TRACY HILLS SPECIFIC PLAN
DRAFT SUBSEQUENT ENVIRONMENTAL IMPACT REPORT
VOLUME II
DECEMBER 2014

APPENDIX F-1
TRACY HILLS STORM DRAINAGE MASTER PLAN (SDMP), DATED SEPTEMBER 2014

CITY OF TRACY
TRACY HILLS
STORM DRAINAGE MASTER PLAN

September 2014

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SWC File No. 2011-78

Executive Summary

This report is a Tier 1 Storm Drainage Master Plan (SDMP) for the Tracy Hills Specific Plan area. This SDMP includes hydrologic and hydraulic analyses; a conceptual plan for storm drainage infrastructure needed to serve new development areas; drainage policies; and documentation regarding existing conditions, facilities, studies, and regulations.

This SDMP is intended to be utilized as a guidance document for the identification of the primary framework of storm drainage facilities needed to serve future land development under the buildout condition for the Tracy Hills Specific Plan area.

In general, new development projects within Tracy Hills will be required to provide site-specific or project-specific storm drainage solutions that are consistent with the overall infrastructure approach presented in this SDMP. The City may allow for a reasonable degree of flexibility to be incorporated into specific design approaches as a part of achieving effective solutions. Modifications and refinements to the storm drainage facilities Master Plan represented herein may be considered by the City during the Specific Plan or development review process for new projects. However, any significant modifications to the elements of this SDMP must be approved by the City and will require that a formal "Supplement" be adopted by the City Council.

The following information is provided and presented in this SDMP:

- A delineation of primary watersheds and sub-basins within primary watersheds.
- Hydrologic analyses for primary watersheds and sub-basins.
- Hydraulic analyses to determine capacities of major existing drainage structure crossings of aqueducts and proposed new storm drainage facilities that will serve new development.
- Graphic representations of the proposed storm drainage infrastructure.
- Typical cross-sections of selected proposed storm drainage infrastructure components.
- Guidelines for the planning and design of joint-use facilities.
- Drainage policies to be applied to new development, including the approach to satisfying the requirements of the City's Manual of Stormwater Quality Control Standards for New Development and Redevelopment (SWQC Manual).
- References to new regulations that impact City storm drainage facility planning and management.

The Study Area for this SDMP is the Tracy Hills Specific Plan area, plus upslope offsite sub-basins that impact the Specific Plan area (see Figure 1-1). Proposed storm drainage infrastructure represented herein reflects the storm drainage facility needs to serve the Tracy Hills Specific Plan area under *ultimate buildout* land use conditions (per the Tracy Hills Specific Plan) and *existing* land use conditions for upslope offsite sub-basins.

The storm drainage infrastructure identified in this SDMP will incorporate terminal retention basins as the means of managing runoff from new development via storage and percolation. Storm runoff generated by new development in Tracy Hills will be self-contained and will not utilize any existing downstream City storm drainage facilities. The use of terminal retention basins will also serve to satisfy the requirements of the City's SWQC Manual. Individual development projects in Tracy Hills will not be utilizing onsite LID facilities as the water quality and recharge goals and benefits set forth in the SWQC Manual will be provided via the proposed terminal retention basins.

In this SDMP, new Master Plan level storm drainage facilities that are being recommended have been sized based on the following criteria:

- Open channels: 100-year 24-hour storm.
- Underground storm drains: 100-year 24-hour storm for the Master Plan framework facilities. "Onsite" storm drains serving individual development projects follow the City Design Standards (10-year storm).
- Terminal Retention Basins: 2 times the 10-year, 48-hour storm storage volume.

The proposed Storm Drainage Infrastructure Plan recommended in this SDMP includes a combination of the following components (see Figures 3-1a and 3-1b herein and larger versions of these Figures located in the pocket at the back of the report):

- Terminal retention/percolation basins
- Open channels
- Underground storm drains

The City may allow for a reasonable degree of flexibility to be incorporated into specific design approaches as a part of achieving effective solutions, including adjustments to alignments of linear storm drainage conveyance facilities and adjustments to configurations of terminal retention/percolation basins.

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1.0 Introduction

This report is a Tier 1 Storm Drainage Master Plan (SDMP) for the Tracy Hills Specific Plan area. This SDMP includes hydrologic and hydraulic analyses; a conceptual plan for storm drainage infrastructure needed to serve new development areas; drainage policies; and documentation regarding existing conditions, facilities, studies, and regulations.

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- References to new regulations that impact City storm drainage facility planning and management.

1.1 STUDY AREA

The Study Area for this SDMP is the Tracy Hills Specific Plan area (see Figure 1-1), plus upslope offsite sub-basins that impact the specific plan area. Proposed storm drainage infrastructure represented herein reflects the storm drainage facility needs to serve the Tracy Hills Specific Plan area under *ultimate buildout* land use conditions (per the Tracy Hills Specific Plan) and *existing* land use conditions for upslope offsite sub-basins.

1.2 PREVIOUS STUDIES

There are previous studies that provide information that has been considered in the preparation of this SDMP. These studies are identified and described in the following subsections.

1.2.1 Citywide Storm Drainage Master Plan

The Citywide Storm Drainage Master Plan (Citywide SDMP) prepared for the City by Stantec Consulting Services Inc. (Stantec) was completed in November 2012 and subsequently adopted by the Tracy City Council in April 2013 (Resolution 2013-056). The Citywide SDMP contains similar information as is being presented in this SDMP, but also includes information relating to existing storm drainage infrastructure serving existing development areas in the City's Sphere of Influence and a delineation of existing and new impact fee program areas. In the Citywide SDMP, the Tracy Hills Specific Plan area was assumed to be self-contained with respect to storm drainage concerns and was not included in the Study Area for said document.

1.2.2 Tracy Hills Storm Drainage Master Plan

A separate Storm Drainage Master Plan was previously prepared for Tracy Hills by Nolte Associates, Inc. and was entitled *Tracy Hills Storm Drainage Master Plan, Volumes 1 – 3, December 2000*. The original separate report recommended that existing watersheds and new development areas within Tracy Hills drain to an existing offsite sand and gravel extraction pit as a point of terminal drainage. Proposed land uses and storm drainage facility approaches have changed since the original Tracy Hills Storm Drainage Master Plan was prepared and are being entirely superseded by the information presented in this SDMP.

1.3 STANDARDS, REGULATIONS, AND POLICIES

The master planning and subsequent design of storm drainage facilities are based upon many factors, and the purpose of this section is to define some of the more important elements so that a uniform set of criteria can be followed. Specifically, the proposed storm drainage facilities that are identified in this SDMP have been evaluated primarily using the design criteria defined herein. It is important to note that the criteria used at the master planning level (as in the development of this SDMP) are in some cases different than those used at an "onsite" design level (i.e., using City Engineering Design and Construction Standards, hereinafter referred to as "City Design Standards"). For instance, the design capacities for Master Plan underground storm drains differ in many instances from the design capacities for "onsite" underground storm drains (as described in the following sub-section). The HEC-HMS computer program has been

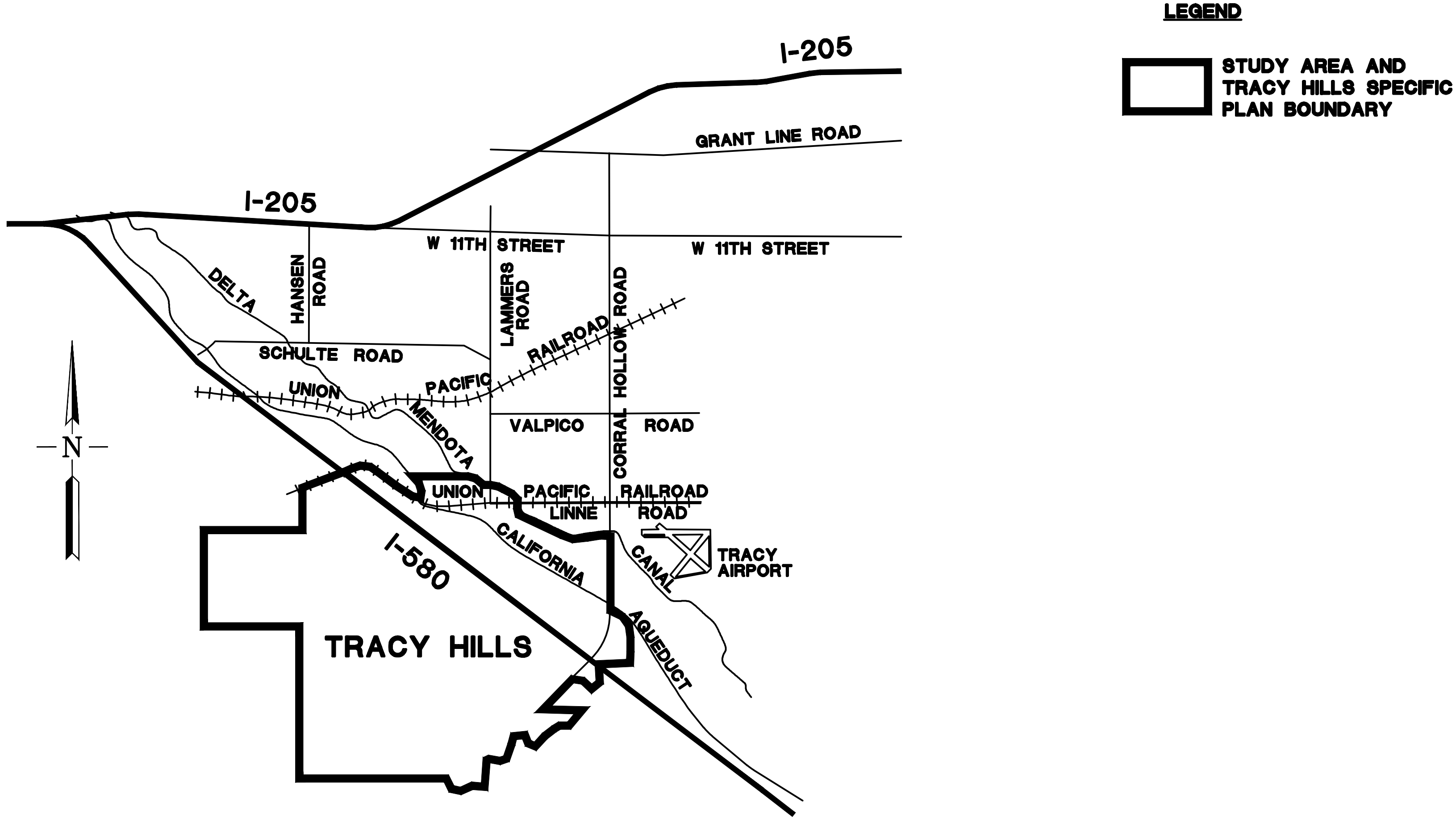

FIGURE 1-1
TRACY HILLS

STUDY AREA MAP

CITY OF TRACY, SAN JOAQUIN COUNTY, CALIFORNIA
NOVEMBER 2013

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used in this SDMP for hydrologic modeling as opposed to the Rational Method which is used to determine design flow rates for individual development projects of limited size per the City Design Standards.

1.3.1 Storm Drainage Facility Design Capacities

Existing City storm drainage facilities serving development areas downstream of the Tracy Hills Specific Plan area include open channels, channel parkways, underground storm drains, detention and retention basins, and pumping facilities. The following is a description of their general design capacities:

- Open channels, channel parkways and detention basins are intended to have a 100-year 24-hour return period storm design capacity under built out conditions for their contributing watersheds. Pumping facilities serving detention basins, when needed, are sized to provide the desired function and attenuation during a 100-year 24-hour return period storm.
- Underground storm drains are intended to have either a 10-year or a 100-year return period storm capacity depending upon their location and function and their contributing watershed.
- Some of the City's older, historical storm drains and open channels have a capacity that is less than the above return period capacities.
- Temporary retention ponds that are utilized as a temporary measure to control storm runoff until such time as sufficient downstream facilities are constructed to accommodate the desired flows have a capacity equivalent to the runoff volume generated from 2 times a 10-year, 48-hour storm for their contributing watershed areas.

In this SDMP, new Master Plan level storm drainage facilities that are being recommended have been sized based on the following criteria:

- Open channels: 100-year 24-hour storm.
- Underground storm drains: 100-year 24-hour storm for the Master Plan framework facilities. The subsequent design of "onsite" storm drains serving individual development projects will be required to follow the City Design Standards (10-year storm). It should be noted that the underground storm drain pipe sizes calculated in this SDMP are for the major backbone infrastructure and are based on assumed minimum pipe gradients. The size of these facilities will be re-evaluated in final design based on a detailed hydraulic analysis.
- Terminal Retention Basins: Runoff volume generated by 2 times the 10-year, 48-hour storm.

No detention basins are proposed in this SDMP to serve Tracy Hills. If detention basins are proposed at some point in the future via a supplement to this SDMP, the following capacity criteria will be applied to them:

- Detention basins: 100-year 24-hour storm.
- Detention basin pump stations (when needed): provide the desired function and attenuation during the 100-year 24-hour storm.

Terminal retention basin sizing represented in this SDMP accounts for the acreage required to accommodate the storage volumes needed for flood control only, and additional land may be required in order to incorporate provision for joint-use recreation facilities and differential grading, if such facilities are proposed.

"Onsite" storm drainage facilities serving individual future development projects or phases of future development projects are not presented herein and shall be designed in consideration of Master Plan storm drainage infrastructure presented in this SDMP, but in conformance with the City Design Standards.

1.3.2 Manual of Stormwater Quality Control Standards for New Development and Redevelopment

The City adopted a Manual of Stormwater Quality Control Standards for New Development and Redevelopment (SWQC Manual) in August 2008. The SWQC Manual has the following goals:

- Assist new development in reducing urban runoff pollution to prevent or minimize water quality impacts.
- Provide standards for developers, design engineers, agency engineers, and planners to use in the selection, design, and implementation of General Site Design Control Measures for Low Impact Design (LID) and appropriate site-specific source and treatment control measures.
- Provide maintenance procedures to ensure that the selected control measures will be maintained to provide effective, long-term pollution control.

LID is an approach to managing stormwater runoff that mimics the natural pre-development hydrology of a development site by using design techniques that infiltrate, filter, store, treat, evaporate, and detain stormwater runoff close to the source. Almost all areas of site design can incorporate LID measures, including residential landscaping, open space, streetscapes, parking lots, sidewalks, and medians. LID can be used in combination with traditional storm drain systems to infiltrate the smaller, more frequent storms, while allowing the larger storms to flow to pipes and basins for flood control (possibly with lower off-site costs than traditional non-LID systems). LID techniques offer great benefits to stormwater quality, especially for the smaller return interval storm events. LID will help reduce the amount of runoff entering the City's system and will aid in recharging ground water.

The storm drainage infrastructure identified in this SDMP will incorporate terminal retention basins as the means of satisfying the requirements of the City's SWQC Manual. Individual development projects in Tracy Hills will not be utilizing onsite LID facilities as the water quality and recharge benefits will be provided via the proposed terminal retention basins.

1.3.3 Municipal Separate Storm Sewer System Regulations

The Clean Water Act (CWA) was amended in 1972 to prohibit the discharge of pollutants to Waters of the United States from any point source unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. Section 402(p) was added to the CWA in 1987 to establish the framework for regulating municipal and industrial stormwater discharges under the NPDES program through a two-phase implementation plan. Phase I regulations were promulgated in 1990 and require large and medium size municipalities (population over 100,000) to comply with the NPDES municipal program. Phase II regulations were promulgated in 1999 and require small municipalities to obtain coverage under the NPDES municipal program. The City of Tracy is subject to the Phase II municipal program and has prepared a Storm Water Management Program (SWMP) to comply with the regulations (General Permit Number CAS000004, Water Quality Order No. 2003-0005-DWQ).

