# E&B Oil Development Project

City of Hermosa Beach

## Planning Application

## Appendix L

# Hydrology and Water Quality Study

E&B Natural Resources

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# HYDROLOGY AND WATER QUALITY STUDY

## E&B Oil Development Project
## 555 6th Street
## Hermosa Beach, CA 90254

Prepared at the Request of
E & B Natural Resource Management Corporation
1600 Norris Road
Bakersfield, CA 93308
(661) 679-1730

Prepared Under the Supervision of:
Ashba Engineers Ltd.
P.O. Box 90833
Long Beach, CA 90809-0833
(562) 989-9154

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**HYDROLOGY AND WATER QUALITY**

**E & B Oil Development Project**

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## 1.0 INTRODUCTION

The purpose of this study is to address potential hydrology and water quality impacts that would occur as a result of the construction and operation of the E&B Oil Development Project (proposed project) located in Hermosa Beach, California. These include potential effects related to the following:

- water quality standards
- groundwater supplies and quality
- erosion and sedimentation
- surface runoff
- storm drain facilities
- 100-year flood hazard and flooding
- mud flows and risk of inundation from seiches
- tsunami

This study describes: the existing conditions on and adjacent to the project site; existing conditions in the area that could affect the project site; the regulatory setting related to hydrology and water quality; thresholds of significance; the characteristics of the proposed project including the construction activities and ongoing operation of the proposed project; design features and operational practices incorporated into the project to minimize or eliminate potential effects related to hydrology and water quality; and the remaining potential impacts of the proposed project.

The proposed project provides for the development of an onshore drilling and production site that would utilize directional drilling of 30 wells to access the oil and gas reserves in the tidelands (granted by the State of California to the City) and in an onshore area known as the uplands. Both of these areas are located within the Torrance Oil Field. In addition, the proposed project would result in the relocation of the City Maintenance Yard to another site and the installation of offsite underground pipelines for the transport of the processed crude oil and gas from the project site to purchasers. Section 6.0 of this study describes the characteristics and phasing of the proposed project.

The proposed project would include site demolition, grading, construction of site improvements as well as drilling, testing activities, and production operations. These activities would result in surface disturbances across the project site that could potentially affect surface runoff water quality, groundwater quality, and the hydrological character of the project site. Drilling, production, and the reinjection of processed produced water into the oil-producing reservoir below the oil water contact could have the potential to affect groundwater quality. The introduction of oil and water to the surface

from the wells, together with separation, processing, piping, and truck loading operations have the potential to result in leaks or spills resulting from a blowout during the drilling, a rupture of a production tank or piping, or an offsite oil truck accident or oil pipeline rupture. The analysis of the potential effects of the proposed project are discussed in Section 6.0 of this study.

## 2.0 LOCATION OF PROJECT SITE

The project site consists of 1.3 acres located at 555 6th Street in the southern portion of the City of Hermosa Beach (City) in southwestern Los Angeles County. The project site is located approximately seven blocks east of the beach and the Pacific Ocean and is bounded by 6th Street on the south and Valley Drive on the east, a large commercial building along the north property line, and three commercial multi-story buildings adjacent to the west property line. The project site is owned by the City of Hermosa Beach and is currently used as their City Maintenance Yard. The project site is shown in its regional setting in Figure 1.

In addition, the proposed project would result in the construction of off-site improvements at the following locations:

- Within Valley Drive between 8th Street and 6th Street for the installation of underground utilities;
- At the intersection of 6th Street and Valley Drive for improvement of the intersection geometrics;
- Within an offsite gas pipeline alignment from the project site south along Valley Drive/N. Francisca Avenue to a location for a gas metering station within the Southern California Edison (SCE) Utility Corridor east of N. Francisca Avenue; and
- Within an offsite oil pipeline alignment from the project site south along Valley Drive to east along Herondo Avenue, Anita Street, and 190th Street; or south along Valley Drive/N. Francisca Avenue to east along the SCE Utility Corridor and 190th Street.

The proposed project would also include the transport of oil during Phase 2 of the proposed project by trucks to the Phillips 66 Torrance Truck Rack located at 2650 Lomita Boulevard, Torrance, California utilizing designated truck routes in the Cities of Hermosa Beach, Redondo Beach and Torrance.

## 3.0 EXISTING CONDITIONS, TOPOGRAPHY AND DRAINAGE

The project site is located in an urbanized area. Valley Drive along the east of the project site is improved with asphalt concrete pavement with concrete curb, gutters and sidewalks. To the south of

the project site, 6th Street does not have a curb, gutter, or sidewalk. The street's asphalt concrete runs directly into the project site including the onsite parking area. An existing landscape area that parallels Valley Drive has no ground cover, but includes four large trees with aboveground roots.

The project site is underlain by Holocene-age dune sands west of the adjacent older alluvial deposits in the Los Angeles basin to the east. The onsite deposits generally consist of dune and drift sands that were deposited as ancient eolian (windblown) deposits. The general topography of the area slopes from the east to west toward the ocean. There are no rivers or streams through the project site or in the adjacent vicinity.

The project site is fully developed with two large buildings and surface asphalt or concrete paving throughout with the exception of a small area along the west side. The project site is used for outdoor storage of materials, supplies, and vehicles associated with the City's maintenance activities including trailers, storage containers, sheds, trash bins, a propane tank, fencing, and masonry walls.

Generally, the project site slopes to the west, with a slight embankment along the western property line. Some areas of the project site slope to the south before turning and descending to the west along 6th Street. The existing topography on the project site has been created by embankment and filling along the westerly portion of the site, leaving a small unimproved slope along this property line. In addition, filling has occurred in the northeast portion of the project site over time (former landfill area). This leveling of the project site is very apparent at the southwest corner of the property where there is a parking area directly off of 6th Street. Approximately half way along the project site's frontage on 6th Street, the grade breaks and descends steeply to the west, creating a differential in elevation between the existing parking area and the maintenance yard of eight feet. This difference is compensated for by an existing 8-foot high retaining wall.

The project site generally drains to the west. The portion of the project site drains to an existing drop inlet. A smaller portion of the project site along the easterly edge of the site drains to Valley Drive through the existing landscape area. There is a slight knoll in the southeast portion of the project site that is a high point for the surrounding onsite areas. All surrounding surfaces on the project site drain away from this point.

For the most part, rainwater runoff on the project site is conducted by surface sheet flow across the paved surfaces to the west and south to 6th Street. A small portion along the westerly property line is an unimproved embankment and a small portion of the existing runoff may have an opportunity to infiltrate the ground before overflowing south along the property line to 6th Street.

There are two areas of localized sump conditions on the project site, each with an existing drop inlet at their low points. One is at the low point of the entry driveway from Valley Drive in front of the existing metal building. This drain is assumed connected to the existing Los Angeles County Flood Control District (LACFCD) storm drain in Valley Drive (see Figure 3). The other sump is at the bottom of a ramp drive down to the lower level of the building in the southeastern portion of the project site. The outlet to this sump drain has not been determined.

In addition to the sump drain near the entry drive from Valley Drive in front of the long maintenance building, a minor amount of the project site paralleling Valley Drive flows east through landscape area, across the public sidewalk, and into Valley Drive. This flow continues south along Valley Drive via its curbs and enters the existing Los Angeles County Flood Control District Project storm drain at 2nd Street.

The LACFCD storm drain consists of reinforced concrete pipe (RCP) with catch basins and connecting pipes along its length, ultimately discharging to the Pacific Ocean at an outfall at the projection of Herondo Street as a 9' X 11' Reinforced Concrete box. (see Figure 3). Recent efforts to improve the quality of discharge from this storm drain have been undertaken by the Los Angeles County Department of Public Works (LACFCD). Project Number 1105 creates a low flow diversion to the sanitary sewer system and, thereby, the most potentially polluted flows to the ocean are averted. The quantities of diverted runoff are limited. The pumping of this discharge to the sanitary sewer is monitored and controlled by LACFCD permit to discharge to an existing Los Angeles County Sanitation District sanitary sewer.

The topography of the project site, as determined by a land survey (see Figure 4), indicates that the elevation of the project site is at approximately 55 feet above mean sea level. Based on the Federal Emergency Management Agency (FEMA) Flood Rate Map for the project area (see Figure 5), the elevation of the project site is above the 500-year flood elevation. Since the project site is located above the 500-year flood level, the project site is not within the 100-year flood plain.

Although the project site is within a beach community, it is sufficiently away from and above the beach such that it is not within the influence of a tsunami wave, as indicated on the State of California published Tsunami map (see Figure 9).

**3.1 Existing Hydraulic Conditions**

Hydrology determination is based on the Los Angeles County Hydrology Manual 2006. This manual is used to determine the amounts of rainfall that can be expected based on Los Angeles County rainfall records and projections. It is supplemented by the County's MODRAT program that performs repetitive calculations. Rainfall amounts are determined from site location together with USGS and USGS maps overlaid with 24-hour rainfall depths shown as contours (referred to as Isohyet charts). The MODRAT program also incorporates from the site location, anticipated soils conditions such as permeability from the Soil Conservation Service maps. These inputs, together with the drainage subarea slope and length of run to the ultimate discharge point, determine the runoff rate of flow to the point. The cumulative at that point and 24-hour discharge are calculated.

The Isohyet map indicates a depth of rain anticipated every 50 years. If a different frequency (or risk) is to be used, a factor is applied. Design frequencies vary depending on the facility to be designed. For example, a public storm drain may use the 25-year frequency. A public street may use a 10-year frequency. A sump condition usually uses a 50-year frequency or once in every 50 years. A major flood control project, such as the Los Angeles River might use a 100-year frequency. The Applicant, E&B Natural Resources Management Corporation, has conservatively selected a 100-year frequency storm event for design of the detention facilities for the proposed project.

A California Registered Civil Engineer experienced in drainage has prepared a Hydrology Study of the project site and its immediate surroundings (See Appendix A). The study is based on a recent topographic survey of the project site. Through a review of this study and the topographic survey, it has been determined that there is no existing runoff onto to the project site from offsite sources. Most current runoff is by sheet flow. The amount of runoff was determined based on the LACDPW Hydrology Manual dated 2006. Using the County's MODRAT program and the Isohyet Charts for Hermosa Beach (Redondo Beach) together with the existing site survey, the total discharge from the project site during a 100-year frequency storm has been determined to be 3.93 cubic feet per second (CFS), representing a 24-hour volume of 0.54 acre ft. or 23,522 cubic feet. This amount is distributed to the various existing discharge points around the perimeter of the project site noted below. It is also the total volume that was conservatively selected for use in the design of the proposed project's ultimate containment area, in Phase 4. The only difference is that, with the Phase 4 improvements, the whole amount will be detained on the project site.

Phase 2, which is an interim design, is also based on 100-year frequency; the flow rate would be 1.64 CFS, representing a 24 hour volume of 3,920 CF. This potential amount of runoff is significantly less

because, at this stage of the construction, the project site would be 93% pervious since the surface material would be 6 inches of crushed aggregate. Consequently, the amount of runoff to be detained and processed during Phase 2 construction is less.

