach	6.9	9.9	20.0			
100 Feet South of the Intersection of Front Street and San Antonio Street, Avila Beach	12.6	18.4	21.6			
At Fossil Point	14.2	21.1	24.5			
At Arroyo Grande Creek and Oso Flaco Creek	7.1	9.9	20.0	4.8	9.9	20.0

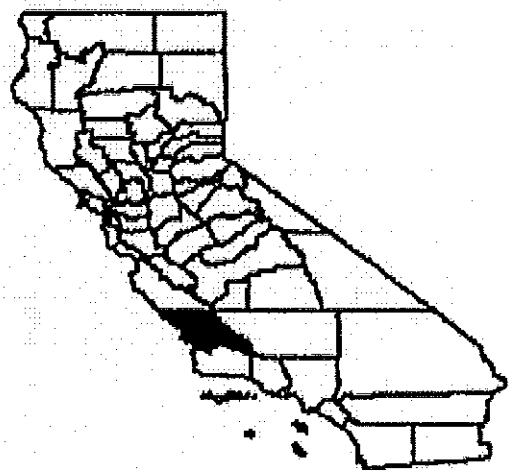
[1]Average Elevations Are Given; Variation May Occur Within the Area Cited.

FLOOD INSURANCE STUDY

SAN LUIS OBISPO COUNTY, CALIFORNIA

UNINCORPORATED AREAS

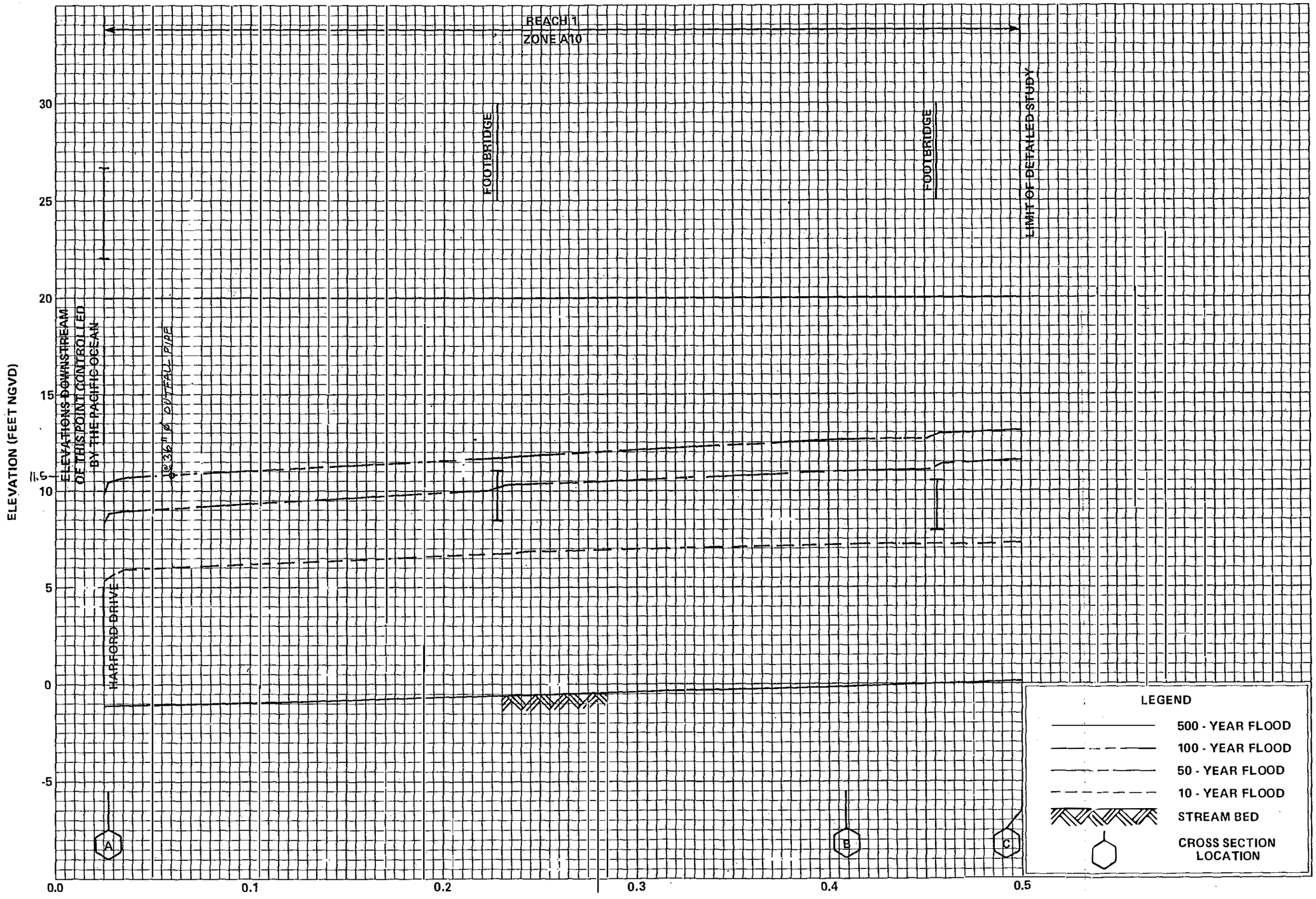
VOLUME 2 OF 2



REVISED:
FEBRUARY 4, 2004

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
060304V002A



FLOOD PROFILES

SAN LUIS OBISPO CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

SAN LUIS OBISPO COUNTY, CA
(UNINCORPORATED AREAS)