The intent of the SWMP is to implement Best Management Practices to reduce the discharge of pollutants from the City to the Maximum Extent Practicable (MEP). The City's current SWMP dated September 2003 includes the following six program categories:

1. Public Education and Outreach
2. Public Involvement and Participation
3. Illicit Discharge Detection and Elimination
4. Construction Site Storm Water Runoff Control
5. Post-Construction Storm Water Management in New Development and Redevelopment
6. Pollution Prevention and Good Housekeeping for Municipal Operations

On February 5, 2013, the State Water Resources Control Board (SWRCB) adopted a new Water Quality Order that replaces Water Quality Order No. 2003-0005-DWQ. The new Water Quality Order, 2013-0001-DWQ, became effective on July 1, 2013 and is entitled "Revised National Pollutant Discharge Elimination System Permit for the Discharge of Storm Water from Phase II Small Municipal Separate Storm Sewer Systems" and includes the following additional requirements:

- Specific BMP and Management Measure Requirements
- Elimination of submission of a SWMP for review and approval by the Regional Water Quality Control Boards (RWQCBs)

- Electronic filing of Notices of Intent (NOIs) and Annual Reports
- New program management requirements
- Total Maximum Daily Limit (TMDL) implementation requirements
- Water quality monitoring and BMP assessment
- Program effectiveness assessment

1.3.4 Water Quality Orders (SWRCB)

The SWRCB has adopted an NPDES General Permit for construction activities, known as the Construction General Permit (CGP). The current CGP (Order No. 2009-0009-DWQ) became effective on July 1, 2010. The CGP requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP) in conjunction with construction activities. The SWPPP must contain a site map(s) which shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography both before and after construction, and drainage patterns across the project. The SWPPP must list Best Management Practices (BMPs) that the discharger will use to protect storm water runoff and the placement of said BMPs. Additionally, the SWPPP must contain a Construction Site Monitoring Program (CSMP) to demonstrate that the site is in compliance with the CGP. Depending on the construction site risk level, the CSMP includes varying levels of visual monitoring and water quality sampling and analysis.

The CGP also includes the following requirements and evaluation criteria:

> *Rainfall Erosivity Waiver:* This option allows a small construction site (>1 and <5 acres) to self-certify if the rainfall erosivity value (R value) for their site's given location and time frame compute to be less than or equal to 5.
>
> *Technology-Based Numeric Action Levels:* The CGP includes NALs [numeric action levels] for pH and turbidity.
>
> *Risk-Based Permitting Approach:* The CGP establishes three levels of risk possible for a construction site. Risk is calculated in two parts: (1) Project Sediment Risk, and (2) Receiving Water Risk.
>
> *Effluent Monitoring and Reporting:* The CGP requires effluent monitoring and reporting for pH and turbidity in storm water discharges. The purpose of this monitoring is to determine whether NALs and effluent limits for active treatment systems are exceeded.

Receiving Water Monitoring and Reporting: The CGP requires some Risk Level 3 dischargers with direct discharges to surface waters to conduct receiving water monitoring whenever their effluent exceeds specified receiving water monitoring triggers.

Rain Event Action Plan: The CGP requires certain sites to develop and implement a Rain Event Action Plan (REAP) that must be designed to protect all exposed portions of the site within 48 hours prior to any likely precipitation event.

Annual Reporting: The CGP requires all projects that are enrolled for more than one continuous three-month period to submit information and annually certify that their site is in compliance with these requirements. The primary purpose of this requirement is to provide information needed for overall program evaluation and pubic information.

Certification/Training Requirements for Key Project Personnel: The CGP requires that key personnel (e.g., SWPPP preparers, inspectors, etc.) have specific training or certifications to ensure their level of knowledge and skills are adequate to ensure their ability to design and evaluate project specifications in compliance with CGP requirements.

The SWRCB has also issued a statewide General Permit (Water Quality Order No. 97-03-DWQ) for regulating storm water discharges associated with industrial activities. This General Permit requires the implementation of management measures that will achieve the performance standard of best available technology economically achievable (BAT) and best conventional pollutant control technology (BCT). It also requires the development of a SWPPP, a monitoring plan, and the filing of an annual report. The SWRCB has issued a draft Water Quality Order to replace the current General Permit for industrial facilities. The draft Order contains several significant changes from the current General Permit, including additional certification, sampling, and inspection requirements. The draft Order is targeted for adoption in the near future.

1.3.5 Urban Level of Flood Protection

Senate Bill No. 5 (SB 5) became law in the State of California in October of 2007 and contains new regulations pertaining to floodplain management for portions of the State that drain to the Sacramento-San Joaquin Valley, including the City of Tracy and San Joaquin County. It required that the State develop and adopt a Central Valley Flood Protection Plan (Flood Protection Plan). The State prepared the Flood Protection Plan and adopted said plan on June 29, 2012. Much of the emphasis of the Flood Protection Plan was placed on areas protected by levees and subject to potentially disastrous flooding if there is a levee failure.

In addition, SB 5 establishes a requirement that “urban areas” and “urbanizing areas” begin applying a 200-year return period storm level of flood protection standard (Urban Level of Flood Protection, or ULOP) to new development in locations meeting certain criteria no later than 36 months after the Flood Protection Plan is adopted by the State. “Urban area” is defined as a developed area in which there are 10,000 residents or more, and hence, the City would currently be classified as an "urban area". The California Department of Water Resources (DWR) has indicated that the 200-year standard will only be required to be applied to floodplain areas (flooding sources) mapped by the Federal Emergency Management Agency (FEMA). Local drainage and areas of shallow flooding are also excluded from the jurisdictional requirements of SB 5 based on more recently enacted provisions of SB 1278. More specific Definitions of local drainage and shallow flooding have been developed by DWR. DWR recently released their *Urban Level of Flood Protection Criteria* document (dated November 2013) to assist communities in interpreting and satisfying the requirements for meeting the ULOP.

In the vicinity of the Tracy Hills Specific Plan area, the only floodplain mapped by FEMA is for Corral Hollow Creek that extends outside of the east edge of proposed new development areas (with the exception of a floodplain encroachment into small portions of the proposed General Highway Commercial land use areas at the far east end of the Specific Plan).The majority of new development areas are situated on significantly higher ground than the valley formed by Corral Hollow Creek. For new development within Tracy Hills, the City will likely be required to make an official "finding" in the future that the Urban Level of Flood Protection is provided within the overall project with respect to Corral Hollow Creek. This should be easily accomplished for the substantial majority of the Specific Plan, but may require some degree of additional study for the proposed General Highway Commercial land use areas at the far eastern end of the Specific Plan, depending upon the configuration and extent of proposed development in this area.

1.4 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

1.4.1 Climate

The Tracy Hills area is typical to that of San Joaquin County and the broader Central Valley, with two distinct weather seasons; wet and cool winters along with dry and hot summers. Average high temperatures in the winter are in the 50s, and summer high temperatures average in the low 90s.

1.4.2 Precipitation

Precipitation records obtained from various rain gages monitored by the California Department of Water Resources in the Tracy area at elevations ranging from 61 ft to 625 ft indicate that the amount of normal annual rainfall in the Tracy area averages about 12 inches per year. Approximately 95 percent of this rainfall typically occurs from early fall through mid-spring (generally October through May), although infrequent summer showers do occur. Storm events during the rainy season consist of either individual storms or clusters of storms. Major storms of greater magnitude and duration generally occur during the rainy season; however, high intensity thunderstorms (though relatively infrequent) can occur in any season.

1.4.3 Topography

The Tracy Hills Specific Plan area slopes from south to north. The highest elevations along the south edge of the proposed development within the Study Area are approximately 600 feet and the lowest elevation at the north edge is approximately 200 feet. Offsite watersheds extending upstream of the proposed development area have headwater elevations as high as about 1400 feet. The existing topography is shown on Figure 1-2. The hillsides that are proposed to be developed slope north and northeast toward the valley floor and include Interstate 580, the California Aqueduct, the Union Pacific Railroad tracks and the Delta-Mendota Canal. The steepest part of the Study Area is between the southerly ridge and Interstate 580. The northwestern portion of the Study Area drains north away from proposed development areas. This portion of the Study Area will remain undeveloped.

1.4.4 Major Drainage Features

There are a number of major drainage features within the Tracy Hills Specific Plan Area or that have an impact on the Study Area. The California Aqueduct, the Delta Mendota Canal, the Union Pacific Railroad, and Interstate 580 are significant drainage features impacting the Study Area and are described below. These major drainage features and drainage structure crossings or inlets associated with these features are depicted on Figure 1-3:

- *California Aqueduct* – The California Aqueduct traverses across the northern portion of the Study Area and perpendicular to the direction of drainage flow dictated by topography. Storm runoff is collected on the upstream side of the aqueduct and is delivered to overchutes that cross over the aqueduct and culverts that pass underneath the aqueduct. The California Aqueduct tends to consolidate runoff to fewer locations and often limits the flow rates discharged to lands below the aqueduct.

- *Delta Mendota Canal* – The Delta Mendota Canal runs generally parallel to and just downslope from the California Aqueduct and forms the north boundary of the Study Area. It further reduces the number of locations where storm runoff is concentrated. Storm runoff passes over or under the canal via overchutes and culverts and further limits the rates discharged to lands below the canal. The Delta Mendota Canal also contains a significant number of locations where local drainage flow that is collected on the upstream side of the canal simply enters the canal directly via drain inlets and is not released to downstream lands.

- *Union Pacific Railroad* – A Union Pacific Railroad line traverses along the north boundary of portions of the Study Area. The railroad bed is generally elevated and runoff is collected on the upstream side of railroad bed and is delivered to a limited number of bridge and culvert crossings of the railroad track.

- *Interstate 580* – Interstate 580 generally runs parallel and upslope of the California Aqueduct. The south edge of the Interstate is in both fill and cut. In the areas of fill there are culverts that carry runoff from the south side of the Interstate to the north side.