**3.2. Existing Groundwater Conditions**

The natural groundwater reservoirs beneath Los Angeles County consist of ground water basins that are grouped together under five major geographic areas. These areas are the Antelope Valley, Coastal Plain, San Fernando Valley, San Gabriel Valley, and Santa Clarita Valley. The basins within these five geographic areas are separated by natural geologic features that impede groundwater movement or by arbitrary political boundaries.

The Central and West Coast Basins (see Figure 8) are the two largest basins in the Coastal Plain group that consists of five different basins. Two million residents of the Coastal Plain depend on groundwater that is protected by barrier facilities for approximately 35 percent of their potable water supply. The project site is located along the westerly edge of the West Coast Basin, west of its ground water barrier.

The West Coast Basin (WCB) is bounded on the west and south by the Pacific Ocean, on the north by the Ballona Escarpment, and on the east by the Newport-Inglewood Uplift. This fault forms a natural barrier to restrict groundwater flows from the adjacent Central Basin. Three major fresh water acquifers exist as part of the WCB, including the 200-Foot Sand (Gage), the Silverado, and the Lower San Pedro and Pico aquifers. Aquifers in the WCB are generally confined and receive the majority of their natural recharge from adjacent groundwater basins underflow and from the Pacific Ocean (seawater intrusion). Groundwater occurs in the pore spaces of the sediments in the basin. Where these sediments are thick and transmissive enough to supply sufficient quantities of water to wells for beneficial use, they are termed "aquifers". The name "aquitard" is given to the less permeable silt and clay layers that separate the aquifers. Aquifer depths can reach more than 1,500 feet in the WCB, although production water wells generally do not need to be drilled this deep to tap sufficient water.

Most of the groundwater in the WCB remains at an elevation below sea level due to historic over pumping, so the importance of maintaining the seawater barrier wells (discussed further below) to keep out the intruding seawater is critical. Groundwater in this basin is primarily recharged from the two barrier projects and from limited Central Basin underflow. The Dominguez Gap Barrier facility was designed to prevent intrusion from San Pedro Bay and the West Coast Basin Barrier Project was designed to prevent intrusion from the Pacific Ocean. Inflows come from a combination of imported

and recycled water purchased by the Water Replenishment District, the seawater barrier injection wells along the coast, areal recharge from precipitation falling on the basin floor and hillside runoff, groundwater underflow from adjacent basins, and continued seawater intrusion in certain areas.

### 3.3 Seawater Intrusion Barrier

In 1940, freshwater pumping wells along the coast of Los Angeles County began to be abandoned due to seawater intrusion. A cooperative study between the United States Geologic Survey's Water Resources Division and the Los Angeles County Flood Control District to investigate this critical situation, determined in 1943 that immediate action was necessary to restrain the situation. Of the different alternatives, only artificial groundwater recharge was found to be economically feasible. Although storm water spreading basins could be used to recharge local unconfined aquifers that lie directly beneath the ground surface, something different and innovative was necessary to reach those deeper confined aquifers containing by far the most-fresh water.

One method which has been proven successful to combat this problem and is currently in use by the Los Angeles Department of Public Works, is to construct a series of injection wells along the coastline which recharge the domestic water supply with imported water and advance treated reclaimed water which has undergone microfiltration, reverse osmosis, and disinfection. This technique attempts to establish groundwater elevations greater than or equal to the original elevations within the different aquifers. The intrusion is halted naturally when the groundwater levels rise and overcome the pressure of the seawater (like the taller column of fresh water) (See Figure 7). The relationship between the fresh water and sea water pressures is described by the Ghyben-Herzberg principle, which is based on the density differences between the two fluids. It gives an approximation to the depth of the seawater/fresh water interface and states that for every foot above sea level the fresh water head is, the depth to the seawater will be 40 times this amount below sea level. For example, if the potentiometric surface is 5 feet above sea level, the depth to the seawater will be approximately 200 feet below sea level. If groundwater level drops a foot, then the interface will rise 40 feet.

The Los Angeles County's two seawater barriers are operated with the goal of achieving and maintaining protective water surface elevations along the coast to prevent seawater intrusion into inland drinking water supplies, while minimizing the amount of water used for injection. The largest of these barriers is the West Coast Basin Barrier Project (WCBBP), which is an expansion of the original pilot study.

Beginning in June of 1995, West Basin Municipal Water District began conveying highly treated recycled water to the West Coast Basin Barrier Project for recharge. The water is blended with imported water. The injected water is supplied by the Water Replenishment District, which purchases imported water from the Metropolitan Water District, and reclaimed water from the West Coast Municipal Water District. Results showed that seawater could be successfully displaced below a confined aquifer's confining cap "aquiclude". This breakthrough, encouraged a pilot injection well program to be initiated along the coastline within the City of Hermosa Beach. It now consists of a line of 153 injection wells from the Palos Verdes Hills, north to the Los Angeles International Airport, a distance of approximately 9 miles (Figure 8). A combination of 75% recycled and 25% imported water is injected into the 200-foot Sand, The Silverado, and the Lower San Pedro Aquifers. The barrier was selected on the basis of geology ad hydrology and these factors resulted in the selection of Prospect Avenue as a suitable south-to-north alignment through the Cities of Torrance, Redondo Beach, and Hermosa Beach. The alignment then jogs towards the coastline to connect to the original test project along the former Santa Fe Railroad right-of-way (Veterans Parkway/Hermosa Valley Greenbelt) in Hermosa Beach. To the north, the alignment curves back inland along the right-of-way and then proceeds north. As such, the project site is located west of the West Coast Basin Barrier.

Groundwater on the project site was encountered in borings, at depths between 47.8 and 49.3 feet below ground surface during the geologic studies conducted on the project site (see NMG Geotechnical Investigation). At these depths, the groundwater table is at elevations of 4 to 5 feet above mean sea level. This corresponds well with water level monitored in Observation Well 704E of the West Coast Basin Barrier Project for infiltration waters finding their way into the surface unconfined aquifer.

Since the project site is located to the west, or the saltwater side, of the West Coast Basin Barrier Project, the water beneath the project site is within the coastal salt water intrusion zone. There are no domestic water supply wells located in the vicinity of the project site. However, in the general area of the project site, there is at least one well that pumps water for on-site industrial water. This pumping counteracts the inflow from the barrier and it is the goal of the Water Replenishment District (WRD) to replace the water with reclaimed water.

### 3.4 Water Quality

The quality of runoff comes under the control of the California Regional Water Quality Control Board (RWQCB). The project site is located in Region 4, Los Angeles. The Board adopted a revised Water Quality Control Plan for the Los Angeles region in June 1994. This plan contains the water quality

objectives and the beneficial uses for groundwater in the West Coast, Santa Monica, and Central ground water basins. The project site is located in the West Coast Basin. Beneficial uses include municipal, agricultural, industrial service and industrial process supplies. Additionally, runoff from the City of Hermosa Beach is contributory to the Santa Monica Bay and the Pacific Ocean. Santa Monica Bay is listed as impaired for human body contact recreation, known as Rec-1, on the California EPA 303(d) list.

## 4.0 REGULATORY SETTING

The proposed project would be implemented in conformance with permits issued from several Federal, State, County, and local agencies. Many of these permits address water quality or material control to protect water quality and emanate at the Federal level, with the CWA through other agencies, such as the EPA, to determine standards, and finally to State and local agencies to develop programs to implement, enforce, and protect water supplies. The regulatory setting for the proposed project is summarized below.

### 4.1 Federal Regulations and Policies

#### The Clean Water Act

The Clean Water Act of 1972 (CWA) establishes the basic structure for regulating discharges of pollutants in the Water of United States and establishes regional quality standards for surface waters. Under the CWA, the U.S. Environmental Protection Agency (EPA) has implemented pollution control standards for industries, as well as water quality standards for all contaminants in surface waters. The CWA made it unlawful to discharge any pollutant from a point source into navigable water unless a National Pollution Discharge Elimination System (NPDES) permit is obtained from the EPA. Each NPDES permit specifies effluent limitation for particular pollutants, as well as monitoring and reporting requirements for the proposed discharge. The implementation of permit issuance, receipt of monitoring data submitted by permittees, compliance monitoring, and enforcement has been granted to the States.

#### Total Maximum Daily Loads

Total Maximum Daily Loads (TMDL) is part of Section 303 of the CWA. Impaired water bodies require reducing the pollutant discharge to a level that the water body can assimilate. The reduction could decrease waste water and storm pollutant discharge to levels lower than required by an NPDES permit, in order to meet TMDL. States develop TMDL to determine how to reduce pollution from point sources and non-point sources, so that pollutant loads stay below the maximum specified in the TMDL. States are required to prioritize waters/watersheds for TMDL development, compile this information in

a list and submit the list to the EPA for review and approval. This list is known as the 303(d) list of impaired waters (RWQCB 2008). The nearest listed body is the Ballona Creek/Estuary. The project site does not fall within this drainage area. However, Santa Monica Bay is listed on California 303(d) list as impaired for human body contact recreation, Rec. 1.

**Safe Drinking Water Act of 1974**

The Safe Drinking Water Act of 1974 (SDWA) was implemented by the EPA. It is the primary federal regulation controlling drinking water quality in every public water system in the United States.

The SDWA authorizes the EPA to establish and enforce guidelines for drinking water, in order to protect water supplies from both naturally occurring and manmade contaminants. Significant amendments to the SDWA were promulgated in 1986 and 1996. Set standards for treatment of individual contaminants, including pesticides, trihalomethanes, arsenic, selenium, radionuclides, nitrates, toxic metals, bacterial viruses, and pathogens, were set in the original SDWA. The amendments to the SDWA made significant changes, most of which resulted in more stringent protection of drinking water sources. The amended SDWA also greatly enhances the existing law by implementing operator training, funding for water system improvements, and public information as important components of establishing safe drinking water.

**Oil Pollution Act**

The Oil Pollution Act of 1990 established a single uniform Federal system of liability and compensation for damages caused by oil spills in U.S. navigable waters. The Act requires removal of spilled oil and establishes a national system of planning for and responding to oils spill incidents, including provisions to:

- improve oil-spill prevention, preparedness, and response capabilities;
- establish limitations on liabilities for damage resulting from oil pollution;
- provide funding for natural resource damage assessments;
- implement a fund for payment of compensation for such damages; and
- establish an oil pollution research and development program.

## 4.2 State Policies and Regulations

### State Water Resources Control Board

The State Water Resources Control Board (SWRCB) and its nine Regional Water Quality Control Boards are the principal state agencies with responsibility for the coordination and control of water quality. The SWRCB enforce the water quality standards set forth in the CWA for the State of California on behalf of the Federal EPA. Most SWRCB objectives are based on California Code of Regulations, Title 22, State Drinking Water Standards. The City of Hermosa Beach lies within Region 4, the Los Angeles Regional Water Quality Control Board. The SWRCB has elected to adopt a Statewide General Permit serving as an NPDES permit, in compliance with CWQ Section 402, to regulate discharge. The General Permit Order 2009-0009-DWQ regulate discharges of storm water associated with construction sites. The general permit authorizes discharges of storm water and non-storm water associated with the construction activity so long as the discharges comply with the requirements and provisions in the permit.