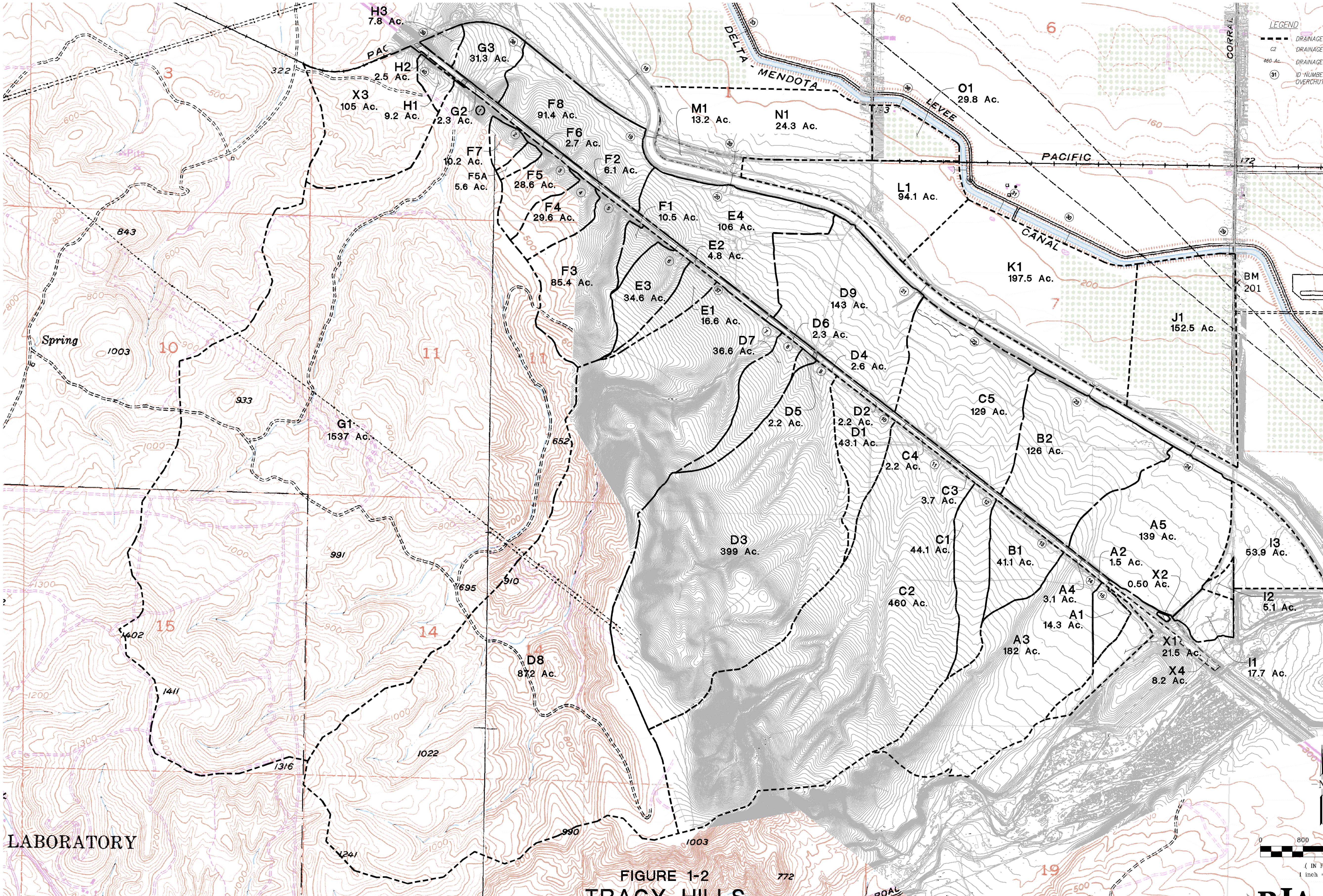

FIGURE 1-2

TRACY HILLS

EXISTING DRAINAGE SUB-BASIN MAP

CITY OF TRACY, SAN JOAQUIN COUNTY, CALIFORNIA

NOVEMBER 2013

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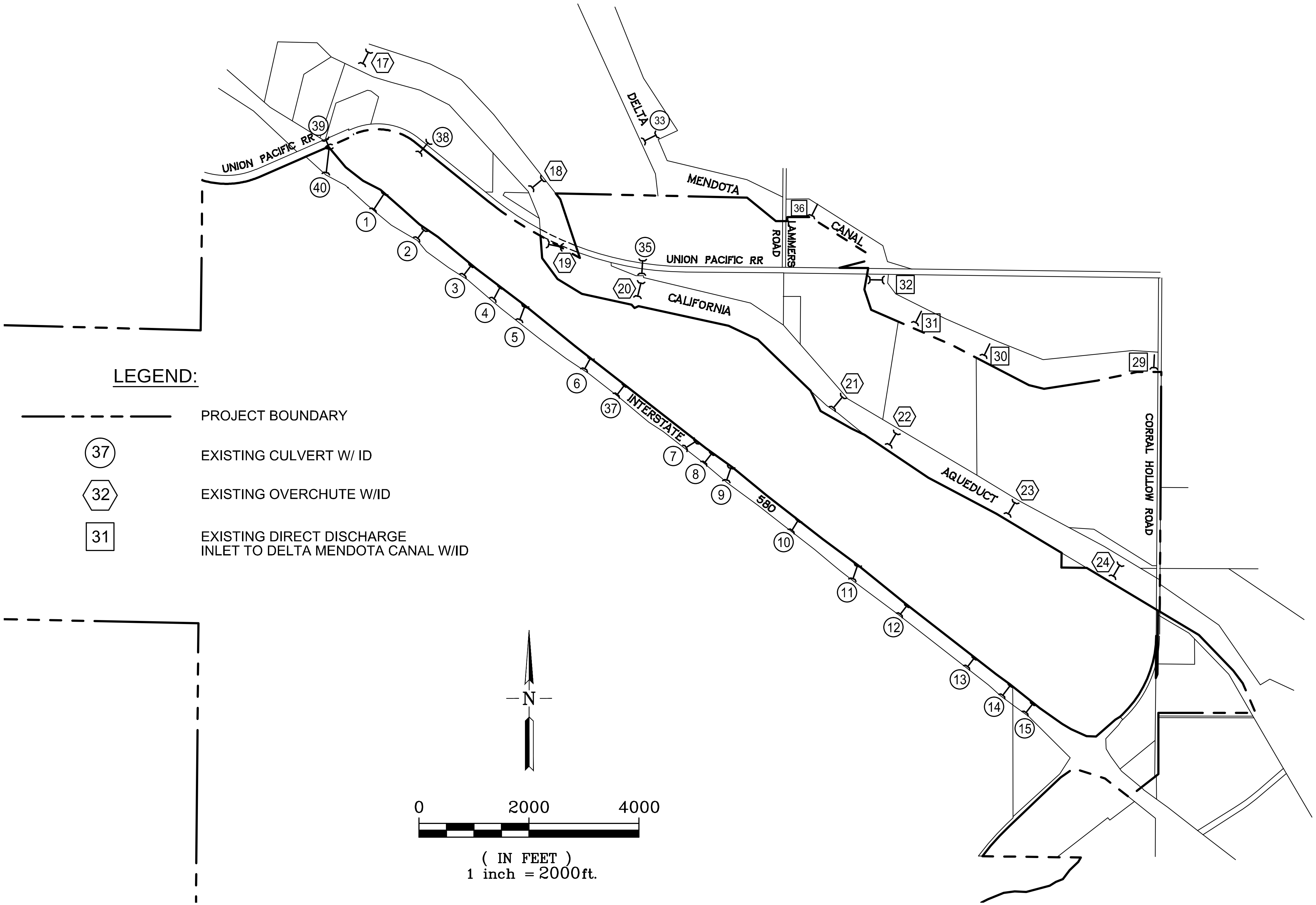

STRUCTURE TABLE	
CULVERT ID	DESCRIPTION
1	2-6 X 5 FT BOX
2	1-24 INCH CIRCULAR
3	1-30 INCH CIRCULAR
4	1-24 INCH CIRCULAR
5	1-42 INCH CIRCULAR
6	1-30 INCH CIRCULAR
7	3-48 INCH CIRCULAR
8	1-30 INCH CIRCULAR
9	1-54 INCH CIRCULAR
10	1-30 INCH CIRCULAR
11	2-48 INCH CIRCULAR
12	1-24 INCH CIRCULAR
13	1-30 INCH CIRCULAR
14	1-36 INCH CIRCULAR
15	1-24 INCH CIRCULAR
17	1-36 INCH CIRCULAR
18	1-36 INCH CIRCULAR
19	2-8 X 6 FT BOX
20	1-36 INCH CIRCULAR
21	1-10 X 4 FT BOX
22	1-36 INCH CIRCULAR
23	1-36 INCH CIRCULAR
24	1-8 X 4 FT BOX
29	1-3 X 2 FT BOX
30	1-3 X 2 FT BOX
31	1-12 INCH CIRCULAR
32	1-4 X 3 FT BOX
33	1-3.5 X 3.5 FT BOX
35	1-14 X 9 FT BOX
36	1-3 X 2 FT BOX
37	1-18 INCH CIRCULAR
38	1-24 INCH CIRCULAR
39	1-24 INCH CIRCULAR
40	1-30 INCH CIRCULAR

FIGURE 1-3

TRACY HILLS

MAJOR DRAINAGE FEATURES MAP

CITY OF TRACY, SAN JOAQUIN COUNTY, CALIFORNIA

NOVEMBER 2013

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The north side of the Interstate is generally in fill and the runoff from the Interstate drains to the north by pipe or slope down drains off the Interstate.

- *Offsite Watersheds* – Portions of the hills to the southwest of the Tracy Hills Specific Plan area drain into the Study Area, and runoff generated by these offsite watersheds needs to be accounted for in the master planning of proposed storm drainage facilities.
- *Downstream Storm Drainage Facilities* – There are numerous storm drainage facilities and features downstream of the Study Area. However, Tracy Hills is proposed to be self-contained with respect to storm runoff generated by new development through the incorporation of terminal retention basins and will not impact downstream storm drainage facilities.

1.4.5 Floodplain Areas

As stated in Section 1.3.5, there is a regulatory (100-year) floodplain area associated with Corral Hollow Creek that extends along the eastern boundary of the Tracy Hills Specific Plan area. The 100-year and 500-year floodplains for Corral Hollow Creek have been mapped per FEMA Flood Insurance Rate Map (FIRM) Panel No. 06077C0740F for San Joaquin County, California and Incorporated Areas dated October 16, 2009. These floodplains are depicted on Figures 1-4A and 1-4B. As stated previously, new development areas within Tracy Hills will predominantly reside in areas that are significantly higher in elevation than Corral Hollow Creek, and these floodplains will not impact said development. The easternmost edge of the Tracy Hills Specific Plan area where General Highway Land uses are proposed contain some small areas that are shown to be impacted by the floodplains per the FEMA maps. If determined to be applicable based on ground elevations at proposed building locations, building finished floors in the impacted areas will need to be elevated a minimum of 1 foot above the 100-year flood elevation for Corral Hollow Creek, and possibly, meet the requirements to withstand a 200-year flood per the ULOP Criteria (see Sub-section 1.3.5).

1.4.6 Soils and Permeability

The Study Area contains many separate soil types, and the Natural Resources Conservation Service 2007 *Soil Survey for San Joaquin County, California* was the primary resource used to define and estimate the general permeability and potential percolation rates of those soils for use in the hydrologic modeling in this SDMP. This soils information was obtained from the San Joaquin County Flood Control and Water Conservation District soils map. In general, the soils in the Study Area have a high permeability. Percolation testing was completed in the Study Area where some of the terminal retention basins are anticipated. The borings for the percolation testing were drilled twenty-five feet deep and the results showed high permeability and very high percolation rates. The results of the percolation tests are provided in Appendix E.

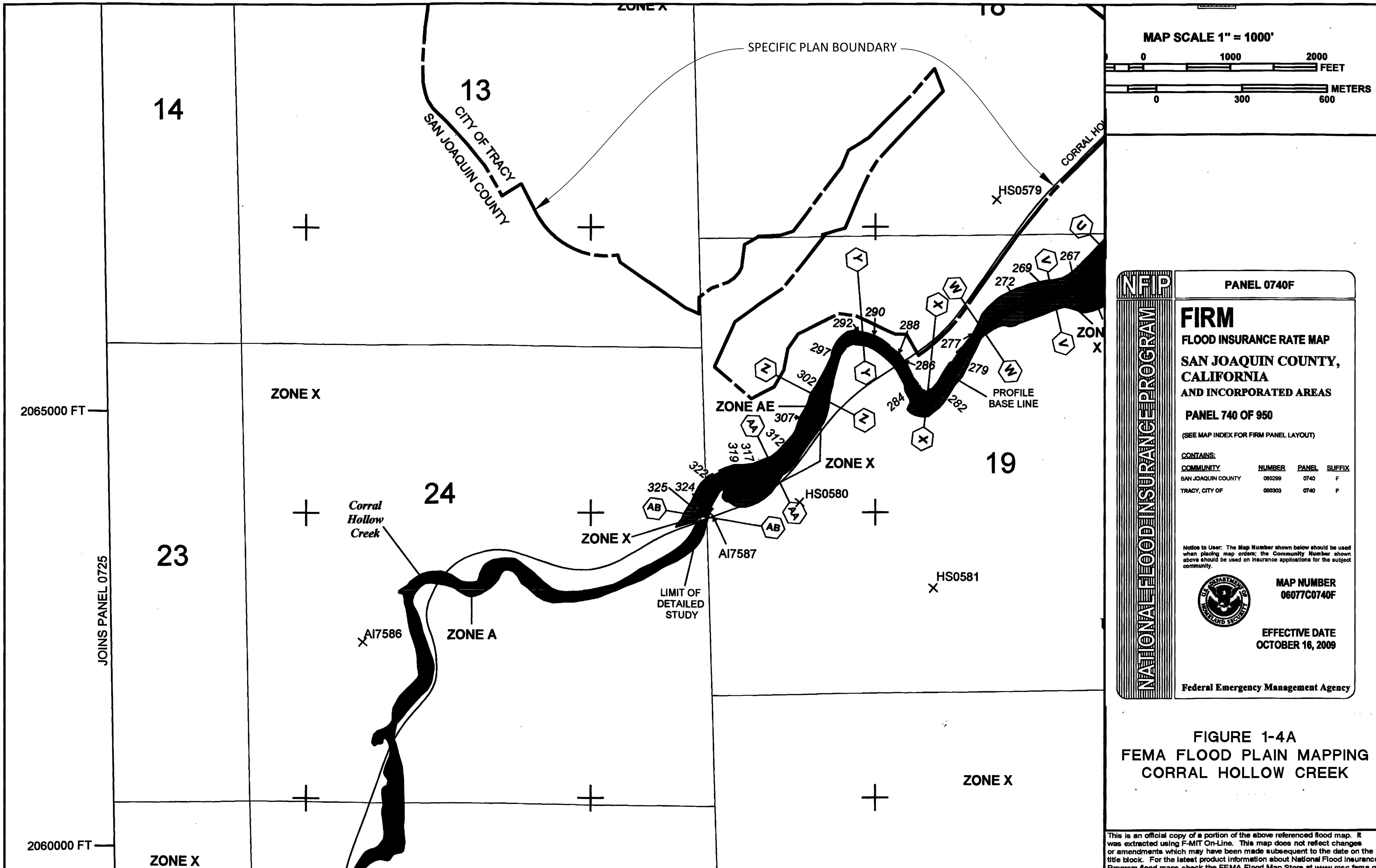

FIGURE 1-4A
FEMA FLOOD PLAIN MAPPING
CORRAL HOLLOW CREEK

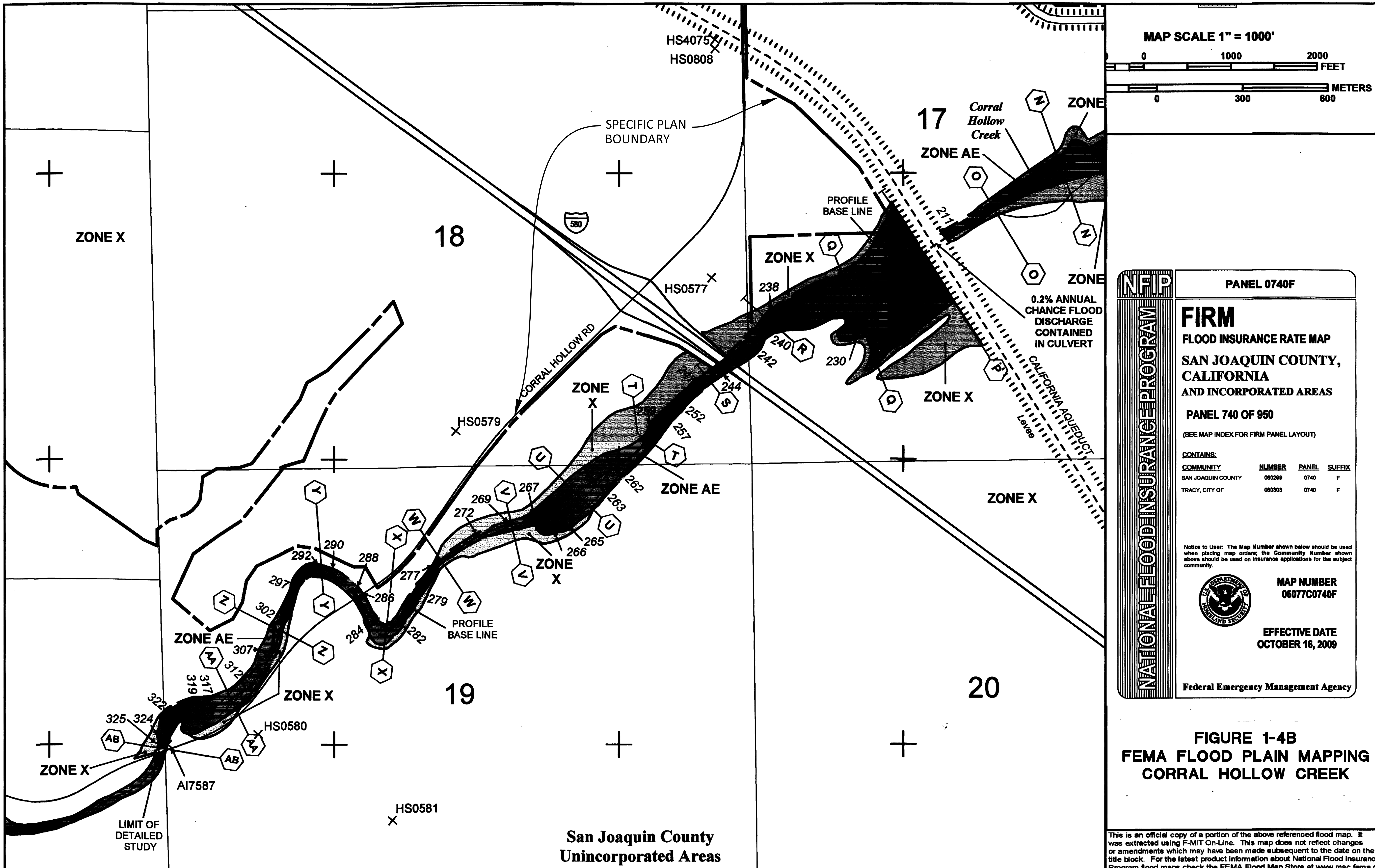

FIGURE 1-4B
FEMA FLOOD PLAIN MAPPING
CORRAL HOLLOW CREEK

1.4.7 Groundwater

A design level geotechnical study has not been completed for the Study Area at this time. During percolation testing, borings were drilled twenty-five feet deep and no groundwater was encountered. A design level geotechnical study will be completed in concert with tentative mapping and construction documents.

1.4.8 Existing Drainage Conditions

The existing drainage conditions include natural drainage channels, Interstate highway culverts, railroad culverts, and canal culverts, drain inlets and overchutes. The drainage areas for the Study Area are separated into three regions:

1. Hillside south of Interstate 580
2. Interstate 580 and downslope to California Aqueduct
3. Area between the California Aqueduct & the Delta-Mendota Canal

South of Interstate 580, the terrain is steep with 2:1 and 3:1 maximum slopes. This area has many natural drainage channels and depressions that cross the Interstate in existing culverts. Along Interstate 580, there are three major culverts (culvert ID's 1, 7 and 11) and multiple smaller pipe crossings. The drainage features within the Interstate include inlets along the roadway edge, inlets in the median and slope down drains. The runoff from the Interstate combines with the runoff from the south side of the Interstate, discharging along the north edge of the Interstate and drains towards the California Aqueduct. The slope between Interstate 580 and the California Aqueduct is approximately 3%.

Along the California Aqueduct, there are multiple overchutes that convey runoff across the Aqueduct. The three aforementioned major water courses from south of the Interstate continue across the California Aqueduct at culvert ID's 19, 21 and 22). A portion of the flow discharged under the Interstate at culvert ID 1 is discharged under the Union Pacific Railroad tracks in an existing 24" culvert and out of the Study Area (culvert ID 38). This existing 24" culvert has limited capacity, is substantially filled with sediment, and the backwater causes the substantial majority of the runoff to flow east along the railroad tracks to the large overchute at the California Aqueduct at culvert ID 19. See Figures 1-2 and 1-3 for these locations.

Runoff that is conveyed across the California Aqueduct drains towards the Delta-Mendota Canal. The slope in this area is flatter (approximately 2%) with less defined drainages. Any runoff reaching the Delta-Mendota Canal, drains directly into the canal or crosses the canal and is discharged out of the Study Area.

See Figure 1-3 for the location and description of the culverts, drain inlets and overchutes.

The aforementioned existing culverts, drain inlets and overchutes have historically provided adequate capacity for conveying runoff from the existing watersheds. With the development of the Tracy Hills project, the watersheds contributing to most of these facilities will be substantially reduced or eliminated due to runoff being directed to the proposed terminal retention basins. Only two crossings of the California Aqueduct (culvert ID's 19 and 21), one crossing of the Union Pacific Railroad tracks (culvert ID 35), and one crossing of the Delta Mendota Canal (culvert ID 33) will continue to convey significant flows as all or portions of their upstream offsite watersheds will be allowed to "pass through" the proposed development areas. The runoff conveyed through culvert ID 21 at the California Aqueduct will discharge into a storm drain system and eventually be stored in Retention Basin G. The other crossings of the California Aqueduct and drain inlets to the Delta Mendota Canal will continue to convey or accept stormwater runoff from the Open Space along the south side of these canals. These Open Space areas will remain undeveloped and will continue to drain in a manner consistent with the existing condition. Capacity calculations for the crossings that will continue to receive "pass through" flows from offsite watersheds on an interim or permanent basis are included in Appendix D.

2.0 Hydrologic Modeling

2.1 HEC-HMS MODEL

The U.S. Army Corps of Engineers' HEC-HMS computer program was used to develop a rainfall/runoff computer simulation for the watersheds and sub-basins in the Study Area. The Soil Conservation Service (SCS) dimensionless unit hydrograph method, frequently used in practice, was used for the analysis. The HEC-HMS computer model develops a runoff hydrograph for individual sub-basins through the input of numerical representations of their physical and hydrological characteristics. The computed hydrographs are then routed and/or combined with hydrographs from other sub-basins to yield a dynamic numerical analysis of peak discharges (design flows) that may be expected to occur at key locations within the Study Area. The model was run for the 10-year 24-hour and 100-year 24-hour storm events. The 100-year 24-hour design flows were subsequently used for the sizing of applicable storm drainage facilities.

The input parameters utilized for sub-basins in the HEC-HMS analysis are presented in Appendix A and are described in the following paragraphs.

2.2 SUB-BASIN DELINEATION

The boundaries for each sub-basin were determined based on field investigations, U.S. Geological Survey 7.5 minute quadrangle maps, topographic mapping with a contour interval of one foot that was recently acquired for much of the Tracy Hills Specific Plan area, prior studies and reports, aerial photographs, and other available maps and plans. The location of various physical features such as roadways, irrigation canals, the Delta-Mendota Canal, the California Aqueduct, storm drainage facilities, railroad tracks and other physical features, as well as future land use area boundaries, were also factors in establishing the sub-basins boundaries. These sub-basin boundaries and delineations, including upslope offsite sub-basins are depicted on Figure 2-1 for proposed developed conditions. Existing conditions sub-basins are depicted on Figure 1-2.

2.3 SOIL GROUP CLASSIFICATIONS

Watershed soil groups were determined using soil maps contained in a report entitled *Soil Survey for San Joaquin County, California* issued December 2007 by the Natural Resources Conservation Service (NRCS) - formerly the US Department of Agriculture Soil Conservation Service as depicted on San Joaquin County Flood Control and Water Conservation District soils maps. Soil groups are classified as A, B, C, or D with Group A having the highest rate of infiltration (lowest runoff production) and Group D having the lowest rate of infiltration (highest runoff production). Soil groups with sub-basin boundaries superimposed over them are depicted in Figure 2-2.

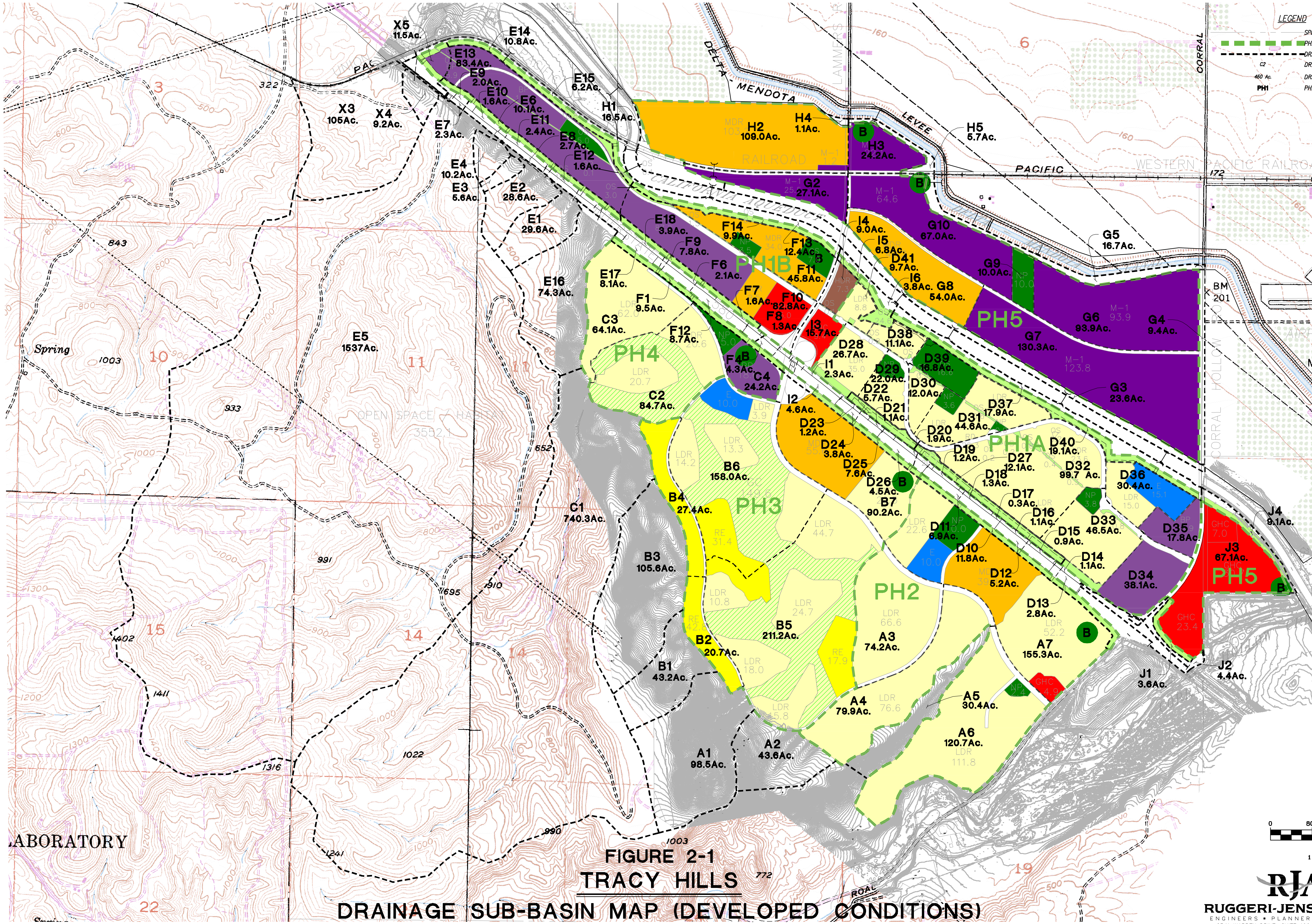

FIGURE 2-1
TRACY HILLS
DRAINAGE SUB-BASIN MAP (DEVELOPED CONDITIONS)

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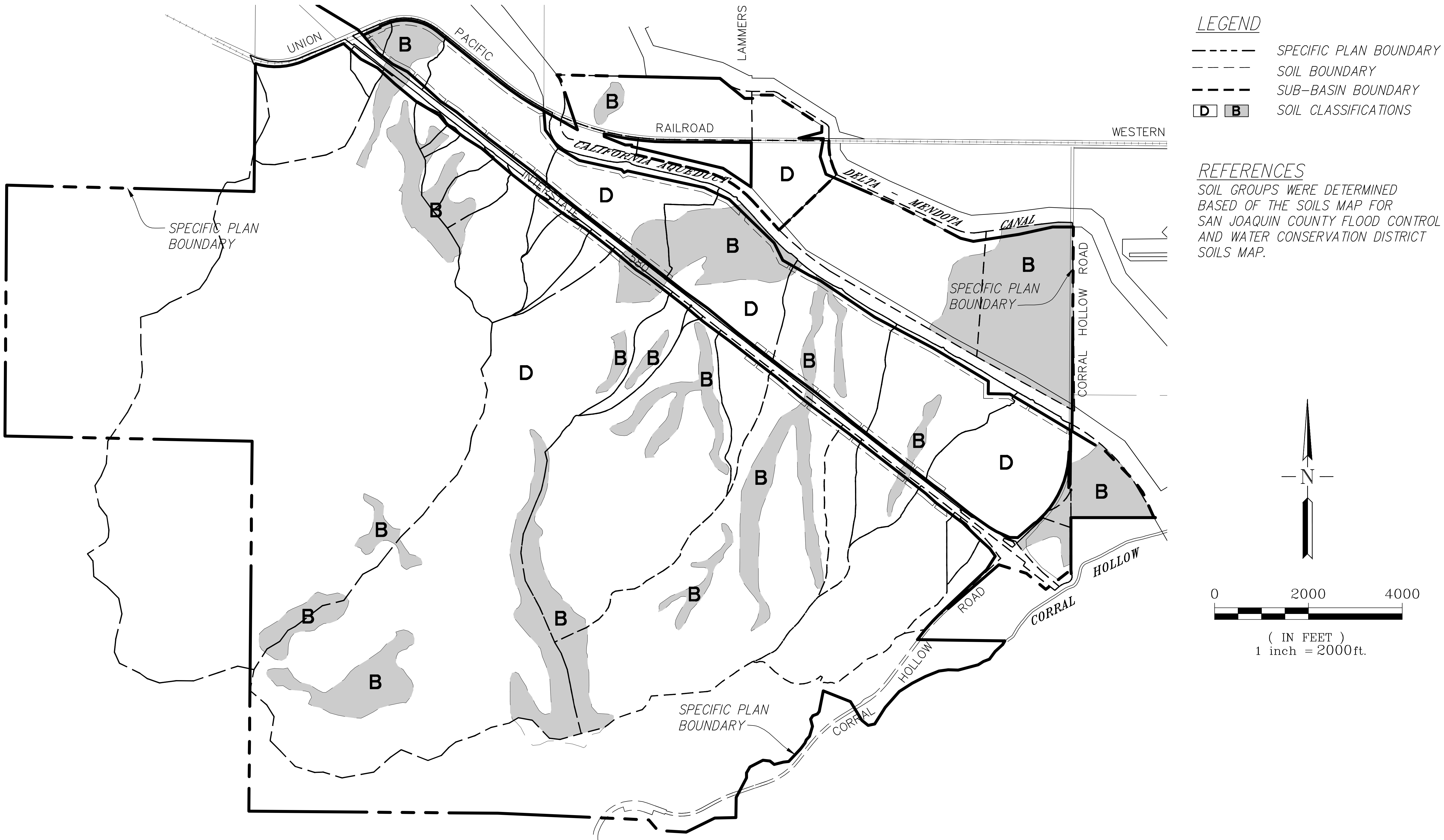

FIGURE 2-2
TRACY HILLS
SOILS MAP

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2.4 RAINFALL LOSS AND SCS CURVE NUMBERS

Rainfall loss is that portion of the precipitation depth that is lost due to evaporation, interception by vegetation, infiltration into soil, and surface depression storage. Rainfall excess is that portion of the precipitation depth that appears as surface or collected stormwater runoff during and after a storm event. Rainfall loss consists of both initial and constant losses and were determined using the NRCS Curve Number (CN) Method that uses a soil cover complex for estimating watershed losses. The CN is related to the underlying hydrologic soil group (A, B, C, or D), land use, cover density, and soil moisture conditions. In addition to soil classification, the Curve Numbers are based on the vegetative cover. For this SDMP, a vegetative cover classified as "good" with grass cover on at least 75% of the area was assumed. The four hydrologic soil groups are described in greater detail as follows:

- *Group A:* Low runoff potential soils having high infiltration rates even when thoroughly wetted and consisting chiefly of deep, well-drained sands or gravels. These soils have a high rate of water transmission. *No Group A soils are located within the Study Area.*

- *Group B:* Soils having moderate infiltration rates when thoroughly wetted and consisting chiefly of moderately deep to deep, moderately well to well-drained sandy-loam with moderately fine to moderately coarse textures. These soils have a moderate rate of water transmission. *A CN of 61 was used for Group B in this SDMP.*

- *Group C:* Soils having a low infiltration rate when thoroughly wetted and consisting chiefly of silt-loam soils with a layer that impedes downward movement of water, or soils with moderately fine to fine texture. These soils have a slow rate of water transmission. *No Group C soils are located within the Study Area.*

- *Group D:* High runoff potential soils having very slow infiltration rates when thoroughly wetted and consisting chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a clay pan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have slow rate of water transmission. *A CN of 80 was used for Group D in this SDMP.*

2.5 LAND USE ASSUMPTIONS AND PERCENT IMPERVIOUS

Land uses assumed in this SDMP were taken from the 1998 Tracy Hills Specific Plan, with the area between Interstate 580 and the California Aqueduct revised per the proposed Specific Plan Amendment (see Figure 2-3 for composite land use assumptions). Supplemental input and direction was provided by City staff.