### The Porter-Cologne Water Quality Control Act

Since 1973, the California State Water Resources Control Board and its nine Regional Water Quality Control Boards have been delegated the responsibility of administering permitted discharge into the Waters of California. The Porter-Cologne Water Quality Act provides a comprehensive water-quality management system for the protection of California waters and regulates the discharge of oil into navigable waters by imposing civil penalties and damages for negligent or intentional oil spills. Under this Act, "any person discharging waste, or proposing to discharge waste, within any region that could affect the quality of the water of the state" must file a report of the discharge with the appropriate Regional Water Quality Control Board. Pursuant to the Act, the regional board may then prescribe "waste discharge requirements" that add conditions related to control of that discharge. Porter-Cologne defines "waste" broadly and the term has been applied to a diverse array of materials, including non-point source pollution. When regulating discharges that are included in the Federal CWA, the State essentially treats waste discharge requirements and NPDES as a single permitting vehicle. In April of 1991, the State Water Resources Board and other State environmental agencies were incorporated into the California Environmental Protection Agency.

The Porter-Cologne Water Quality Act is primarily a state regulation addressing water quality and waste discharge on land. Permitted discharges must be in compliance with the regional Basin Plan that was developed by the Los Angeles Regional Water Quality Control Board for Region 4, which

includes Los Angeles County and the project site. Each Regional Board implements the Basin Plan to ensure that projects consider regional beneficial uses, water quality objectives, and water quality problems.

The Los Angeles Regional Water Quality Control Board regulates urban runoff discharges under NPDES permit regulations. NPDES permitting requirements cover runoff discharged from point source, for example, industrial out fall discharges, and non-point source, for example, storm water runoff sources. The Los Angeles Regional Water Quality Control Board implements the NPDES program by issuing construction and industrial discharge permits.

As a part of the NPDES permit, a Storm Water Pollution Prevention Plan (SWPPP) must be prepared. Best Management Practices (BMPs) are required as part of the Stormwater Pollution Prevention Plan (SWPPP). The EPA defines Best Management Practices as "schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of the Water of the United States." Best Management Practices include treatment requirements, "operating procedures and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage". (20 CFR 122.2)

**Disposal of Oil Field Waste (CAC, Title 23, Chapter 3, Subchapter 15, Articles 3 and 5)**

Oil field materials, including but not limited to drilling muds, oily wastes, and brines, generally contain toxic substances and materials that could significantly impair the quality of usable waters and generally constitute Group I Wastes. Such waste, which is ordinarily deposited at Class I or Class II-1 disposal sites, may be disposed by other means if such operations do not unreasonably affect water quality because of the type of waste and disposal operation, or an operation is in compliance with ordinances and regulations of other governmental agencies which adequately protect water quality. In 1980, Congress added section 1425 to the Safe Drinking Water Act, which controls underground injection of waste, giving the States authority to demonstrate that they maintain an effective program to prevent underground injection which endangers drinking water sources. The California Regional Water Quality Control Board, Los Angeles Region, authorizes such disposal options.

**Safe Drinking Water and Toxic Enforcement Act**

The Safe Drinking Water and Toxic Enforcement Act provides two ways to administratively list chemicals known to the State to cause cancer or reproductive toxicity. A chemical can be listed if a body considered to be authoritative by the State's qualified experts, such as the EPA or Food and Drug

Administration, formally identifies the chemical as causing cancer or reproductive toxicity. The criteria for listing these chemicals are outlined in 22 CFR Section 12902.

**Groundwater Management Act**

The Groundwater Management Act, commonly referred to as Assembly Bill AB 3030, is designed to provide local public agencies with increased management authority over groundwater resources. Groundwater is a valuable natural resource within California and AB 3030 ensures safe production and quality by encouraging local agencies to work cooperatively to manage groundwater resources within their jurisdiction. (Water Code Section 10750)

## 4.3 Local Policies and Regulations

**Standard Urban Stormwater Mitigation Plan**

The Standard Urban Stormwater Mitigation Plan is part of the Development Planning Program of NPDES, Phase I, Stormwater Permit for the County of Los Angeles. The Standard Urban Stormwater Mitigation Plan (SUSMP) applies to development and redevelopment projects within the County that fall within specific categories. The County of Los Angeles has developed a SUSMP Manual that includes the permitting and inspection process for projects required to meet SUSMP regulations. The objective of the SUSMP is to effectively prohibit non-storm water discharges and reduce the discharge of pollutants from storm water conveyance systems to the maximum extent practicable statutory standards. The SUSMP defines hydrology standards for designing volumetric and flow rate-based Best Management Practices. (LACDPW 2006)

**County of Los Angeles Flood Control Act**

The State legislature adopted the County of Los Angeles Flood Control Act in 1915, after a disastrous flood took a heavy toll on lives and property. The Act established the Los Angeles County Flood Control District and empowered it to provide flood protection, water conservation, recreation, and aesthetic enhancement within its boundaries. In August 2000, the Watershed Management Division of the Los Angeles County Department of Public Works became the planning and policy arm of the Flood Control District. Overall the District encompasses more than 3,000 square miles, 85 cities, and approximately 2.1 million land parcels. It includes a vast majority of drainage infrastructure within incorporated and unincorporated areas in every watershed including 500 miles of open channels, 2,800 miles of underground storm drains, and an estimated 120,000 catch basins.

The Los Angeles County Flood Control District (LACFCD) regulates hydrologic and hydraulic design within its boundaries through its 1982 Hydraulic Design Manual and its 2006 Hydrology Manual. In conjunction

with the Watershed Management Strategic Plan, the Public Works Division provides criteria and planning procedures for flood plain, waterways, channels, and closed conduits within Los Angeles County.

They promulgate the standard for project design through their "Standard Urban Stormwater Mitigation Plan" or SUSMP. This is the vehicle used to determine compliance with the California State EPA Stormwater Program for discharge from the site.

**City of Hermosa Beach**

The City of Hermosa Beach is currently the owner of the project site known as 555 6th Street. The Community Development Department is charged with the administration of the ordinances and policies relating to land use and development within the City, along with enforcing building standards for the purpose of safeguarding public health and safety. In addition, the City Public Works Department has responsibility for some of the flood control measures in the region and regulates engineering standards and requires permits.

## 5.0 Thresholds of Significance

As defined in CEQA Appendix G, the Environmental Checklist Form, hydrology and water resource impacts would be significant if the proposed project would:

- Violate any water quality standards of waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the groundwater table level, ultimately affecting the production of existing nearby wells;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or offsite;
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or substantially increase the rate of runoff in a manner that would result in flooding on or offsite;
- Create, contribute, or alter hydrologic characteristics of the area producing runoff that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff;
- Otherwise substantially degrade water quality;

- Place structures within a 100-year flood hazard area, as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map of flood hazard delineation;
- Place structures that would impede or redirect flood flows within a 100-year flood hazard area;
- Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure or a levee or dam; or
- Be susceptible to an inundation by a seiche, tsunami, or mudflow.

As discussed above, due to the location of the proposed project, there would be no potential for impacts related to the following environmental issues:

- The project site is in an urbanized area and there are no streams or rivers on-site or in the vicinity that could be altered, resulting in flooding or erosion on or off-site;
- The project site is not within an area that would be subject to a tsunami, seiche, or mudflow;
- The project site is not in an area protected by a dam or levee; and
- The project site is above the 100-year flood zone, and is not placing people or structures within the 100-year flood zone.

## 6.0 CONDITIONS WITH PROPOSED PROJECT

The following describes the characteristics of the proposed project including the design features and operational practices related to hydrology and water quality that have been incorporated into the project to minimize or eliminate the potential effects of construction activities and ongoing operations.

### 6.1 Project Characteristics

The proposed project would involve four distinct development phases consisting of the following:

Phase 1: Site Preparation

Phase 2: Drilling and Testing

Phase 3: Final Design and Construction

Phase 4: Development and Operations

Phase 1: Site Preparation provides for: the demolition and removal of the existing structures and facilities on the project site; construction of a retaining wall along the westerly property boundary and, setback 10 feet, along a portion of the southern property boundary; rough grading to allow for

construction of a well cellar for three oil wells and one water injection well, drainage of the project site towards the well cellar, installation of the temporary production equipment, and provision of a level area for the drill rig; installation of electrical service; and installation of a chain link construction fence, a sound attenuation wall, and temporary landscaping along Valley Drive and 6th Street.

Phase 2: Drilling and Testing would involve drilling up to three test wells and one water injection well at the project site, installation of temporary production facilities, disposal of the produced gas via an onsite gas combustor, and the trucking of the produced oil to the Phillips 66 refinery in Torrance. The purpose of Phase 2 is to determine the potential productivity and economic viability of the proposed project. If Phase 2 yields the quantity and quality of production that E&B deems economically viable, the proposed project would proceed to Phase 3.

Phase 3: Final Design and Construction would be to utilize the production information from Phase 2 to prepare the final drilling program, design the project, procure the equipment, perform the project soil remediation, grade the site, and construct the permanent oil and gas production facilities and other supporting onsite and offsite improvements for the proposed project. The major activities in this phase include remediation of the soils, construction of permanent facilities (excavation, grading walls, production equipment, etc.) and construction of the off-site oil and gas pipelines.

Phase 4: Development and Operations would maximize oil and gas recovery from the reservoir by drilling additional wells (up to 27 oil and gas producing wells and 3 injection wells) and activating the permanent production facility for the ongoing operations of the proposed project. The facility would be designed to process up to 8,000 barrels of oil per day and 2.5 million cubic feet of gas per day. The major activities in Phase 4 would include drilling the remaining wells and operating and maintaining the wells and facility for the 30 to 35 year life of the proposed project.

E&B has committed to construct and operate all phases of the proposed project in a manner that is in conformance with Federal, State and local codes, standards, and regulations. In order to obtain permits for the proposed project's construction, E&B must demonstrate conformance with the water standards and construction and operations requirements.

## 6.2 Project Design Features

### 6.2.1 Phase 1

Construction vehicles and equipment would be used during this phase of the proposed project. Prior to the initiation of any construction activities, a Storm Water Pollution Prevention Plan (SWPPP) would be developed and approved in accordance with the State General Construction Permit and the

Los Angeles Regional Water Quality Control Board. The SWPPP would be developed by a qualified Stormwater Pollution Prevention Plan Developer (QSD). The SWPPP would set forth several construction and industrial generally accepted Best Management Practices (BMPs) for areas of potential runoff. These BMPs are to control potential pollutant discharge from the project site and to reduce erosion and sediment transport. Filtering elements such as silt fences, straw wattles, and absorbent materials would be used together with filter technology to catch sediment, debris, oil and pollutants. A Qualified Stormwater Pollution Prevention Plan Practitioner (QSP) would oversee and monitor the implementation of this plan.

The SWPPP is meant to be a working document. At the different phases of construction activities, site disturbance, and material storage, the document would change and adapt for the activities as they occur. Each significant change as a result of construction activities or material use on the project site would be addressed in the SWPPP revisions. Each revision would reflect implementation and adjustment of BMPs employed at the project site to effectively control surface point source runoff and to control the contact of material with surface waters.