The percent of impervious area for each sub-basin was based on a weighted average of the amount and type of the different land uses within the sub-basins, as estimated by direct measurements of the various land use areas. This is an important input parameter in the HEC-HMS program because the model relates the amount of impervious area to the total area of a given sub-basin to estimate the amount of runoff losses attributed to pervious areas. For the

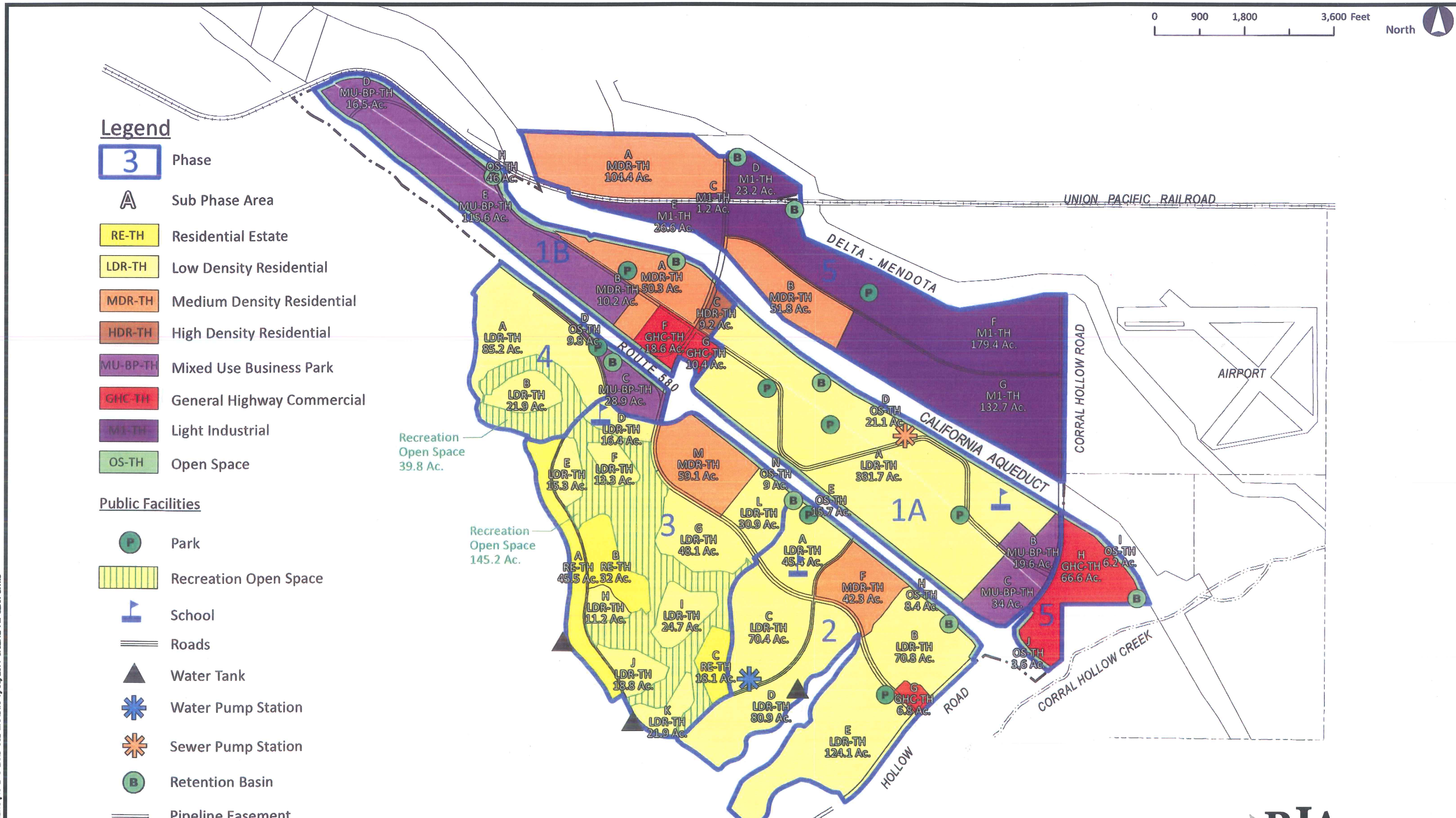

FIGURE 2-3

TRACY HILLS LAND USE MAP

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purposes of hydrologic modeling, design flow determination, and the planning of storm drainage facilities in this SDMP, future build-out of the Tracy Hills Specific Plan area and existing conditions for the upslope offsite sub-basins were assumed.

Impervious cover percentages assigned to each land use were based on the assumption that onsite LID practices would not be incorporated into new development projects and that the City's SWQC Manual requirements would be achieved via the utilization of terminal retention basins that will serve as the permanent outfall for larger groupings of development areas, plus some upslope areas that are not proposed to become developed.

Table 2-1 shows the impervious cover percentages that have been utilized in the HEC-HMS model developed for this SDMP for the various land uses.

Table 2-1: Land Use Impervious Cover Values

Land Use Designation	% Impervious Cover
Residential Estate	10
Low Density Residential	25
Medium Density Residential	35
High Density Residential	65
Professional Office/Medical	90
General Highway Commercial	90
Neighborhood Service	90
Village Commercial	90
Parks	10
Greenways	10
Open Space/Open Space Buffers	3
Lakes	100
Schools	60
Light Industrial/Business Park	90
Interstate R/W	75

2.6 RAINFALL

For the purposes of this SDMP, the following 24-hour depths of rainfall have been used in the hydrologic modeling as shown in Table 2-2. The SCS 24-hour Type I Rainfall Distribution was used for the Study Area.

Table 2-2: Precipitation	
Return Period Storm	**24-hour Rainfall Depth**
10-year return period storm	1.85 inches
100-year return period storm	2.69 inches

2.7 UNIT HYDROGRAPH

For runoff computations from each sub-basin, the NRCS Dimensionless Unit Hydrograph option was utilized in the HEC-HMS computer model.

2.8 LAG TIME

The temporal distribution of the unit hydrograph is a function of the basin lag time. The lag time is defined as a time required for 50 percent of the volume of runoff to reach the basin outlet and was estimated utilizing the NRCS method. The equation is as follows:

$$Lag = (L)^{0.8}(S+1)^{0.7}/1900(Y)^{0.5}$$

L = hydraulic length of watershed in feet

S = potential maximum surface retention = (1000/CN) -10

CN = hydrologic curve number

Y = average watershed land slope in percent

Parameters used for each sub-basin in lag time calculations and the resultant lag times are represented on Appendix A.

2.9 ROUTING

Routing of runoff between sub-basins was performed utilizing the Muskingum-Cunge method for open channel flow. The Modified Puls Reservoir Routing method was used to route flow into terminal retention basins.

2.10 TERMINAL RETENTION/PERCOLATION BASINS

The City of Tracy has no existing storm drain facilities adjacent to the Study Area. With no existing drainage system available, other options were evaluated. The best solution for the Study Area was determined to be terminal retention/percolation basins. The terminal retention/percolation basins being proposed for the Study Area will be sized following the guidelines in the City Design Standards, Section 5.07, Temporary Retention/Percolation Basins, Multiple Parcels.

Retention basin capacity has been performed based on consecutive 10-year, 48-hour storms. The depth of a single 10-year, 48-hour storm is 3.12 inches. This depth is multiplied by the tributary drainage area and average composite runoff coefficient of the drainage area to determine the resultant volume. The total required storage capacity is 200% of that volume. A minimum of one foot of freeboard is also provided. The use of this procedure was considered to be an acceptable and appropriately conservative approach due to the very high percolation rates that were determined from percolation tests. Boring and percolation tests were completed and are included in Appendix E.

Capacity calculations for the terminal retention/percolation basins proposed for the Study Area are provided in Appendix C.

2.11 HEC-HMS RESULTS

The HEC-HMS output files are included in Appendix A. The 100-year 24-hour storm flows at particular concentration points were used for conveyance infrastructure sizing and capacity calculations.

Selected 10-year 24-hour and 100-year 24-hour return period storm discharges are shown at key locations throughout the Study Area on Figure 3-1b in Section 3.0 of this SDMP.

3.0 Master Plan Storm Drainage Infrastructure

3.1 FACILITY COMPONENTS

The proposed Storm Drainage Infrastructure Plan recommended in this SDMP includes a combination of the following components (see Figures 3-1a and 3-1b herein and larger versions of these figures located in the pockets at the back of this report):

- Terminal retention/percolation basins
- Open channels
- Underground storm drains

In general, new development projects will be required to provide site-specific or project-specific storm drainage solutions that are consistent with the overall infrastructure approach presented in this SDMP. The City may allow for a reasonable degree of flexibility to be incorporated into specific design approaches as a part of achieving effective solutions, including adjustments to alignments of linear storm drainage conveyance facilities and adjustments to configurations of terminal retention facilities. Modifications and refinement to the storm drainage facilities Master Plan represented herein may be considered by the City during the development review process for new development. However, any significant modifications to the elements of this SDMP must be approved by the City and will require that a formal “Supplement” be adopted by the City Council.

Figure 3-1b overlays 10-year and 100-year discharges at key locations on the proposed Storm Drainage Infrastructure Plan (a larger version of Figure 3-1b is in the pocket at the back of this report).

New development projects will be required to construct elements of the master plan infrastructure that have alignments that pass through them or extend along their project boundaries. The cost of construction of these master plan elements may be offset against other drainage funding requirements applicable to each project (such as drainage impact fees) or may be classified as eligible for future reimbursements within time frames to be determined by the City. In some instances, the City may require or may accept the construction of offsite facilities or interim versions of master planned facilities, as appropriate.

3.1.1 Terminal Retention/Percolation Basins

Each proposed storm drain backbone system will terminate at a proposed terminal retention basin within the Study Area. The calculated volumes for each basin are shown in Table 3-1 in Section 3.2.3. The sub-basin areas contributing to each retention basin are assumed to include a buildout condition for development areas, and some of the contributing areas also include offsite sub-basins that are assumed to remain undeveloped. Land use areas and composite runoff coefficients used in the retention basin volume calculations are provided in Appendix C.

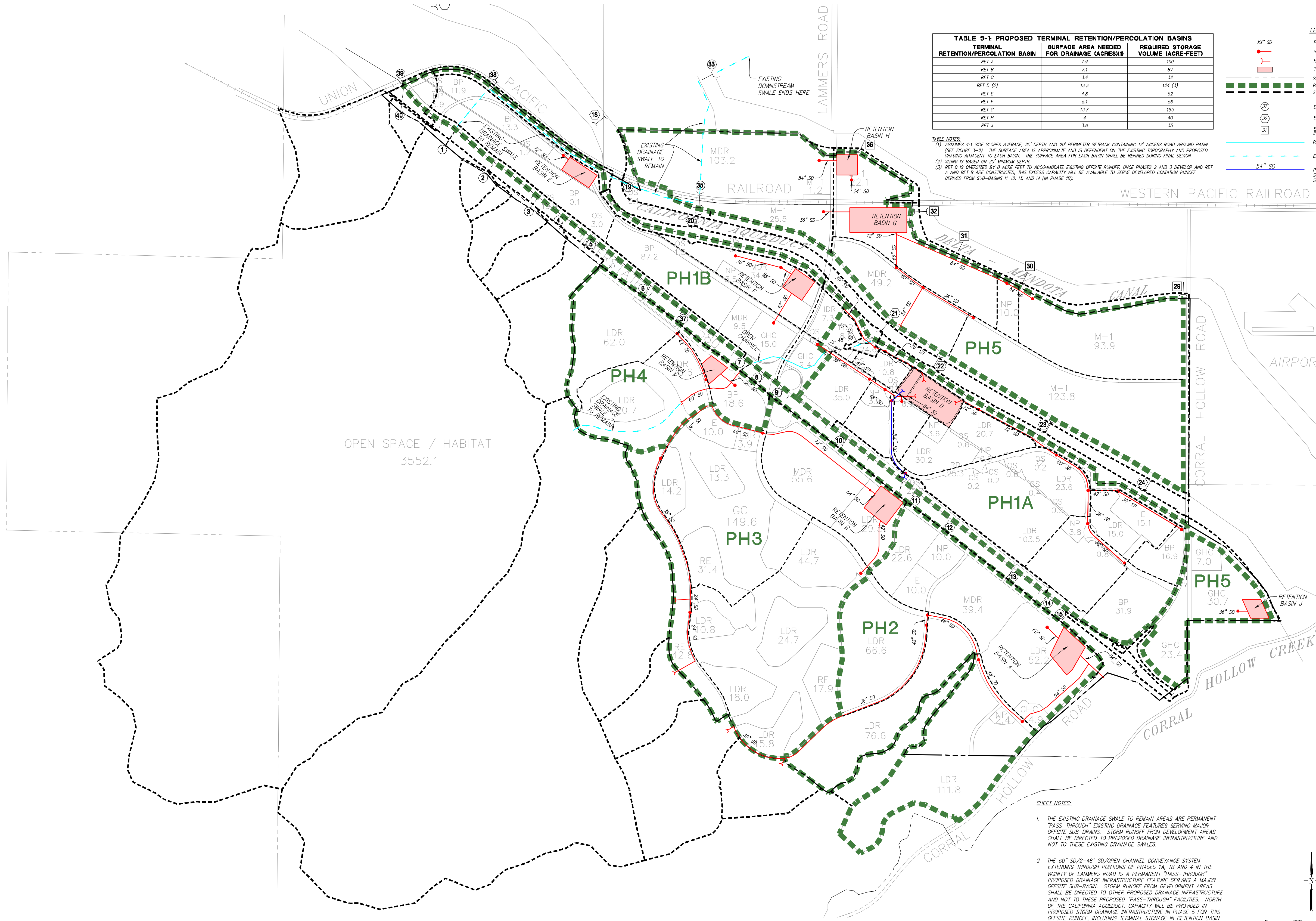

TABLE 3-1: PROPOSED TERMINAL RETENTION/PERCOLATION BASINS

TERMINAL RETENTION/PERCOLATION BASIN	SURFACE AREA NEEDED FOR DRAINAGE (ACRES)(1)	REQUIRED STORAGE VOLUME (ACRE-FEET)
RET A	7.9	100
RET B	7.1	87
RET C	3.4	32
RET D (2)	13.3	124 (3)
RET E	4.8	52
RET F	5.1	56
RET G	13.7	195
RET H	4	40
RET J	3.6	35

TABLE NOTES:

(1) ASSUMES 4:1 SIDE SLOPES AVERAGE, 20' DEPTH AND 20' PERIMETER SETBACK CONTAINING 12' ACCESS ROAD AROUND BASIN (SEE FIGURE 3-2). THE SURFACE AREA IS APPROXIMATE AND IS DEPENDENT ON THE EXISTING TOPOGRAPHY AND PROPOSED GRADING ADJACENT TO EACH BASIN. THE SURFACE AREA FOR EACH BASIN SHALL BE REFINED DURING FINAL DESIGN.

(2) SIZING IS BASED ON 20' MINIMUM DEPTH.

(3) RET D IS OVERSIZED BY 8 ACRE FEET TO ACCOMMODATE EXISTING OFFSITE RUNOFF. ONCE PHASES 2 AND 3 DEVELOP AND RET A AND RET B ARE CONSTRUCTED, THIS EXCESS CAPACITY WILL BE AVAILABLE TO SERVE DEVELOPED CONDITION RUNOFF DERIVED FROM SUB-BASINS I1, I2, I3, AND I4 (IN PHASE 1B).

SHEET NOTES:

1. THE EXISTING DRAINAGE SWALE TO REMAIN AREAS ARE PERMANENT "PASS-THROUGH" EXISTING DRAINAGE FEATURES SERVING MAJOR OFFSITE SUB-DRAINS. STORM RUNOFF FROM DEVELOPMENT AREAS SHALL BE DIRECTED TO PROPOSED DRAINAGE INFRASTRUCTURE AND NOT TO THESE EXISTING DRAINAGE SWALES.