All existing buildings and structures and paving would be removed during this phase of the proposed project. Approximately 3,500 tons of material would be removed from the project site and approximately 350 linear feet of five to eight-foot high retaining wall would be constructed. Minimal rough grading would be conducted on the project site and the surface covered with crushed aggregate base material. The grading would allow the construction of a well cellar for three oil wells and one water injection well, installation of temporary production equipment, and set up of the drilling rig. The changed site grade would generally drain towards the well cellar. With the exception of material storage and containment areas, this drainage will be intercepted and directed to a detention point where it can be processed to the required SWPPP limits and discharged from the project site into the existing City storm drain system. If this water cannot meet SWPPP requirements, it will be hauled off-site by vacuum truck and properly disposed of.

A concrete lined well cellar would be constructed for the drilling of the wells in Phase 2. The concrete well cellar (below the surface elevations) would measure at a minimum of 40 feet in length, 8 feet in width, and 8 to 12 feet deep (minimum of 2,560ft$^3$). The cellar would have a storage capacity of 456 barrels (1ft$^3$=0.17810760 Barrels US, Oil). The cellar provides containment in the event of a spill during the Phase 2 drilling and testing of the wells. The well cellar will be equipped with a pump to pump any fluids into the temporary production facility or be pumped into a vacuum truck and hauled to an approved disposal facility.

Any and all hazardous materials and chemicals used and stored onsite during this phase of the proposed project would be stored in an area(s) with containment of at least 110% of the largest container volume to ensure that leaks or spills from any container would not come in contact with the native soil.

Approximately 2,000 gallons per day of water would be required for clearing and grading operations and construction. Water would be provided by the City's domestic water provider, California Water Service, via the 6" line in 6th Street. The California Water Service indicates it would provide this water demand with no impacts on their system.

**6.2.2 Phase 2**

Drilling of up to three wells and a water injection well would occur in the well cellar and temporary production equipment would be installed during Phase 2. This production equipment would consists primarily of several temporary liquid handling tanks and piping between the tanks for both the separation of the oil, water, and gas that would be produced during the drilling and testing operations. The gas would be disposed of onsite using a gas combustor (enclosed ground flare). The water, after being removed from the oil, would be filtered and then disposed of by injecting the produced water via the water injection well into the oil-producing reservoir below the oil water contact.

As required by the EPA, a Spill Prevent Control and Countermeasure (SPCC) Plan would be completed and approved prior to any drilling and installation of temporary production equipment. The proposed project would also be subject to the Spill Contingency Requirements (SCP) as set forth by the Division of Oil, Gas and Geothermal Resources (DOGGR). Both plans are designed to prevent releases and to respond to unauthorized releases. Among the numerous requirements required by either SPCC or SCP, is the requirement for adequate secondary containment for spills. The proposed project would provide containment around the temporary tanks by creating an earthen berm approximately 18 inches high. Prior to installation of the temporary tanks, an impervious liner would be installed where the tanks would be located as well as covering the earthen berm to prevent any oil spill from coming in contact with any native soil. The tanks would be installed on top of the impervious liner. The containment area would have at least 110% capacity of a single tank plus sufficient capacity to retain up to a 100 year storm event in the area of the containment area taking into account the volume of the other tanks and equipment within the containment area. Any leak/spill or rainwater within the containment system would be returned to the production system and/or hauled off-site for proper disposal.

Areas not located within a containment area would be subject to the SWPPP (as defined in Phase 1) of the proposed project and, as needed, modified to accommodate any construction-related

changes for this phase. Consistent with the SWPPP, minor spills located in these areas would be cleaned up immediately and disposed of properly.

The drilling operations would also be subject to spill prevention and control. The drilling pad would be constructed to ensure any fluids spilled directly around the drill rig would flow into the well cellar. A pollution pan would be installed under the drill rig floor to contain drilling mud or other fluids that might spill. The mud would be captured and contained in the catch pan and returned to the active mud pit system. In addition, during drilling operations an impermeable berm would be placed around the entire drilling rig after installation. In the event a leak should occur in the mud handling system, the leak would be contained directly around the drill rig and flow toward the well cellar. Rainwater accumulations within the bermed area around the rig would similarly flow into the well cellar, before being pumped into the active mud pit system. Spill containment around the hydraulic oil tank would be installed to catch and retain any leaks or spills that may occur. As an extra precaution, a spill trailer at the drill site would be equipped with absorbent materials, small spill booms to contain and direct flow, plastic sheets, personal protective equipment, and rakes, shovels and hand tools to be used in the event of a spill.

Prior to drilling, all wells will be approved by Department of Gas Geothermal Resources (DOGGR). DOGGR has primary authority to permit oils wells and has primary authority through the EPA to approve Class II Injection wells. The application for a permit to drill in part requires a casing program. The first step in completing a well is to case the hole. As the well is drilled a series of steel pipes known as casings are inserted to prevent the boring from closing in on itself. Cemented casing also serves to isolate the well from surrounding formation. Each length of casing along the well is often referred to as a casing string. The steel casing is a key part of well design and essential to isolating the formation zones and ensuring integrity of the well. Cement is pumped down the casing and into the annular space to form a seal and the casing. Cemented casing strings protect groundwater resources (if present) by isolating these shallow resources from the oil, gas, and produced water (water produced during operation of a well) inside of the well. It is important to note that the shallow portions of the well have multiple strings of steel casing installed.

The proposed oil bearing zone may be under pressure. A Blow Out Prevention (BOP) system would be used during the drilling operations to prevent uncontrolled release of reservoir fluids and would shut off the flow to prevent spills. The proposed safety systems are composed of a blow out prevention stack, actuation systems, a choke manifold, kill systems, and other equipment. Such systems would be placed on each well head during drilling. (Additional information related to the BOP and other

safety systems can be found in the Plant Safety and Control System, prepared by InterAct, dated October 2012.)

Once operational all produced water and rain water located within containment areas would be re-injected or removed and disposed of in an approved disposal site. All produced oil would be trucked offsite utilizing a designated truck route. Trucking of oil could result in off-site spills that may enter storm drains and affect surface Waters of the United States. Each truck is capable of hauling up to 160 barrels of oil. This would be the worst-case scenario in the event of an accident and rupture of the tank. Trucking of oil is a temporary activity and would only last for approximately 10 to 11 months. In the event that a spill should occur, the trucking company and operator would initiate a response in coordination with local officials. Prior to trucking activities, the trucking company and the operator in coordination with the local response officials would develop a response plan.

Any hazardous materials and chemicals that are used and stored on-site during Phase 2 of the proposed project would be stored in an area(s) provided with containment of at least 110% of the largest container volume to ensure that leaks or spills from any container would not come in contact with the native soil.

During the drilling of the wells, 130,000 gallons per well of water would be used. In order to offset the demand for potable water, the proposed project would use reclaimed water supplied from a reclaimed water system operated by West Basin Municipal Water District. Reclaimed water provided by West Basin Water District is available from their 12-inch main located in Valley Drive. The Applicant proposes to use reclaimed water for the well drilling, landscaping, and any other acceptable application where allowed. The West Basin Municipal Water District has indicated they would provide this water demand with no impact on their system.

**6.2.3 Phase 3**

Prior to any construction in Phase 3, all wells would be shut in and the well cellar covered by steel plates. All temporary oil and gas production equipment would be removed from the project site. Construction activities would adhere to generally accepted BMPs related to dust control and spills as outlined and required by the SWPPP. All minor spills related to construction activities would be cleaned up immediately and disposed of properly. The proposed project would have adequate clean up materials clearly marked on-site. Furthermore, the SWPPP (as defined in Phase 1) would be modified as necessary to accommodate the construction changes for this phase. Use of drainage swales and filtering elements such as silt fences, straw wattles, and absorbent materials would be used together with filter technology to catch sediment, debris, oil, and pollutants onsite. Tracking control BMPs to reduce

tracking sediment off-site, including stabilized construction entrance and exit with steel shakers and tire wash area, would be used to ensure that no dirt or contaminated material leaves the project site when trucks or other vehicles are leaving. Street sweeping along with normal BMPs would be used during the off-site construction activities to keep areas clean of dirt and debris and ensure sediment does not enter the storm drain systems. The applicant would monitor and maintain the storm water pollution control facilities identified in the SWPPP in a manner consistent with the provisions of their Federal Water Pollution Control Act National Pollutant Discharge Elimination Program (NPDES). A Qualified Stormwater Pollution Prevention Plan Practitioner (QSP) would oversee and monitor the implementation of this plan.

The final drainage and grading for the proposed project would be designed and constructed with the intent of detaining the 100 year 24-hour storm event on-site within the walls and processing the storm water as produced water along with the water generated as part of the oil production process. Produced water, including the storm water would be processed through an approved clarifier, induced flotation system, a filter, and then would be injected into the oil bearing reservoir below the oil water contact. The equipment could process water at an estimated rate of up to 16,000 barrels per day in an emergency providing the well production would be shut in long enough to dispose of the storm water.

During the initial grading for Phase 3, soil remediation would take place. Remediation of contaminated soils would adhere to the Remedial Action Plan (RAP) as prepared by Brycon, LLC. Excavation, loading, hauling, and disposal of contaminated soils would be performed only by personnel experienced and licensed to handle hazardous materials in accordance with the RAP, conforming to both the Department of Toxic Substance Control and California State Regional Water Quality Control Board requirements. Covered trucks that contain the excavated materials would be wiped prior to leaving the project site to ensure no contaminated materials are deposited onto the roadway. In accordance with the RAP, the remaining landfill and any contaminated soils would be capped with 5 feet minimum of clean earth. Deeper total petroleum hydrocarbon (TPH) impacted soils would be treated using in Situ Vapor Extraction. Refer to the RAP for a complete discussion of the plan that would be implemented as part of the removal of the contaminated material.

Once construction of the facilities for the proposed project are complete, the remaining surfaces within the walls would be paved with concrete and/or asphaltic concrete to create a continuous impervious surface within the walls of the project site.

The original concrete line well cellar would be extended to a minimum of 110 feet in length, 8 feet in width and 8 to 12 feet deep (minimum of 7,040 $ft^3$). There would also be a second well cellar of the same size constructed. The two cellars would have a total storage capacity of approximately 2,510 barrels. This feature provides containment in the event of a spill. The well cellar would be connected to the sump tank and fluids would be directed to the permanent production facility.

Permanent oil production equipment, including tanks and vessels, would be located in the tank farm containment area that is capable of holding at least 110% of the volume of the largest tank (40 foot diameter by 16 feet tall). This containment area would also be sized to retain the site runoff of a 100 year frequency 24-hour storm event. Allowance would be made for 1 foot of freeboard together with additional equipment. The storm water would be processed as part of the oil and gas production process and would be combined with the produced water from wells, and injected into the oil-producing reservoir below the oil water contact. All other areas outside of the containment areas would drain to a drainage system that would convey and capture the rainwater and send it to the containment area.

Once completed, the entire project site within the walls would be improved with concrete basins for all production equipment, concrete well cellars for wells, and asphalt or concrete improved surfaces. Areas outside the containment area would drain to an internal drainage system that drains to the tank farm containment area. There would be no off-site discharges of any fluid from within the walled site after completion of Phase 4 for storm events up to and including the 100-year storm event. Nor would any leaks/spills be able to come in contact with the native soils or permeate into the aquifers below the project site.

Outside of the perimeter wall, a landscape buffer 10 feet wide would be incorporated into the project frontage along Valley Drive and 6th Street. This area more than offsets the pervious area inside the wall that would be paved and allows the opportunities for infiltration of runoff outside the perimeter wall. Runoff from impervious driveways and runoff intercepted by the perimeter walls would be directed through this landscaping allowing it to serve as a bio-swale. Routine sediment, trash, and debris that could discharge from the landscape area, would be controlled by curbing and picked up as a part of routine maintenance.

An approximately 3.55-mile, eight-inch diameter oil pipeline would be installed for transporting oil to the purchaser of the oil for the duration of the proposed project. The crude oil pipeline would be constructed utilizing generally accepted and recognized pipeline construction methods as described in the Project Description of the Planning Application Form. Pipeline activities would be controlled and monitored as part of the approved SWPPP Plan.

Any and all hazardous materials and chemicals that are used and stored onsite during Phase 4 of the proposed project would be stored in an area(s) provided with containment of at least 110% of the largest container volume to ensure that leaks or spills from any container would not come into contact with the native soil.

Approximately 2,000 gallons per day of water would be required from clearing and grading operations and construction, and up to 10,000 gallons per day during the pipeline installation. Water would be provided by the California Water Service (CWS). CWS indicates this additional demand would not impact their system.

**6.2.4 Phase 4**

As required by the EPA, a Spill Prevention Control and Countermeasure (SPCC) would be completed and approved prior to any drilling and installation of the permanent production equipment. In addition, the proposed project would be subject to the Spill Contingency Requirements (SCP) as set forth by the Division of Oil, Gas and Geothermal Resources (DOGGR). Both plans are designed to prevent releases and to respond to unauthorized releases. Among numerous requirements, both plans require adequate secondary containment around tanks. The final site layout would be designed to contain all rainwater from up to a 100 year 24-hour storm event on-site together with a worst-case spill from wells, tanks, drilling, equipment, vehicles, etc.

The oil pipeline would be operated in accordance with the laws of the California State Fire Marshall (CSFM). The CSFM implements the Pipeline Hazardous Materials Safety Administration (PHMSA) regulations as set forth in the Code of Federal Regulations, Title 49, Parts 195 and 194. Part 195 sets forth requirements for leak detection, emergency response, operations and maintenance, operator qualifications, integrity management and personnel drug and alcohol testing for safety sensitive positions. Part 194 requires response plans for liquid lines and these must be approved by PHMSA. A worst-case spill analysis was performed by SPEC Services. The worst-case scenario includes a rupture in the pipeline at the corner of Herondo Street and Valley Drive. The volume for this spill is estimated to be 178 barrels. In the event there was a spill, it is likely it could enter a storm drain and impact Waters of the United States. As such, the proposed project would fall under the jurisdiction of the Office of Spill Prevent & Response (OSPR). The proposed project would: require approval of an oil spill contingency plan; obtain a Certificate of Financial Responsibility; and become a member of an Oil Spill Response Organization.

The applicant would properly maintain the associated crude oil pipelines, storage tanks and processing facilities within and outside the project site. This would include smart pigging in accordance

to State of California Office of State Fire Marshall requirements and the standards outlined in the California Department of Oil, Gas and Geothermal Resources, and the Regional Water Quality Control Board, pipeline, tank and processing inspections. The applicant would install a leak detection system for the oil pipelines. The system would include pressure and flow meters, flow balancing supervisor control and data acquisition system, and a computer alarm system in the event of a suspected leak. Temperature, pressure and flow would be monitored at each pipeline entrance and exit. If any variables deviate by more than 10 percent of the normal operating range, the system would trigger both audible and visual alarms and automatic shut down of the oil and gas production facility and the crude oil pipeline. Flowing balancing would be conducted every 5 minutes, 1 hour, 24 hours and 48 hours with the accuracy defined once the system is established and tested. With the implementation of these design features, this scenario benefits from early detection and quicker response time to an event along the pipeline before oil discharge reaches the levels where they might overflow and discharge to surface waters.

As in Phase 2, prior to drilling the remaining wells, all planned wells would be approved by DOGGR. DOGGR has primary authority to permit oil wells and has primary authority through the EPA to approve Class II injection wells. The application for a permit to drill in part requires a casing program. The first step in completing a well is to case the hole. As the well is drilled a series of steel pipes known as casings are inserted to prevent the boring from closing in on itself. Cemented casing also serves to isolate the well from the surrounding formation. Each length of casing along the well is often referred to as casing string. The steel casing strings are a key part of well design and essential to isolating the formation zones and ensuring the integrity of the well Cement is pumped down hole to form a seal between the hole and casing. Cemented casing strings protect groundwater resources (if present) by isolating these shallow resources from the oil, natural gas, and produced water (water produced during operation of a well) inside of the well. It is important to note that the shallow portions of the well have multiple strings of steel casing installed.

Operators of Class II injection wells must file for a permit with the DOGGR. Before a permit is issued, the proposed injection protect will be studied by DOGGR engineers and reviewed by the Regional Water Quality control Board Los Angeles Region. DOGGR engineers would evaluate the geologic and engineering information, solicit public comments, and hold a public hearing, if necessary. Injection project permits include may conditions, such as approved injection zones, allowable injection pressures, and testing requirements (DOGGR 2007). In California, Class II injection wells have proved to be an environmentally safe method of disposal of produced water. A peer review conducted by a

national organization, the Ground Water Protection Council, determined that DOGGR has a program that effectively protects underground sources of drinking water.

**6.3 Hydrological Conditions with the Proposed Project**

The City Maintenance Yard is the location of the proposed project. In its existing condition, rainfall runoff is discharged from the project site. These discharges are to 6th Street, Valley Drive, and the LACFCD storm drain in Valley Drive. The re-grading of the project site and the final site improvement would change this surface runoff pattern.

During Phase 2, the existing paving would be removed from the project site together with existing buildings and other impervious surfaces. The project site would then be regraded to create a relatively level work surface within the retaining walls and fence around the project site. A well cellar approximately 40 feet long by 8 feet wide by 8 to 12 feet deep below the surrounding surface grade would be constructed on the project site for the drilling of the first three wells. The entire project site would be sloped from the perimeter fence to the well cellar. The surface of the graded site would be covered with 6 inches of crushed aggregate base. At this stage, the Phase 2 site would potentially produce 1.26 CFS or 3920 CF of runoff to this sump condition. However, as a part of the drilling, processing, and delivery systems, portions of this discharge would be contained and processed through the clarifying system for reinjection as described above.

These include areas around the drilling rig, containment around the liquid storage tanks and containment areas around other equipment and materials. All of these containment areas would contain the 100-year storm event in addition to the potential spill or leaks. All of these contained waters would be processed and reinjected or removed by vacuum truck and disposed of off-site in an approved method. The remaining runoff that has not been exposed to potential leak or spill would be captured on-site and directed to a berm detention basin area in accordance with the SWPPP BMPs incorporated into the Phase 2 design. The runoff waters in the detention basin area can wait their turn to be processed and reinjected or they may be allowed to infiltrate and evaporate.

The amount of runoff to this detention basin area has been significantly reduced by the fact that the previously paved areas are now pervious and will produce less runoff, as well as, by the deduction of the containment areas. This is estimated to be less 726 CF that would have to be temporarily detained on-site during a 100-year storm event until processing or infiltration has taken place. This detention basin area would be designed based upon the applicable SWPPP BMPs and the area may be moved or adjusted as necessary based on the activities taking place on the site. All potential runoff would be

captured and/or treated on-site. The net effect is that discharge from the project site during a 100-year storm event would be greatly reduced, controlled, and disposed of onsite.

Existing runoff loads to downstream off-site storm drain systems would be reduced to minor runoff amounts from the exterior landscape areas. Consequently, there is no impact to any off-site downstream flooding conditions or existing storm drain systems.

Similarly, during the Phase 3 soil remediation, the potential runoff from a 100-year storm event from areas outside the remediation work area would be captured and directed to detention basin areas. These together with adjusted BMPs for this activity such as berming, dust control, construction entrance and exit BMPs, will be employed to control potential discharge from the site. (Additional material control methods for this activity are covered in the RAP plan.)

With the construction of the Phase 3 improvements, hydrology of the project site would again change. Phase 3 construction would include the completion the permanent perimeter wall, extension of the existing well cellar, construction of the second well cellar, excavation of the depressed tank farm, construction of concrete retaining walls, and concreting of all the surface areas. In addition, all structures and equipment will be installed, tested, and made operational.

Because the improved site would have impervious surfacing, the potential runoff amount would be approximately equal to the original existing condition of 3.93 CFS or 23,522 CF of runoff. However, all of this potential discharge would be captured by an onsite drainage system and directed to the depressed tank farm area. The tank farm containment area would be sized to contain the 100-year storm event discharge from the complete project site together with the potential volume of 110% of the largest installed tank, while allowing for the displacement of other tanks and, in the event, wastewater and equipment. Even with this change and, in the event that processing is unavailable, the tank farm would be adequately sized to contain this storm event with 1-foot of freeboard. All of this wastewater would be processed through the clarifying system to the standards adequate to be used in the reinjection process. It is estimated that the tank farm containment could be cleared in 11 hours. Thus alleviating any concerns over vector control. These design features would allow for the proposed project to capture, detain, process and inject the entire 100-year frequency 24-hour storm event. There would be no discharge to off-site storm drain facilities or any contribution to any downstream flooding condition.

## 6.4 Potential Project Impacts

### 6.4.1 Conclusions of the Impact Analysis

Based on the analysis provided above, with the incorporation of the operational practices and design features into the proposed project, the following conclusions can be made:

- The proposed project would comply with the applicable water quality standards and waste discharge requirements;
- The proposed project would not deplete the groundwater supplies or interfere with groundwater recharge;
- The proposed project would not cause erosion or sedimentation on-site or off-site;
- The proposed project would not cause flooding on-site or off-site;
- The proposed project would not increase in the rate or amount of runoff that would otherwise exceed the capacity of any existing or planned storm water drainage system; and
- The proposed project would not provide sources of polluted runoff or degrade surface water quality or groundwater quality.

Therefore, upon compliance with the applicable regulatory requirements and with the incorporation of the operational practices and design features discussed above, no significant impact related to these environmental issues would occur with the implementation of the proposed project.

### 6.4.2 Other Potential Impacts

Due to the nature of the proposed project, oil from subsurface reservoirs would be brought to the surface by drilling and pumping. Once at the surface, the oil, gas, and water emulsion would be processed to separate the water, gas, and oil into separate streams. The water together with rainwater would be processed to remove all the oil and other solids and reinjected into the subsurface oil bearing reservoir below the oil water contact. Produced oil would be shipped either by truck (in Phase 2) or transported by pipeline (in Phase 4) to the purchaser. The gas would either be combusted on-site (in Phase 2) or transported by pipeline (in Phase 4) to the ultimate purchaser. The following surface and subsurface spill scenarios have been identified as potential environmental impacts during the project analysis and are addressed by the operational practices and design features incorporated into the proposed project:

**Surface Spills Related to Construction - Phases 1 and 3**

Surface spills related to construction would be limited to:

- Spills or leaks of hazardous material stored on-site. To address this, all hazardous materials would have secondary containment and, therefore, would not enter storm drains or permeate native soil.
- Trucking of contaminated material during implementation of the Remedial Action Plan. The Remedial Action Plan (RAP) includes mitigation requirements that would essentially eliminate any potential for contaminated material to be tracked from the project site onto public right-of-way and into storm drains or other surface waters.