2. THE 60" SD/2-48" SD/OPEN CHANNEL CONVEYANCE SYSTEM EXTENDING THROUGH PORTIONS OF PHASES 1A, 1B AND 4 IN THE VICINITY OF LAMMERS ROAD IS A PERMANENT "PASS-THROUGH" PROPOSED DRAINAGE INFRASTRUCTURE FEATURE SERVING A MAJOR OFFSITE SUB-BASIN. STORM RUNOFF FROM DEVELOPMENT AREAS SHALL BE DIRECTED TO OTHER PROPOSED DRAINAGE INFRASTRUCTURE AND NOT TO THESE PROPOSED "PASS-THROUGH" FACILITIES. NORTH OF THE CALIFORNIA AQUEDUCT, CAPACITY WILL BE PROVIDED IN PROPOSED STORM DRAINAGE INFRASTRUCTURE IN PHASE 5 FOR THIS OFFSITE RUNOFF, INCLUDING TERMINAL STORAGE IN RETENTION BASIN G.

3. THE PROPOSED 42" SD DEDICATED STORM DRAIN IN PHASE 1A WILL ACCOMODATE RUNOFF FROM OFFSITE SUB-BASIN C2 (SEE FIGURE 3-4) AS A "PASS-THROUGH" SYSTEM UNTIL SUCH TIME AS UPSTREAM PHASE 3 IS DEVELOPED AND THIS OFFSITE RUNOFF IS CONTAINED VIA UPSTREAM TERMINAL STORAGE IN RETENTION BASIN B.

4. OFFSITE DRAINAGE ENTERING NEW DEVELOPMENT AREAS THAT IS NOT ACCOMMODATED BY "PASS-THROUGH" INFRASTRUCTURE SHALL BE ACCOMMODATED VIA A COMBINATION OF ONSITE STORM DRAINAGE FACILITIES (NOT SHOWN ON THIS PLAN) AND MASTER PLAN STORM DRAINAGE INFRASTRUCTURE (SHOWN ON THIS PLAN). IF NEW UPSTREAM DEVELOPMENT HAS CONTAINED OFFSITE DRAINAGE, DRAINAGE INFRASTRUCTURE SERVING DOWNSTREAM DEVELOPMENT AREAS WILL NO LONGER NEED TO ACCOMMODATE SAID OFFSITE DRAINAGE.

5. NEW DEVELOPMENT AREAS SHALL NOT OBSTRUCT ANTICIPATED 100-YEAR RETURN PERIOD DISCHARGES AT THE OUTLETS OF CULVERTS AND OVERCHUTES CROSSING INTERSTATE 580, THE CALIFORNIA AQUEDUCT, OR THE UNION PACIFIC RAILROAD.

FIGURE 3-1a

TRACY HILLS

PROPOSED STORM DRAIN INFRASTRUCTURE PLAN

CITY OF TRACY, SAN JOAQUIN COUNTY, CALIFORNIA

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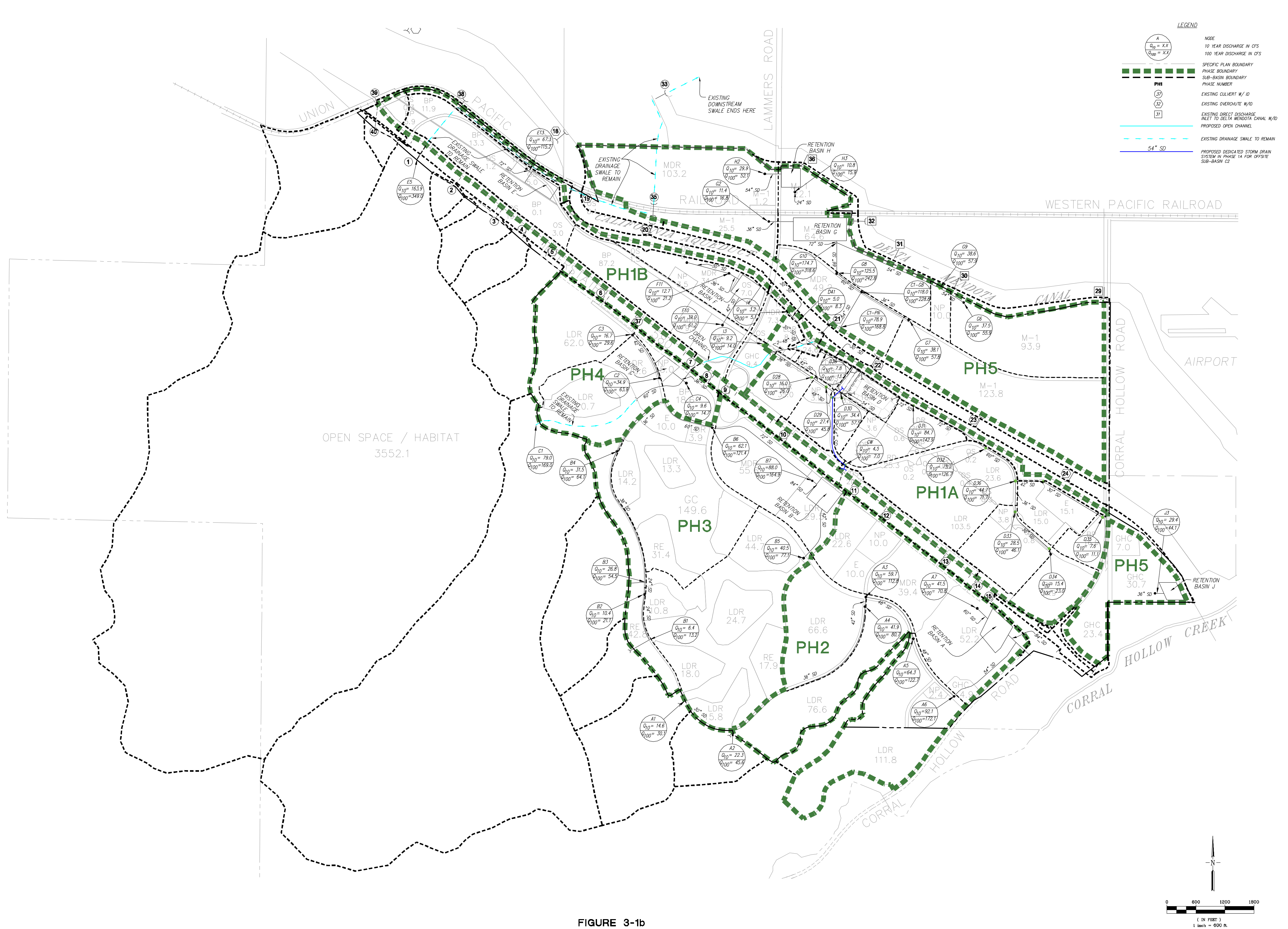

FIGURE 3-1b

TRACY HILLS

10-YEAR & 100-YEAR DISCHARGES

AT KEY LOCATIONS UNDER BUILDOUT CONDITIONS

CITY OF TRACY, SAN JOAQUIN COUNTY, CALIFORNIA

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The terminal retention/percolation basins will have 4:1 side slopes, 12 foot access roads within a 20-foot wide setback area around each basin and access to the basin bottom. A cross-section of a typical terminal retention/percolation basin is shown on Figure 3-2.

The City Design Standards require that a retention basin shall be designed to empty 100 percent of the volume within 10 calendar days. Percolation testing was done to determine the effectiveness of the soil to drain within the required time period. The percolation data from the proposed retention basin locations are located in Appendix E. The percolation data shows that the soils in the proposed basin locations satisfy this requirement.

All terminal retention basins will be setback from major existing facilities (such as the California Aqueduct, the Delta Mendota Canal, and Interstate 580) by an undisturbed buffer of 100 feet or more. Based on a review of available soils information and geotechnical studies performed to date for Tracy Hills, the project geotechnical engineer has rendered an opinion that the proposed terminal retention basins will not impact the structural integrity of these major existing facilities and that if site specific conditions are encountered during construction that require special recommendations, mitigation measures can be incorporated into the basin designs at that time. This opinion is also provided in Appendix E.

The retention basins are designed to store and percolate runoff generated during a very large and rare storm scenario. The percolation rates of the soil on the site are very beneficial to this type of design and the conservative approach to sizing the basins also makes it unlikely that one of these basins will ever overtop. In the event that unforeseeable factors cause a retention basin to overtop, the stormwater runoff will drain directly to open space along the Interstate, California Aqueduct and/or Delta-Mendota Canal. There are conveyance systems in place in these facilities to convey the runoff downstream or intercept the runoff. There are also areas in the open space where water can pond and reduce the amount of runoff entering those conveyance systems.

The proposed incorporation of permanent terminal retention basins into this SDMP to serve the future development of Tracy Hills is atypical to storm drainage solutions that have previously been allowed by the City. This type of solution is being considered by the City for this project based on downstream constraints and excellent measured soil percolation rates that are unique to this hillside area of the City. The future integrity of the ability of these terminal retention basins to drain effectively via percolation will be paramount to the function of the storm drainage system. The City will require that a maintenance district or some other responsible entity be established for Tracy Hills for the purpose of providing long term maintenance of these terminal retention basins. The funding for the maintenance district and maintenance activities shall be borne by new development within Tracy Hills.

During the design of terminal retention/percolation basins, depths, configurations and surface areas may need to be adjusted to conform to local topography, proposed site grading and other physical and technical considerations. *Development planning and design proposals to make geometric adjustments to terminal retention basins will be given reasonable consideration by the*

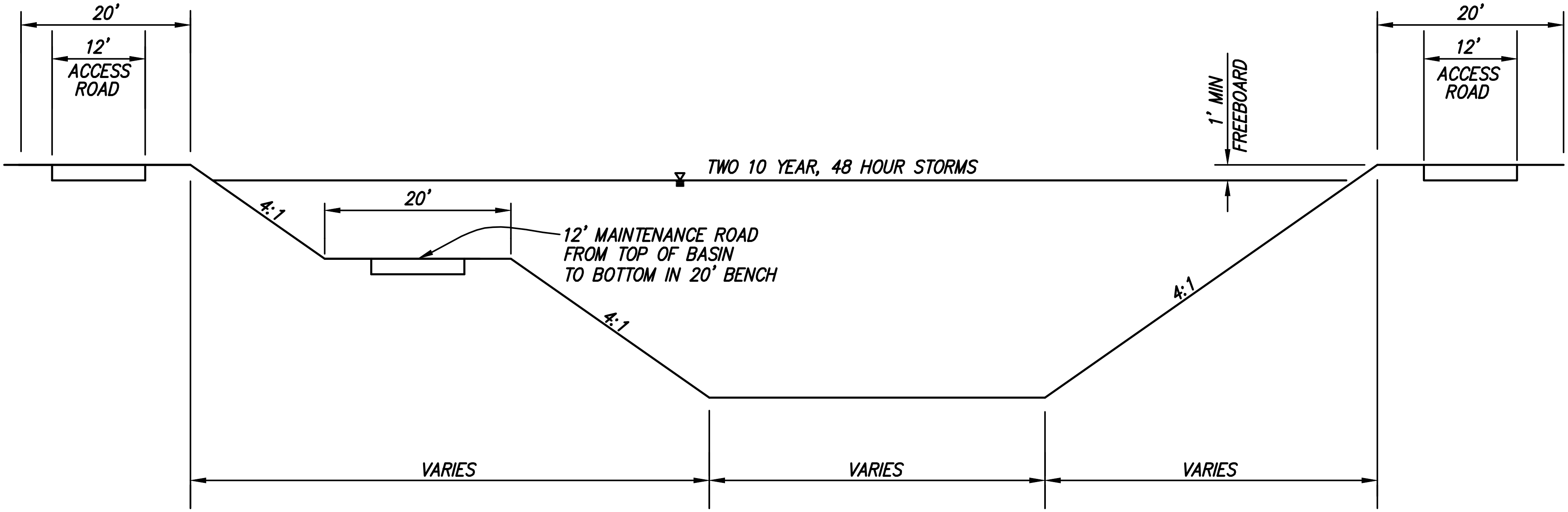

FIGURE 3-2

TRACY HILLS

RETENTION BASIN CROSS SECTION

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City as long as the functional storage volumes and other hydraulic parameters presented in this SDMP are retained. These geometric adjustments may be made during the development review process for phases of development or individual projects, where applicable. If berms are integrated into a terminal retention/percolation basin's design, spillways shall be provided above the design water surface elevation in order to control any overflow and provide for emergency releases should the design storm be exceeded. In instances where berms are utilized, the height of the spillway crest shall not be more than 6 feet above the natural grade of the downslope area of the berms as the City will not accept any retention basin that becomes a jurisdictional dam as defined by the State of California Division of Safety of Dams.

As part of the future detailed design of the terminal retention/percolation basins recommended in this SDMP, new development may consider the integration of aesthetic treatments, including active or passive joint-use recreational components. This SDMP does not specifically identify park-related joint-use components to be incorporated into any of the proposed basins, although it is a goal that joint-use elements be incorporated into these basins wherever possible. By combining lands allocated to storm water retention with lands allocated to parks or open space, the functional, recreational, environmental and aesthetic value of these facilities will be dramatically improved. Terminal retention/percolation basin land area requirements represented in this SDMP account for the acreage required to accommodate the storage volumes needed for flood control purposes only, and additional land area will be required to incorporate provision for joint-use recreation facilities and differential grading, if such facilities are proposed.

Any proposed joint-use basin will serve to:

- Maximize efficient use of land
- Satisfy attenuation needs for storing peak flood flows
- Provide storm water quality treatment
- Expand community recreational opportunities, with minimal "down time" for recreation elements (and/or) provide habitat, recharge, and other environmental benefits
- Incur reasonable maintenance requirements and costs
- Serve as a functional open space amenity for the City

With regard to integrating recreation elements as a joint-use into terminal retention facilities, there are several fundamental guidelines that should be followed. They are:

- Low flow must be accommodated in a manner that confines the frequent inundations to areas that will create minimal nuisance or disruption of recreational uses and will characteristically require only limited maintenance.

- Contouring (differential grading) within joint-use terminal retention facilities is recommended to create internal elevation variations (or tiers) that have differing frequencies, depths and durations of inundation and differing flood risk.
- Internal drainage within terminal retention facilities should provide for positive flow across elevated tiers and to the lowest lying areas of the facilities.
- Internal slopes should be flat enough to allow for mowing of turf areas and to allow other routine landscape or recreational-related maintenance activities to occur.
- Hydraulic design components should be included as needed (inflow structures, percolation bedding, sediment basins, spillways, etc.).
- Other requirements as dictated by jurisdictional regulations and policies, local site conditions or additional functional uses should be followed.

In general, passive recreational elements should be incorporated in portions of joint-use terminal retention facilities having the greatest potential flood risk and frequency. Active recreation elements are more suitable in areas within these facilities having lesser degrees of flood risk and frequency.

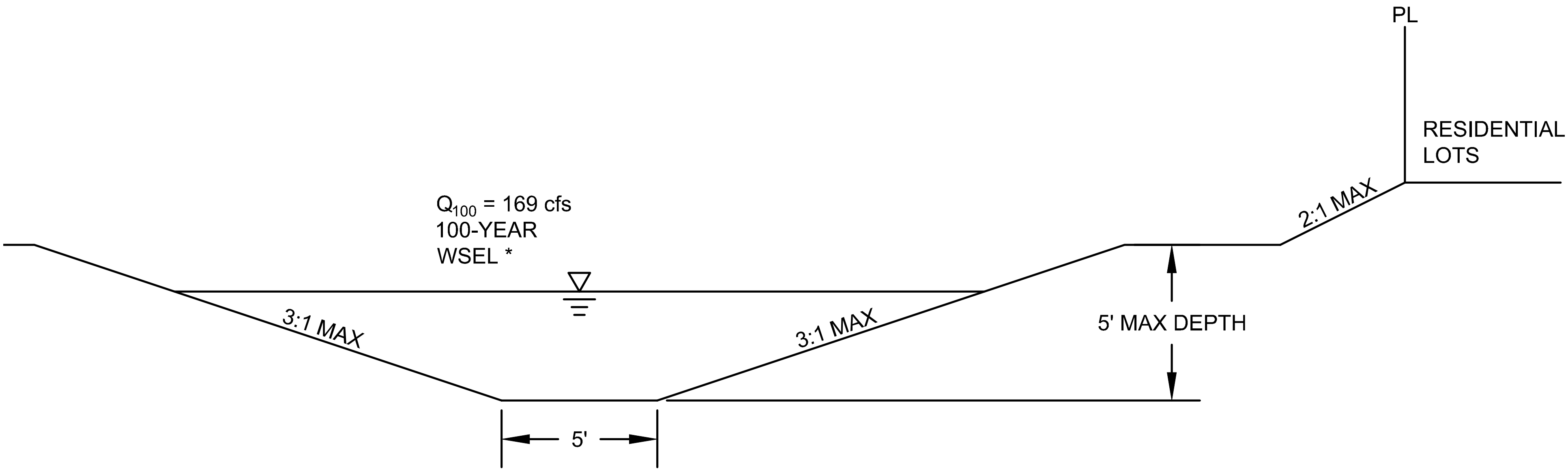
An additional benefit of terminal retention/percolation basins is improved water quality. Retention basins provide attenuation storage and opportunities for pollutants to settle and be retained within the basin and provide opportunities for recharge. These facilities will be utilized to satisfy the requirements set forth in the City's SWQC Manual for new development areas.

3.1.2 Open Channels and Existing Drainage Swales

This SDMP includes proposed open channels and existing drainage swales for conveyance of storm runoff from some of the upslope offsite sub-basins to downstream terminal retention/percolation basins or other facilities. These facilities will also assist in providing additional flow attenuation and storm water quality treatment.

Due to the steep slopes within the Study Area, the open channels may require grade control or stabilization measures where velocities exceed 5 feet per second (fps) or where soil conditions may be susceptible to headcutting, erosion and deposition. These stabilization measures could include rock drop structures, geotextile lined channels and/or rip-rap lined channels. The specific details of the open channel shall be determined during final design process. A typical open channel cross-section is provided in Figure 3-3.

Existing drainage swales, when proposed to remain in place for "pass through" conveyance of flows, shall have their low flow conveyance areas retained in essentially their natural state. New development may encroach along the flood fringe areas as long as the expected velocities, flow depths and geomorphology are not altered when compared to existing conditions and the



NOTE:
* CHANNEL SHALL MAINTAIN VELOCITIES BELOW 5 fps FOR 100-YEAR STORM DESIGN BY IMPLEMENTING VELOCITY MITIGATION MEASURES. EXAMPLES OF MEASURES ARE RIP-RAP, ROCK DROP STRUCTURES AND GEOTEXTILE FABRIC WITH VEGETATION. ADDITIONAL EROSION CONTROL MEASURES MAY BE NEEDED TO ASSURE CHANNEL STABILITY AND SHALL BE DETERMINED DURING FINAL DESIGN.

FIGURE 3-3

TRACY HILLS

OPEN CHANNEL CROSS-SECTION

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encroachments do not create a hazard or nuisance for said new development. Further requirements, in any, shall be determined during the final design process.

3.1.3 Underground Storm Drains

The proposed underground storm drain systems extend from onsite and offsite collection points, to the terminal retention/percolation basins. The underground storm drain systems will be located in proposed public street rights-of-way or drainage easements. The underground storm drain systems proposed with this SDMP are limited to the major backbone infrastructure pipes that collect runoff from large areas within each sub-basin or groups of sub-basins. There may be more than one backbone system discharging into a given terminal retention basin. Proposed underground storm drain systems will not cross Interstate 580, the California Aqueduct, the Union Pacific Railroad or the Delta Mendota Canal. Any existing runoff that continues to be conveyed to any of these facilities will cross or enter that facility via existing infrastructure at reduced rates and volumes after upstream development occurs, as a result of the use of temporary retention ponds and permanent terminal retention basins.

Pipe sizes of the master plan backbone storm drain systems are based on the 100-year, 24-hour storm discharges. Pipe sizes for the drainage systems that collect onsite runoff within subdivisions or other development areas that connect to the backbone storm drain system will be calculated based on the City Design Standards (10-year storm). Detailed hydraulic analysis for these pipe systems will be required during final design. The detailed hydraulic analysis may require the backbone infrastructure pipe sizes in this SDMP to be adjusted. The starting HGL's for storm drains discharging to the terminal retention/percolation basins will be based on the water surface elevation determined for the 100-year, 24-hour storm within the applicable terminal retention/percolation basin.

3.1.4 Conveyance of Offsite Runoff

Offsite runoff will be conveyed by one of three methods:

1. Underground Storm Drain System
2. Open Channel
3. Existing Overland Conveyance

Underground storm drains and open channel systems collecting offsite runoff will discharge to a terminal retention/percolation basin or to an infiltration/percolation area.

There are two (2) proposed infiltration/percolation areas, and their purpose is to compensate for a reduction in upstream infiltration that will occur due to replacement of existing open flow paths by storm drains or narrower open channels.

The first location is within Phase 1A of proposed development where a temporary percolation area is proposed for one of the offsite runoff areas at a location upstream of the California Aqueduct at crossing ID 22 near Terminal Retention Basin D (see Section 3.2.4). The size of this infiltration/percolation area was calculated by determining the amount of area being removed from potential infiltration and percolation along the existing overland flow path within Phase 1A. The flow width available for infiltration and percolation under existing conditions was calculated based on the 100-year, 24-hour storm. The temporary percolation area is shown on Figure 3-5 at the end of Section 3.2.4. It may be removed when upstream development captures and retains the applicable offsite runoff.

The second location is at the terminus of an Open Channel that is proposed to convey offsite runoff to the existing California Aqueduct crossing at ID 21 (see Figure 3-1a). Similarly, a percolation area will be provided at the discharge point upstream of the crossing at ID 21 and the size of the percolation area has been calculated based on the amount of infiltration and percolation area being removed from the existing upstream overland flow path during a 100-year, 24-hour storm (due to proposed upstream culvert enclosures and narrowing of flow conveyance widths). The Open Channel will account for 40% of the area required to replace the area being removed along the existing flow path. The percolation area proposed at this location is shown on Figure 3-6 at the end of Section 3.2.4.

Sizing calculations for the above infiltration/percolation areas are provided in Appendix C.

The existing swale/channel in Sub-basin E5 on the west side of I-580 drains through culvert ID 1 and discharges to existing overland conveyance that is tributary to crossing IDs 19 and 38 that cross the California Aqueduct (though little flow will cross the California Aqueduct at crossing ID 38 as it is only a 24" diameter pipe and is substantially filled with sediment). The existing swale within proposed development areas will be maintained and allowed to reach the crossings. All developed flow will be directed away from the existing swale and discharged to Retention Basin E in this area. There will be a minor reduction in tributary area to the crossings. North of the California Aqueduct, the existing swale/channel flows east along the Union Pacific Railroad to culvert ID 35 within Sub-basin G2, crosses underneath the Union Pacific Railroad at culvert ID 35 and then extends north within Sub-basin H2. The existing swale/channel will be maintained in these areas as well, and no runoff from development areas will be discharged to it.

3.1.5 Temporary Retention Facilities

When new development projects are not located near existing or proposed terminal retention basins or conveyance facilities leading to terminal retention basins, the City will consider allowing the use of temporary retention ponds as an interim drainage solution in conformance with City Design Standards, subject to appropriate engineering substantiation regarding feasibility. When temporary retention ponds are approved by the City, the project developer is required to maintain them until the storm drainage system for the development project is connected to the City's permanent storm drainage system and the temporary retention pond is filled and decommissioned. In the event that temporary retention ponds are approved by the

City for individual or groups of development projects, said approvals will only be provided with the understanding or anticipation that a permanent solution that will allow for the decommissioning of applicable temporary retention ponds within a reasonable time frame is imminent. The City may require that the developer deposit enough funds in advance with the City to pay for the future decommissioning of a temporary retention pond.

3.2 PROPOSED STORM DRAINAGE INFRASTRUCTURE PLAN

The proposed storm drainage infrastructure plan is illustrated in Figure 3-1a. It shows the proposed backbone storm drain systems, open channel conveyance systems, existing swales that will remain and terminal retention basins.

3.2.1 Backbone Storm Drains

Each proposed backbone storm drain is labeled with a pipe size on Figure 3-1a based on the 100-year 24-hour return period storm discharges derived from the HEC-HMS model and full flow capacities for assumed pipe slopes. For long storm drain runs along alignments parallel to contours or adjacent to canals (where there is little topographic slope), a pipe slope of 0.001 ft/ft was used to determine full flow capacities. For storm drain runs along downslope alignments with steep slopes, a pipe slope of 0.01 ft/ft was used to determine full flow capacities for pipes up to 48" diameter, even if actual ground slopes exceed this value in order to keep very high velocity flows from surcharging to unacceptable heights at manholes and junction structures. For pipes larger than 48" diameter along downslopes alignments, sizing is based on 0.007 ft/ft. A table of full flow pipe capacities at these different slopes is provided in Appendix B.

The infrastructure plan is divided into phases and can be constructed in a variety of sequences. The backbone storm drain pipe sizes can be adjusted during final design depending on how the developed site is ultimately graded.

3.2.2 Open Channel

An open channel is proposed on the north side of Interstate 580 to convey runoff entering development areas from existing offsite Sub-basin C1 (shown on Figure 2-1) through development areas (Sub-basins F10 & I3) to proposed double 48" RCP storm drain pipes that will discharge to an existing overchute crossing of the California Aqueduct (ID 21). Past the California Aqueduct, this runoff will be conveyed via a closed conduit system and will be discharged to Retention Basin G. The open channel design shall implement alternative velocity mitigation and erosion control measures where velocities exceed 5 fps or where soil conditions may be susceptible to headcutting, erosion and deposition (See Section 3.1.2).

3.2.3 Terminal Retention/Percolation Basins

Table 3-1 lists proposed terminal retention/percolation basins that will serve the buildout of new development for the Tracy Hills Specific Plan and their required surface areas and storage capacities. Each retention basin has its own tributary drainage area, and the drainage area designation corresponds to the retention basin designation. The future development of Sub-basins I1, I2, I3 and I4 (in Phase 1B) is planned to be integrated to discharge into Retention Basin D after the existing runoff from the tributary area from Phases 2 and 3 are developed and directed to Retention Basins A and B. Extra capacity in Retention Basin D after development of Phases 2 and 3 will be used to serve the developed runoff from Sub-basins I1, I2, I3 and I4 (in Phase 1B).

Table 3-1: Proposed Terminal Retention/Percolation Basins

Terminal Retention/Percolation Basin	Surface Area Needed for Drainage (acres)(1)	Required Storage Volume (acre-feet)
RET A	7.9	100
RET B	7.1	87
RET C	3.4	32
RET D (2)	13.3	124 (3)
RET E	4.8	52
RET F	5.1	56
RET G	13.7	195
RET H	4	40
RET J	3.6	35

(1) Assumes 4:1 side slopes average, 20' depth and 20' perimeter setback containing 12' access road around basin (see Figure 3-2). The surface area is approximate and is dependent on the existing topography and proposed grading adjacent to each basin. The surface area for each basin shall be refined during the final design.
(2) Sizing is based on 16' minimum depth.
(3) RET D is oversized by 8 acre feet to accommodate existing offsite runoff. Once Phases 2 and 3 develop and RET A and RET B are constructed, this excess capacity will be available to serve developed condition runoff derived from Sub-basins I1, I2, I3, and I4 (in Phase 1B).

3.2.3 Interim Offsite Runoff Conveyance for Phase 1A Development

As previously discussed, there are several existing sub-basins that convey runoff from the south side of Interstate 580, across the Interstate, to the California Aqueduct and beyond (see Figure 2-1). At project build-out, the majority of these existing sub-basins will be developed and their runoff conveyed to the appropriate project terminal retention basins. However, with the development of Phase 1A, several of these existing sub-basins will continue to drain into Phase 1A.

The smaller existing drainage sub-basin areas south of Interstate 580 are proposed to be piped, in combination with the future Phase 1A subdivision infrastructure improvements, from the north side of Interstate 580 to Retention Basin D. However, existing Sub-basin C2 (see Figure 1-2) is too large to have its runoff accommodated within Retention Basin D. Therefore, the runoff from Sub-basin C2 is proposed to be collected in a 54" pipe that will be dedicated for flow from undeveloped Sub-basin C2, routed through the Phase 1A development, and discharged such that it will continue to be conveyed across the California Aqueduct in Culvert ID 22 (see Figures 1-3 & 3-4) as it is under existing conditions. To fully mitigate for the loss of infiltration due to piping vs. overland flow across Phase 1A, a 1.7 acre percolation area will be provided on an interim basis adjacent to Retention Basin D (see Figure 3-5). Calculations supporting the size of this percolation area are included in Appendix C. Once development occurs south of Interstate 580, flow within the "dedicated" pipe will be limited to runoff from and immediately adjacent to Interstate 580. At this point in time, the percolation area set aside on an interim basis for runoff from tributary area C2 may be reclaimed for residential development and the "dedicated" pipe outlet rerouted to discharge to Retention Basin D.

Prior to the completion of upstream development and storm drainage infrastructure upstream of Interstate 580, the runoff generated from offsite Sub-basin C2 will also produce potentially significant ponding on the upstream side of the California Aqueduct at Culvert ID 22 as it does under existing conditions, as this culvert consists of a 36" overchute having limited capacity. The following additional conditions will apply to Phase 1A development until such time as upstream development and storm drainage infrastructure eliminates the discharge of runoff from Sub-basin C2 to Phase 1A development areas:

1. New development within Phase 1A will be required to have finished floor elevations for new buildings elevated a minimum of 1 foot above the water surface elevation generated on the upstream side of the California Aqueduct at Culvert ID 22 during a 100-year 24-hour storm. A water surface elevation of 250.0 feet has been determined by a reservoir routing analysis in the HEC-HMS model for the existing condition 100-year 24-hour storm with inflows from Sub-basin C2 (See Appendix D).

2. Existing flood storage provided on the upstream side of the California Aqueduct during the 100-year 24-hour storm in the vicinity of Culvert ID 22 shall be retained or equivalent volume provided with new development in Phase 1A. The peak storage determined from the reservoir routing analysis in the HEC-HMS model for the existing condition 100-year 24-hour storm with inflows from Sub-basin C2 is 13.33 acre-feet (See summary sheet in Appendix D). Any storage volume below elevation 250.0 feet that has been reduced due to encroachment by fill from new development will be offset and compensated for by storage provided via grading of portions of the interim infiltration/percolation area adjacent to Retention Basin D to elevations below 250.0 feet.