Therefore, these potential scenarios would not impact water quality (surface or ground water), since the materials and liquids would be contained on-site and would not enter any off site storm drains or surface waters or permeate any underground acquifer.

**Surface Spills Related to Oil and Gas Production (Phases 2 and 4)**

A review was completed to identify potential oil and produced water spill scenarios related to the project activities during Phase 2 Drilling and Testing, and Phase 4 Development and Operations. The review also considered if the spill was off-site or on-site and contained or uncontained. Off-site means outside of the perimeter walls for the proposed project. This review, summarized below, would show if the scenarios had the potential to impact surface or ground waters.

| On-site/ Off-site | Phase | Activity | Contained/ Uncontained | Uncontained Volume (Barrels) |
|---|---|---|---|---|
| On-site | 2 | Drilling Blowout | Contained | |
| On-site | 2 | Facility Spill | Contained | |
| Off-site | 2 | Trucking | Uncontained | 160 |
| On-site | 4 | Drilling Blowout | Contained | |
| On-site | 4 | Facility Spill | Contained | |
| Off-site | 4 | Pipeline Spill | Uncontained | 178 |

The review shows that on-site spill scenarios do not have the potential to impact surface or ground waters. This is due to the containment sizes and drainage patterns provided within the perimeter walls of the proposed project. Spills outside the containments, but within the perimeter wall, would drain to the well cellar and any residual oil on the ground would be immediately cleaned up.

In addition, the review shows that two off-site spill scenarios have the potential to enter the surface or ground waters as discussed below. This is due to lack of containment outside the perimeter walls during transport. These off-site scenarios are discussed below.

**Phase 2, Drilling and Testing - Trucking Spill (worst-case spill scenario)**

The first scenario contemplates a spill during the trucking of oil in Phase 2. One truck is capable of hauling 160 barrels of oil. If an accident occurred and this accident caused a rupture in the tank, the oil would be released on the street. The analysis further reviewed storm drains along Valley Dive and Herondo Street. The scenario considers an accident with a rupture at the corner of Herondo Street and Valley Drive. Under this scenario, the oil would enter the storm drain system. Furthermore, in the middle of a significant storm event, oil would not be diverted to the low flow pump station and the oil would make it to the ocean through the storm drain system.

Trucking of oil is a temporary activity and would only last for a period of approximately 10 to 11 months. The frequency of occurrence for a truck accident that results in a rupture is *2 in 10,000 years (Unlikely) - notation*. Given the frequency and volume of oil, this would be considered an insignificant risk under the County of Santa Barbara Department of Resource Management Environmental Thresholds & Guidelines Risk Matrix (Preliminary Summary Report, E&B Oil Development Project, Quantitative Risk Analysis, Section 3, Environmental Risk Analysis, dated November 7, 2012).

Trucking of oil falls under the jurisdiction of the Department of Transportation Motor Carrier Permit program and the California Highway Patrol.

**Phase 4, Development and Operation - Pipeline Spill (worst case spill scenario)**

The second scenario contemplates a spill during pipeline operations in Phase 4. The scenario considers s a full bore rupture due to third party damage or corrosion at the corner of Herondo Street and Valley Drive. An analysis shows that the maximum volume that would be released is 178 barrels. Under this scenario, the oil would enter the storm drain system. Furthermore, in the middle of a significant storm event oil would not be diverted to the low flow pump station and the oil would make it to the ocean through the storm drain system.

Pipeline operations would continue for the duration of the life of the proposed project. The frequency of occurrence for a pipeline rupture is *2 in 10,000 years (Unlikely) - notation*. Given the frequency and volume of oil, this would be considered an insignificant risk under the County of Santa Barbara Department of Resource Management Environmental Thresholds & Guidelines Risk Matrix

(Preliminary Summary Report, E&B Oil Development Project, Quantitative Risk Analysis, Section 3, Environmental Risk Analysis, dated November 7, 2012).

The oil pipeline would be operated in accordance the laws of the California State Fire Marshall (CSFM). The CSFM implements the Pipeline Hazardous Materials Safety Administrations (PHMSA) regulations as set forth in the Code of Federal Regulations Title 49 Part 195 and & 194. Part 195 sets forth requirements for leak detection, emergency response, operations and maintenance, operator qualifications, integrity management, and drug and alcohol testing for safety sensitive positions. Part 194 requires response plans for liquid lines and these must be approved by PHMSA. As such, the proposed project will fall under the jurisdiction of the Office of Spill Prevention & Response (OSPR). The applicant would require approval of an oil spill contingency plan, obtain a Certificate of Financial Responsibility, and become a member of an Oil Spill Response Organization (OSRO).

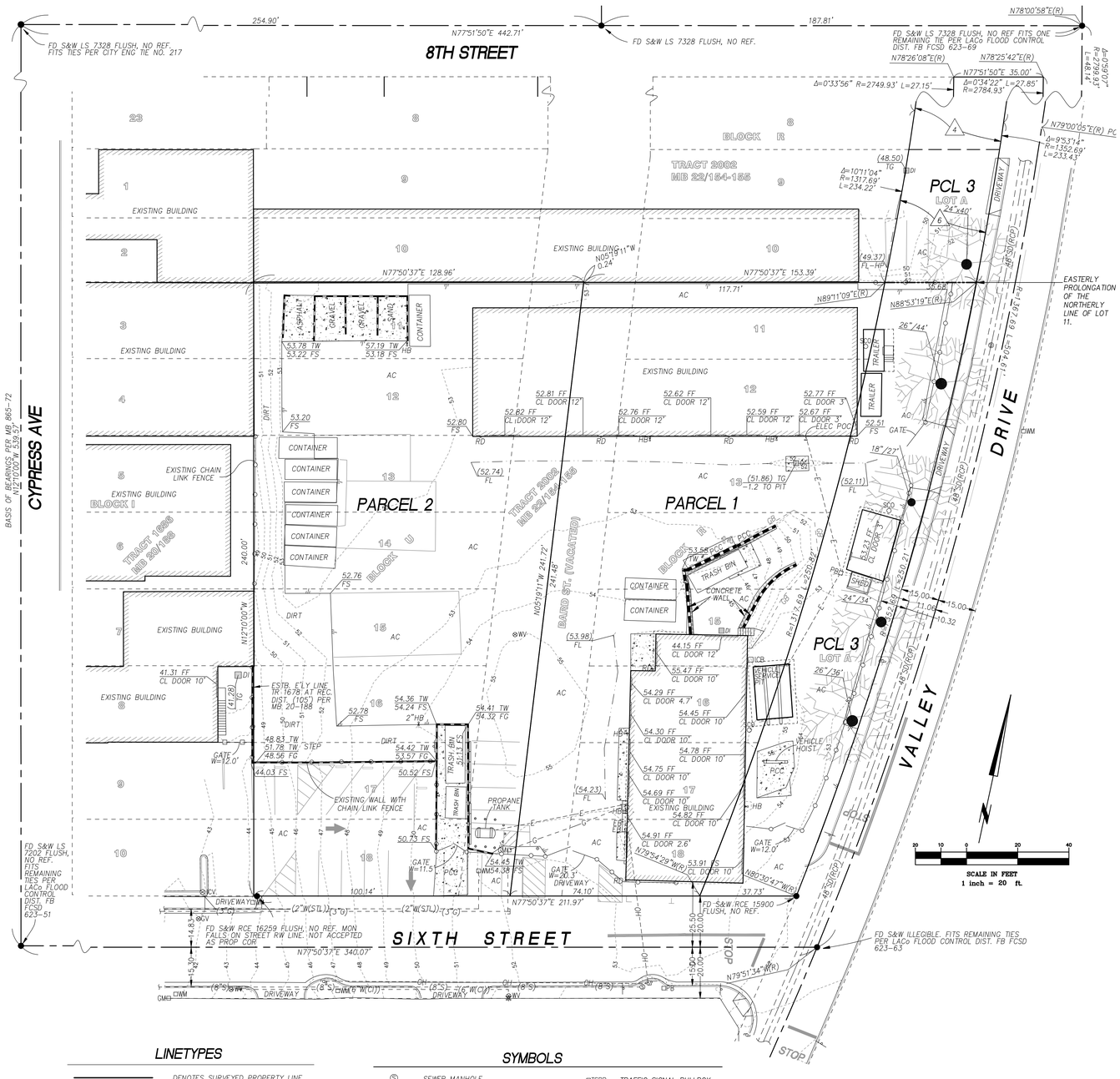
**Subsurface Leaks Related to Drilling of Wells - Phases 2 and 4**

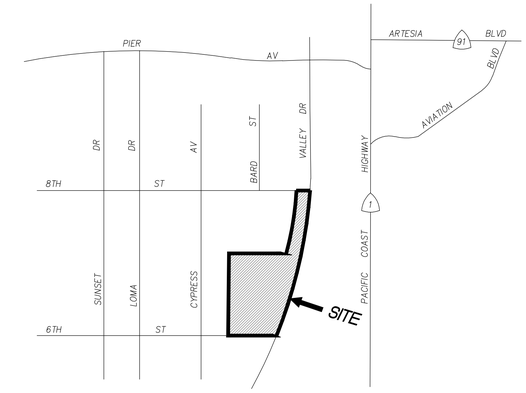
The opportunity for oil or produced water coming into contact with fresh water acquifers during the drilling or operation phases of the proposed project (Phases 2 and 4) is not considered possible. The drilling method to be implemented by the proposed project would conform to the rules and oversight of DOGGR for the drilling of any oil wells and Class II Injection wells. In addition, the underground reservoir that would be penetrated during Phase 2 and Phase 4 drilling are west of the West Coast Basin Barrier and is not considered of beneficial use.

17th Ct
16th Ct
14th St
Manhattan Ave
Monterey Blvd
Loma Dr
Pier Ave
Ardmore Ave
15th St
14th St
11th Pl
11th St
Aviation Blvd
10th
9th
Ocean Dr
9th St
8th St
7th St
Hermosa Beach
11th St
11th Ct
Bayview Dr
Manhattan Ave
Palm Dr
Loma Dr
Valley Dr
Ardmore Ave
Pacific Coast Highway
Prospect Ave
Pine St
Gentry St
8th St
7th
A
6th St
5th St
6th St
4th St
2nd St
2nd St
Hwy 1
Hill St
Hermosa Ave
Bayview Dr
Monterey Blvd
Beach Dr
Valley Dr
1st St
Anita St
N Maria
N Lucia Ave
Palm Dr
Herondo St
N Francisca Ave
N Pacific Coast Hwy
Agate St
Yacht Club Way
Hopkins
Malina Ave


Figure 1

# TOPOGRAPHIC AND BOUNDARY MAP
## for the HERMOSA BEACH MAINTENANCE YARD




**VICINITY MAP**
NOT TO SCALE

## SCHEDULE B EXCEPTIONS

LEGAL DESCRIPTIONS AND SCHEDULE B EXCEPTIONS SHOWN HEREON PER LAWYERS PRELIMINARY TITLE REPORT NO. 09511964 – 68 DATED APRIL 23, 2012.

1. An easement for the purpose shown below and rights incidental thereto as set forth in a document
   Granted to: Hermosa Beach Land and Water Company
   Purpose: Pipe lines
   Recorded: In Book 1617, Page 47, and In Book 6450, Page 51, Both of Deeds
   Affects: Said land

   The exact location and/or extent of said easement is not disclosed in the public records.

2. Covenants, conditions and restrictions as set forth in the document
   Recorded: In Book 1901, Page 136, of Deeds

   This exception omits any covenant, condition or restriction based on race, color, religion, sex, handicap, familial status or national origin, unless and only to the extent that the covenant, condition or restriction (a) is not in violation of state or federal law, (b) is exempt under 42 U.S.C. Section 3607 or (c) relates to a handicap but does not discriminate against handicapped people.

3. An oil and gas lease for the term therein provided with certain covenants, conditions and provisions, together with easements, if any, as set forth therein.

   Dated: February 10, 1930
   Lessor: The City of Hermosa Beach
   Lessee: California–Ventura Oil Company, a Corporation, now California–Ventura Oil Company Ltd.
   Recorded: In Book 10150, Page 375, Official Records

   No assurance is made as to the present ownership of the leasehold created by said lease, nor as to other matters affecting the rights or interest of the lessor or lessee in said lease.

4. An easement for the purpose shown below and rights incidental thereto as set forth in a document
   Granted to: David W. Beaty, Gregory E. Noll and James H. Dodson
   Purpose: Ingress and egress for vehicular and foot traffic
   Recorded: March 25, 1965, as Instrument No. 5005, Official Records
   Affects: Portions of the herein described land, the exact location of which can be determined by examination of the above–mentioned instrument, which contains a complete legal description of the affected portions of said land.

5. Covenants, conditions and restrictions as set forth in the document referred to in the numbered item last above shown. This exception omits any restrictions based on race, color, religion, sex, sexual orientation, familial status, marital status, disability, national origin, source of income as defined in subdivision (p) of Section 12955, or ancestry, that restriction violates state and federal fair housing laws and is void, and may be removed pursuant to Section 12956.2 of the Government Code. Lawful restrictions under state and federal law on the age of occupants in senior housing or housing for older persons shall not be construed as restrictions based on familial status.

6. An easement for the purpose shown below and rights incidental thereto as set forth in a document
   Granted to: Eddie G. Collins
   Purpose: Ingress and egress for vehicular and foot traffic
   Recorded: June 1, 1965, as Instrument No. 776, Official Records
   Affects: Portions of the herein described land, the exact location of which can be determined by examination of the above–mentioned instrument, which contains a complete legal description of the affected portions of said land.

7. Covenants, conditions and restrictions as set forth in the document referred to in the numbered item last above shown. This exception omits any restrictions based on race, color, religion, sex, sexual orientation, familial status, marital status, disability, national origin, source of income as defined in subdivision (p) of Section 12955, or ancestry, that restriction violates state and federal fair housing laws and is void, and may be removed pursuant to Section 12956.2 of the Government Code. Lawful restrictions under state and federal law on the age of occupants in senior housing or housing for older persons shall not be construed as restrictions based on familial status.

8. An oil and gas lease for the term therein provided with certain covenants, conditions and provisions, together with easements, if any, as set forth therein.

   Dated: October 14, 1986
   Lessor: The City of Hermosa Beach
   Lessee: Windward Assoc/Mac Pherson Oil
   Recorded: March 26, 1987, as Instrument No. 87–452659, Official Records

   No assurance is made as to the present ownership of the leasehold created by said lease, nor as to other matters affecting the rights or interest of the lessor or lessee in said lease.

9. Covenants, conditions and restrictions as set forth in the document referred to in the numbered item last above shown. This exception omits any restrictions based on race, color, religion, sex, sexual orientation, familial status, marital status, disability, national origin, source of income as defined in subdivision (p) of Section 12955, or ancestry, that restriction violates state and federal fair housing laws and is void, and may be removed pursuant to Section 12956.2 of the Government Code. Lawful restrictions under state and federal law on the age of occupants in senior housing or housing for older persons shall not be construed as restrictions based on familial status.

   Modification(s) of said covenants, conditions and restrictions
   Recorded: March 26, 1987, as Instrument No. 87–452660, Official Records

10. An unrecorded oil and gas lease for the term therein provided, with certain covenants, conditions and provisions, together with easements, if any, as set forth therein.

    Dated: January 14, 1992
    Lessor: City of Hermosa Beach, a California Municipal Corporation
    Lessee: Windward Associates, a California Limited Partnership
    Disclosed by: Memorandum of Oil & Gas Lease
    Recorded: April 9, 1998, as Instrument No. 98–581404, Official Records

    No assurance is made as to the present ownership of the leasehold created by said lease, nor as to other matters affecting the rights or interest of the lessor or lessee in said lease.

11. A document subject to all the terms, provisions and conditions therein contained.
    Entitled: Notice of Conditional Use Permit and Acceptance of Conditions, City of Hermosa Beach
    Dated: March 17, 1998
    Executed by: Windward Associates, a California Limited Partnership
    Recorded: April 9, 1998, as Instrument No. 98–581405, Official Records

12. A document subject to all the terms, provisions and conditions therein contained.
    Entitled: Lease Restriction
    Dated: January 14, 1992
    Executed by: Windward Associates, a California Limited Partnership
    Recorded: April 9, 1998, as Instrument No. 98–581406, Official Records

13. A document subject to all the terms, provisions and conditions therein contained.
    Entitled: Agreement to be Bound
    Dated: April 1, 1998
    Executed by: City of Hermosa Beach, a Municipal Corporation
    Recorded: April 9, 1998, as Instrument No. 98–581407, Official Records

14. Water rights, claims or title to water, whether or not shown by the public records.

15. Title search discloses no open deeds of trust. Please confirm prior to close of escrow.

## PREPARED FOR

E&B NATURAL RESOURCES MGMT. CORP.
ATTN: MIKE FINCH, HSE MANAGER
1600 NORRIS RD.
BAKERSFIELD, CA 93308
PH (661) 392–7575 EXT. 104

## LEGAL DESCRIPTION

All that certain real property situated in the County of Los Angeles, State of California, described as follows:

Parcel 1:

Lots 11 to 18 inclusive, Block R, Tract No. 2002, in the City of Hermosa Beach, County of Los Angeles, State of California, as per Map recorded in Book 22, Pages 154 and 155 of Maps, in the Office of the County Recorder of said County, together with the Easterly half of Bard Street vacated, adjoining said Lots on the West.

Parcel 2:

Lots 11 to 18 inclusive, Block U, Tract No. 2002, in the City of Hermosa Beach, County of Los Angeles, State of California, as per Map recorded in Book 22, Pages 154 and 155 of Maps, in the Office of the County Recorder of said County, together with the Westerly half of Bard Street vacated, adjoining said Lots on the East.

Except therefrom Lots 11 and 12 of Parcel 2, all oil, gas, petroleum, asphaltum, hydrocarbon substances and other minerals lying 200 feet below the surface of said property and that may be produced or reserved therefrom together with an easement only as to that sub–surface portion of said land which lies 200 feet below the surface of said land for the purpose of prospecting for, passing and drilling through, drilling, mining, developing, removing and extracting oil, gas, petroleum, asphaltum, hydrocarbon substances and other minerals from said land and other land by means of wells drilled or openings made only on other land and then only into the subsurface of said land and not through or upon the surface of said land; provided, however, all drilling and mining operations shall be in compliance with the then requirements of the law, and provided further that the right to enter upon the surface of said land is expressly not reserved or excepted, as excepted and reserved by Publix Title Company in Deed recorded March 20, 1961, as Instrument No. 541, of Official Records of Los Angeles County.

Parcel 3:

That portion of Lot "A" of Tract No. 2002, in the City of Hermosa Beach, County of Los Angeles, State of California, as per Map recorded in Book 22, Pages 154 and 155 of Maps, in the Office of the County Recorder of said County, lying Northerly of the Easterly prolongation of the Northerly line of 6th Street, 40 feet wide and Southerly of the Easterly prolongation of the Southerly line of 8th Street, 40 feet wide, as shown on said Map.

**(LEASE AREA: DOES NOT INCLUDE THAT PORTION OF LOT A NORTH OF THE EASTERLY PROLONGATION OF LOT 11, BLOCK R, TRACT NO. 2002. AS SHOWN HEREON).**

Except therefrom the title and exclusive right to all of the minerals and mineral ores of every kind and character now known to exist or hereafter discovered upon, within or underlying said land or that may be produced therefrom including, without limiting the generality of the foregoing, all petroleum, oil, natural gas and other hydrocarbon substances and products derived therefrom together with the exclusive and perpetual right of said grantor, its successors and assigns, of ingress and egress beneath the surface of said land to explore for, extract, mine and remove the same, and to make such use of the said land beneath the surface as is necessary or useful in connection therewith, which use may include lateral or slant drilling, digging, boring, or sinking of wells, shafts or tunnels; provided however, that said grantor, its successors and assigns, shall not use the surface of said land in the exercise of any of said rights and shall not disturb the surface of said land or any improvements thereon or remove or impair the lateral or subjacent support of said land or any improvements thereof, as reserved in Deed from Pacific Electric Railway Company, a Corporation, recorded as Document No. 508, Official Records.

## BENCHMARK

LOS ANGELES COUNTY PUBLIC WORKS BENCHMARK NO. Y–12136 ELEV. 92.501 FEET 2005 (NAVD 88) BEING A L&DPW TAG IN W CB 900MM(3FT) S/O ECR @ SW COR OF PACIFIC COAST HIGHWAY AND PIER AVENUE.

## ASSESSOR'S PARCEL NUMBER

APN 4187–031–900

## BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS CYPRESS AVENUE WHICH BEARS N12°10'00"W PER TRACT NO. 2002 M.B. 22/PAGES 154–155.

## DATE OF SURVEY

APRIL 23, 2012

## GENERAL PLAN

IND – INDUSTRIAL

## ZONING

M1 – LIGHT MANUFACTURING
BUILDING SETBACKS – NONE (EXCEPT AS REQUIRED BY A PRECISE PLAN), BUILDING HEIGHT = 35' MAX.

## FLOOD ZONE

ZONE X – (UNSHADED), AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN. PER FIRM MAP NO. 06037C1907F REVISED 9–26–08.