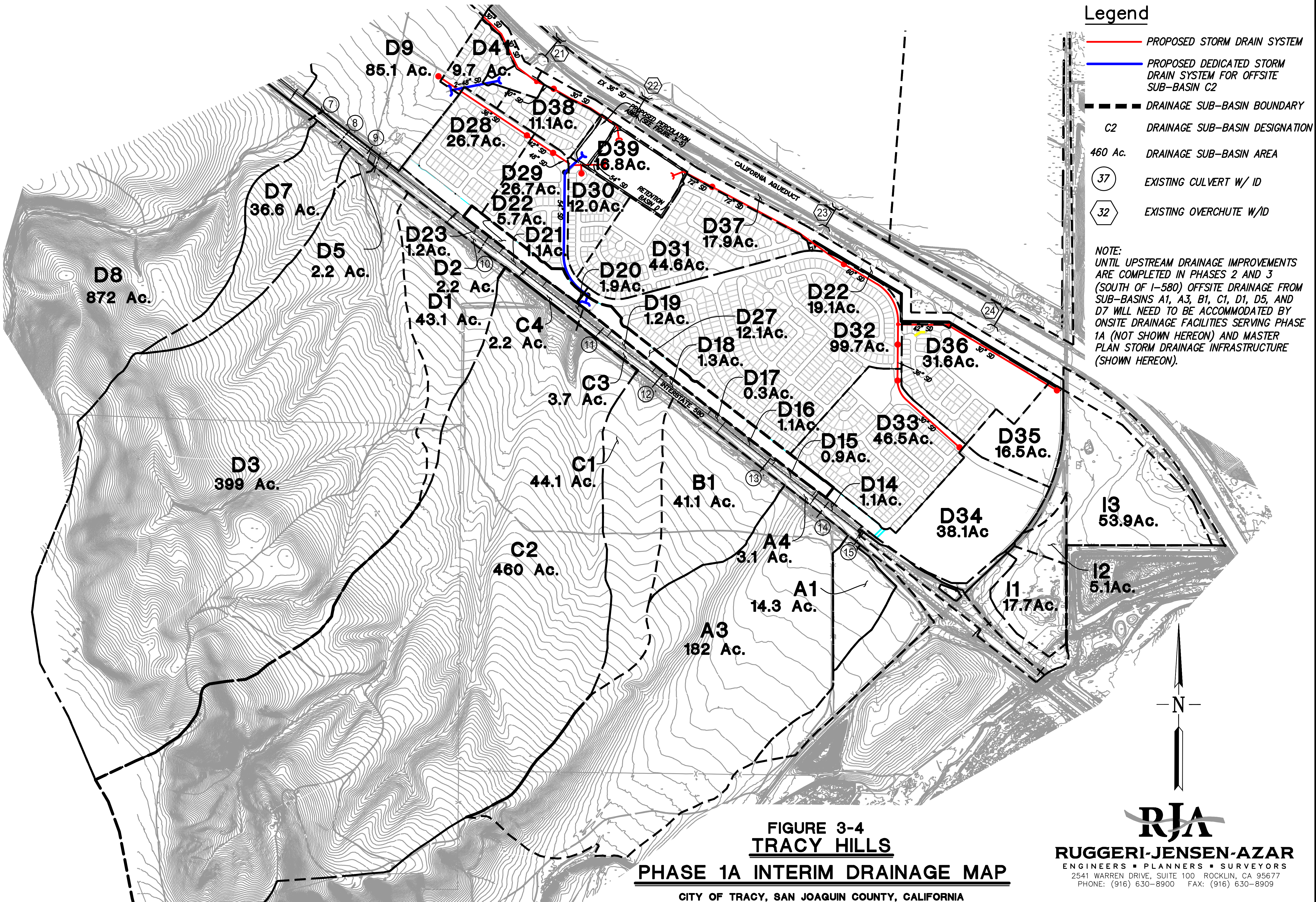

FIGURE 3-4
TRACY HILLS
PHASE 1A INTERIM DRAINAGE MAP
CITY OF TRACY, SAN JOAQUIN COUNTY, CALIFORNIA
NOVEMBER 2013

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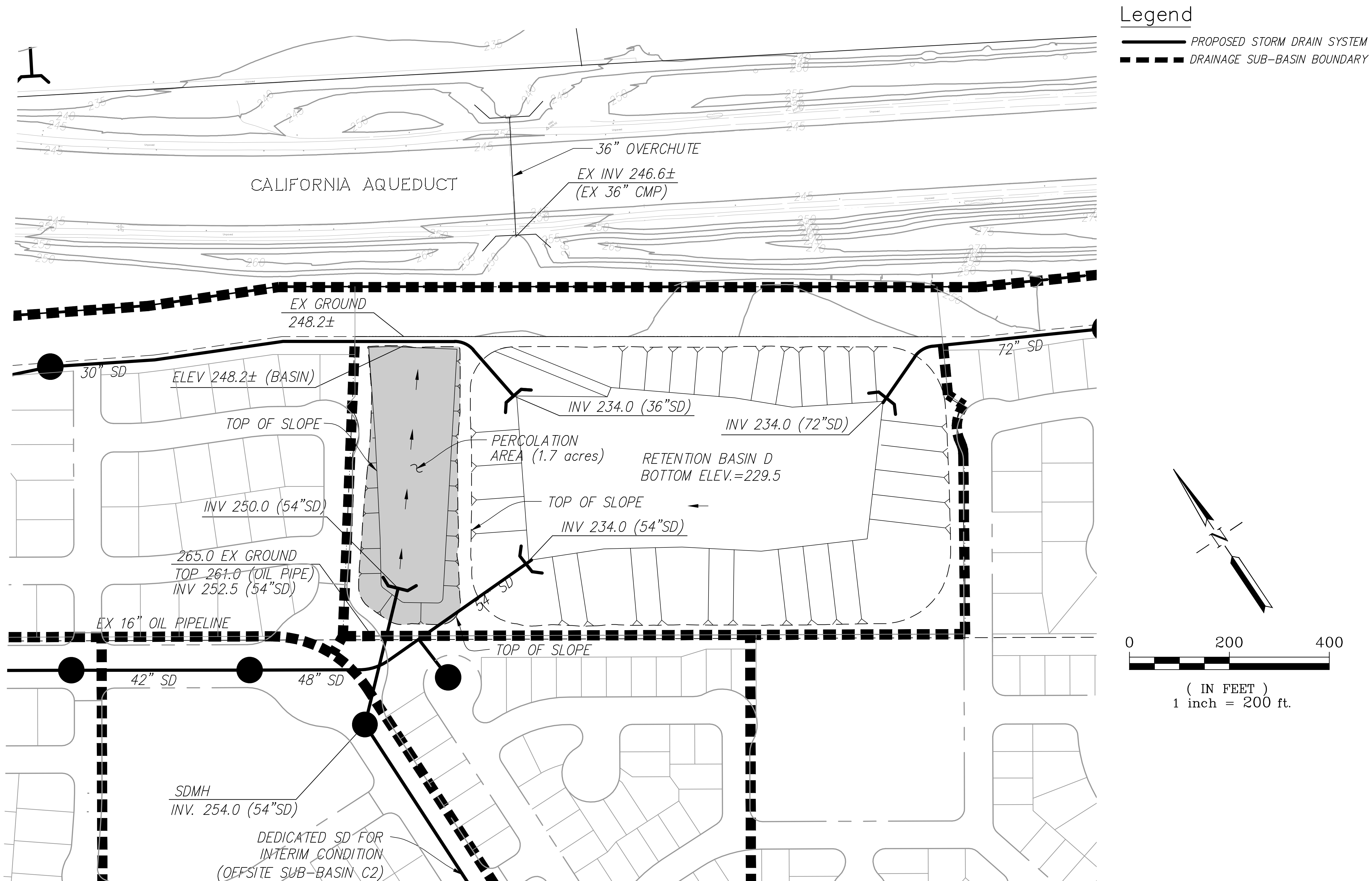

FIGURE 3-5
TRACY HILLS
PHASE 1A PERCOLATION AREA

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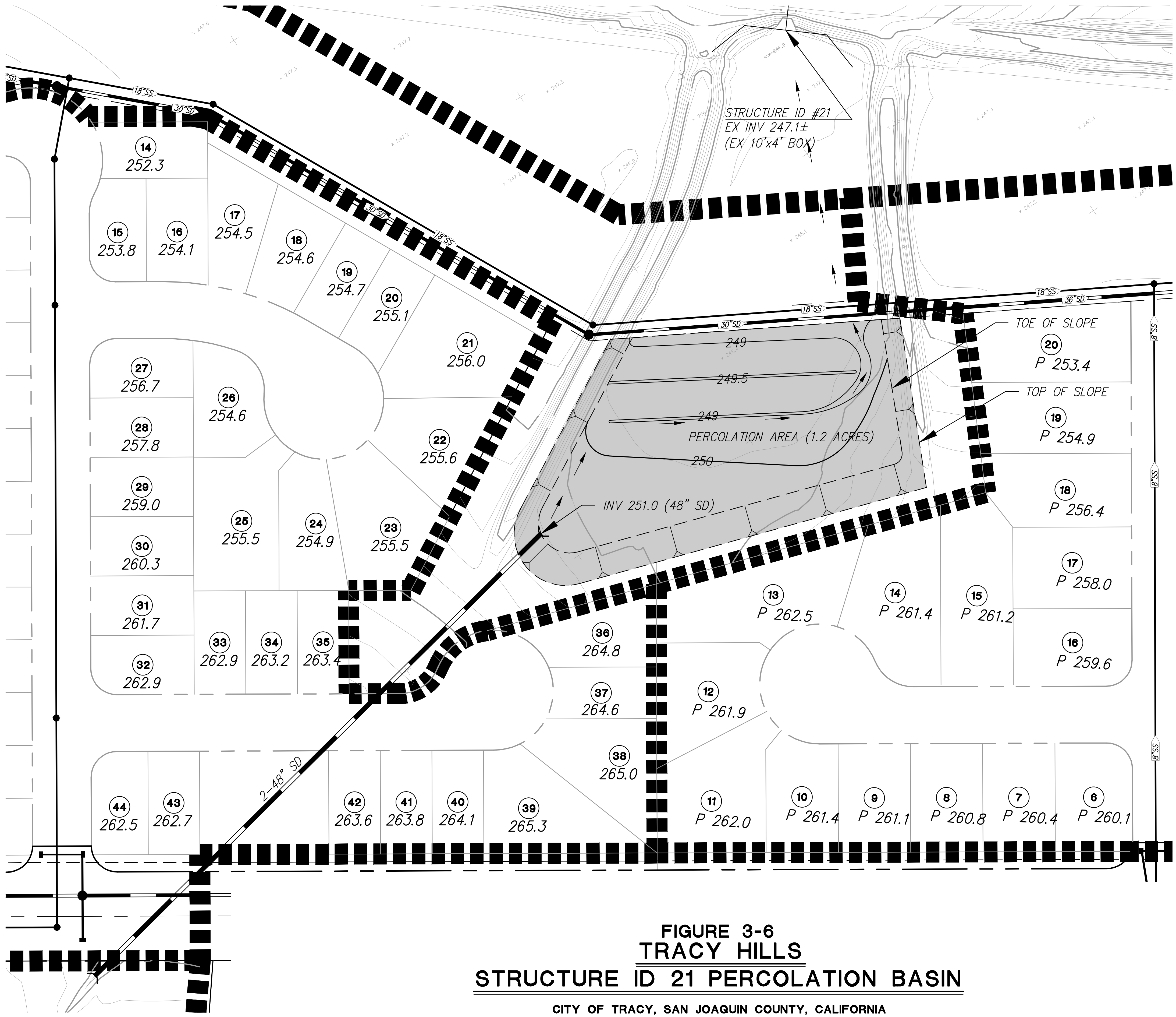

Legend

- PROPOSED STORM DRAIN SYSTEM
- DRAINAGE SUB-BASIN BOUNDARY

PERCOLATION TABLE	
DESCRIPTION	**SIZE**
PROPOSED CHANNEL UPSTREAM OF 2-48" SD	0.8 ACRES
PERCOLATION BASIN	1.2 ACRES
TOTAL REQUIRED PERCOLATION AREA	2.0 ACRES

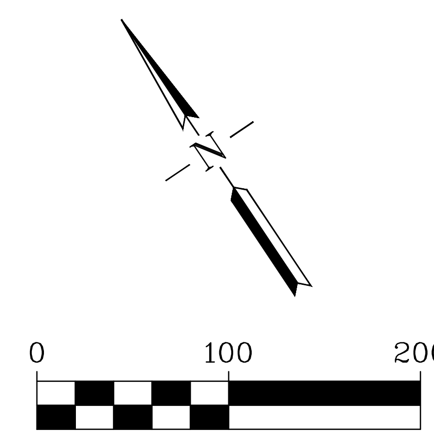

FIGURE 3-6
TRACY HILLS
STRUCTURE ID 21 PERCOLATION BASIN

CITY OF TRACY, SAN JOAQUIN COUNTY, CALIFORNIA
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4.0 Glossary

BMP	Best Management Practice as applied to any program, technology, or process used to improve or maintain downstream water quality under the NPDES program
CBC	Concrete Box Culvert
CGP	Construction General Permit
CN	Curve Number
CWA	Clean Water Act
Detention Basin	A depressed or bermed area that collects and stores surface runoff for regulated downstream release
Discharge	A rate of stormwater runoff experienced at a given location and at a given point in time during or after a storm event, usually expressed in cubic feet per second (cfs)
DWR	State of California Department of Water Resources
FEMA	Federal Emergency Management Agency
General Plan	City of Tracy General Plan Amendment
Infiltration	The interception, absorption, and storage of runoff within the pore spaces of surface soils
Joint-use Facility	Storm drainage detention or terminal retention/percolation basin that includes active and/or passive recreation elements as a joint-use with flood storage
LID	Low impact development
MEP	Maximum Extent Practicable, a standard for water quality that applies to all MS4 operators regulated under the NPDES program
NOI	Notice of Intent

NPDES	National Pollutant Discharge Elimination System, a program that regulates stormwater quality from nonpoint sources
NRCS	Natural Resources Conservation Service
Offsite	Referring to a watershed that extends upstream, outside of the proposed development area
Percolation	The subsurface gravity flow of runoff through the pore spaces in rock or soil
Return Period	The reciprocal of the percent probability of a flood event of a certain magnitude occurring in a given year, often expressed in terms of 10-year flood, 100-year flood, etc.
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
RWQCB	Regional Water Quality Control Board
SB 5 (or) SB 1278	Senate Bill 5 (or) Senate Bill 1278
SD	Underground storm drain
SDMP	Storm Drainage Master Plan
Specific Plan Area	An area defined and affected by a City's specific plan, which is a tool for the systematic implementation of the General Plan
Study Area	Tracy Hills Specific Plan area, plus upslope offsite sub-basins that contribute storm runoff to the specific plan area
Surcharging	An overload of a storm drain system occurring when volumes beyond the system's capacity are introduced and the water level in a storm drain pipe rises above the crown of the pipe
SWMP	Storm Water Management Program, a plan developed to implement measures to improve stormwater quality in Phase II communities participating in the NPDES program
SWPPP	Storm Water Pollution Prevention Plan
SWQC Manual	Stormwater Quality Control Standards for New Development and Redevelopment, adopted by the City of Tracy

SWRCB	State Water Resources Control Board
Temporary Retention Pond	A depressed or bermed area that collects and stores surface runoff and that does not have an outlet other than infiltration, percolation and evaporation and is used as a temporary storm drainage solution until such time as downstream storm drainage facilities are complete to a stage where the temporary pond may be filled and decommissioned.
Terminal Retention Basin	A depressed or bermed area that collects and stores surface runoff and that does not have an outlet other than infiltration, percolation and evaporation and is used as an permanent storm drainage solution.
TMDL	Total Maximum Daily Load, the maximum amount of a pollutant that a water body can receive and still meet water quality standards for beneficial uses.

5.0 References

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