## AREA OF CITY PARCEL

PARCEL 1 – 23,990 SQ. FT.
PARCEL 2 – 27,492 SQ. FT.
PARCEL 3 – 17,914 SQ. FT.
TOTAL AREA = 69,396 SQ. FT. (1.593 ACRES)

## LEASE AREA

PARCEL 1 – 23,990 SQ. FT.
PARCEL 2 – 27,492 SQ. FT.
PARCEL 3 SOUTHERLY LEASE AREA – 8,764 SQ. FT.
TOTAL AREA = 60,246 SQ. FT. (1.383 ACRES)

## LEGAL OWNER

CITY OF HERMOSA BEACH, A MUNICIPAL CORPORATION
1315 VALLEY DRIVE
HERMOSA BEACH, CA 90254

## LINETYPES

- DENOTES SURVEYED PROPERTY LINE
- DENOTES EXISTING LOT LINES
- DENOTES STREET CENTER LINE
- DENOTES LEASE AREA LIMIT LINE
- DENOTES FLOWLINE
- 16"W(STL) — DENOTES SURVEYED WATER LINE
- 20"W(STL) — DENOTES RECORD WATER LINE
- 8"SD(CMP) — DENOTES SURVEYED STORM DRAIN LINE
- (SD) — DENOTES RECORD STORM DRAIN LINE
- E — DENOTES SURVEYED ELECTRICAL LINE
- (ELEC) — DENOTES RECORD ELECTRICAL LINE
- (8"S) — DENOTES RECORD SEWER LINE
- (3"G) — DENOTES RECORD GAS LINE
- (TELE) — DENOTES RECORD TELEPHONE LINE
- OH — EXISTING OVERHEAD LINE
- 1200 — EXISTING CONTOUR
- WROUGHT IRON FENCE (SURVEYED)
- CHAIN LINK FENCE (SURVEYED)
- EDGE OF ROADWAY PAVEMENT
- DENOTES EXISTING CONCRETE
- DENOTES EXISTING WALL

## SYMBOLS

- SEWER MANHOLE
- STORM DRAIN MANHOLE
- ELECTRICAL MANHOLE
- TELEPHONE MANHOLE
- MANHOLE (TYPE UNKNOWN)
- WM — EXISTING WATER METER
- WV — WATER VALVE
- HB — HOSEBIB
- FIRE HYDRANT
- GM — GAS METER
- GV — GAS VALVE
- SIGN
- PB — ELECTRICAL PULLBOX
- CATV — CABLE TV PULLBOX
- FP — FLAG POLE
- TSPB — TRAFFIC SIGNAL PULLBOX
- TELE — TELEPHONE PULLBOX
- SLPB — STREET LIGHT PULLBOX
- EM — ELECTRIC METER
- EC — ELECTRIC CABINET
- EB — ELECTRICAL BOX
- DI — DROP INLET
- PB — ELECTRIC PULLBOX
- ICV — IRRIGATION CONTROL VALVE
- ICB — IRRIGATION CONTROL BOX
- T — TRANSFORMER
- EXISTING TREE
  DENOTES TREE TRUNK DIAMETER
  DENOTES TREE CANOPY DIAMETER
- EXISTING PALM
- SURVEY BENCHMARK
- SURVEY CONTROL POINT
- MB — MAILBOX

## SURVEYORS NOTES

Item 1–Surveyor's Note: 1. Document 1617–47 is not an easement. It is a deed to Warren Gillelen for pipelines, appurtenances and rights of way that were then owned by Hermosa Beach Land & Water Co. It contains descriptions that can be located. However, we don't have enough information at this time to locate them. 2. Document 6450–51 is a deed to Herbert E. Culler et al reserving rights for pipelines per first described deed. Deed specifies that grantee, successors, heirs, and assigns shall not drill or excavate for oil, petroleum etc.

Item 2–Surveyor's Note: Document specifies that grantee, successors, and assigns shall not drill, excavate, or bore for oil or petroleum, etc.

Item 3–Surveyor's Note: Oil & Gas lease together with easements for pipelines, powerlines, telephone, and telegraph over Lots 11–18 Block R, Lots 13–18 Block U, Bard Street (abandoned) of Tract No. 2002, MB 22, pages 154–155

Item 8–Surveyor's Note: Oil & Gas lease over Lots 11–18, Block R, Lots 11–18, Block U & a portion of Lot A, & a portion of Bard Street, vacated adjoining said lots of Tract No. 2002, MB 22, pages 154–155

Item 9–Surveyor's Note: Amendment to oil and gas lease.

Item 10–Surveyor's Note: Drill Site Lots 11–18 Block R, Lots 11–18 Block U, Bard Street (abandoned), Lot A (abandoned) of Tract No. 2002, MB 22, pages 154–155

LICENSED LAND SURVEYOR
STEFAN C. LANTHIER
L.S. 7259
EXP. 12/31/12
SURVEYOR
STATE OF CALIFORNIA
SEAL

05–17–12
05–11–12
05–04–12


Cornerstone Land Surveying, Inc.
Civil • Surveying • Planning
958 Temescal Circle
Corona, CA 92879
(951) 736–0200 PH (951) 736–0300 FAX

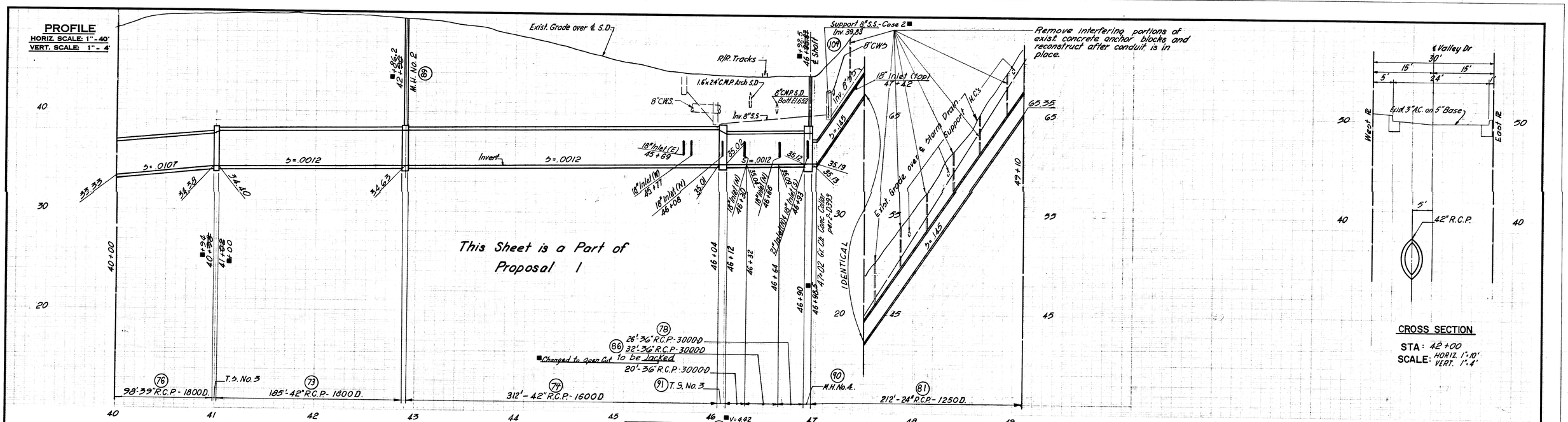

DRAWING FILE LOCATION: C:\12–188 HERMOSA\188 HERMOSA BEACH TOPO.DWG

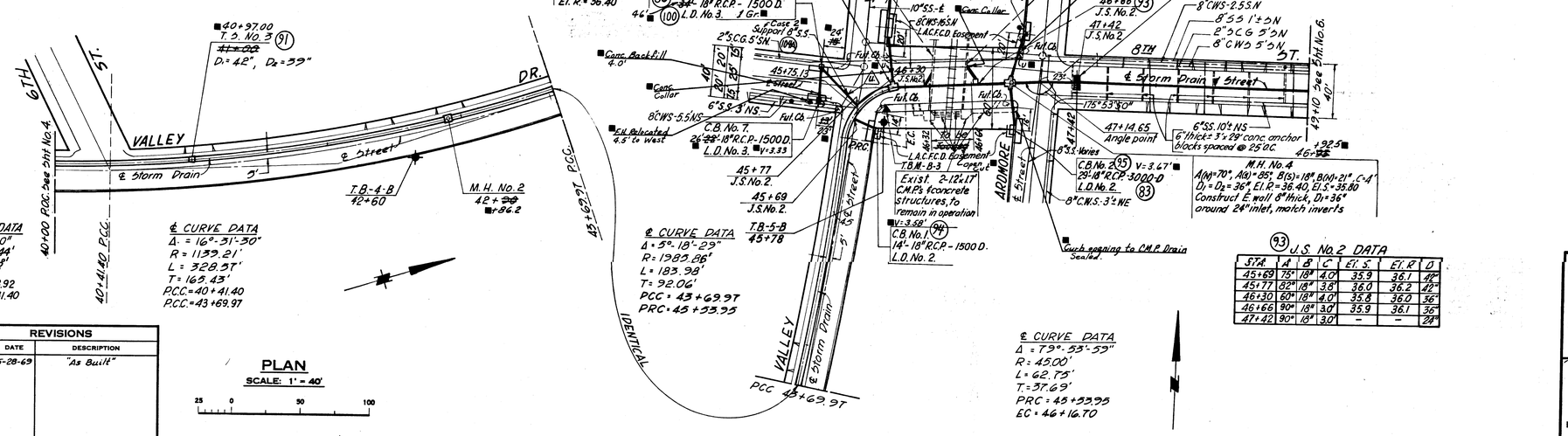
TOPOGRAPHIC AND BOUNDARY MAP
HERMOSA BEACH MAINT. YARD
555 SIXTH ST.
HERMOSA BEACH, CA 90254

SHEET 1 OF 1

JN12–188

Figure 2







## BENCH MARK

TBM-B-3. Chis'd □ South Curb 8th St. 1 ft. East of CR. at the S.E. Cor. of the Int. of Valley Dr. & 8th St.
El. 44.06.

## (93) J.S. No. 2 DATA

| STA | A | B | C | El. S. | El. R | D |
|---|---|---|---|---|---|---|
| 45+69 | 75° | 18" | 4.0' | 35.9 | 36.1 | 42" |
| 45+77 | 82" | 18" | 3.8' | 36.0 | 36.2 | 42" |
| 46+30 | 60" | 18" | 4.0' | 35.8 | 36.0 | 36" |
| 46+66 | 90" | 18" | 3.0' | 35.9 | 36.1 | 36" |
| 47+42 | 90" | 18" | 3.0' | – | – | 24" |

## PLAN

SCALE: 1" = 40'

25 0 50 100

| REVISIONS | | |
|---|---|---|
| MARK | DATE | DESCRIPTION |
| ■ | 5-28-69 | "As Built" |

DRAWN BY: CITY
CHECKED BY: CITY
DESIGNED BY: CITY
SUBMITTED BY: C.W.H.

1964 STORM DRAIN BOND ISSUE

CITY OF HERMOSA BEACH
OFFICE OF THE CITY ENGINEER
APPROVED Jan. 14 1966
BY: John E. Stevens
JOHN E. STEVENS R.C.E. 11026

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING-ARCHITECTURE
DATE Jan. 13 1966
BY: H. M. Tranbarger
K.S. TRANBARGER R.C.E. 10651

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
PROJECT NO. 623, UNIT 2
HERMOSA BEACH
LINE B

CONCRETE CONDUIT
40+00 TO 49+10
PLAN, PROFILE & SECTION

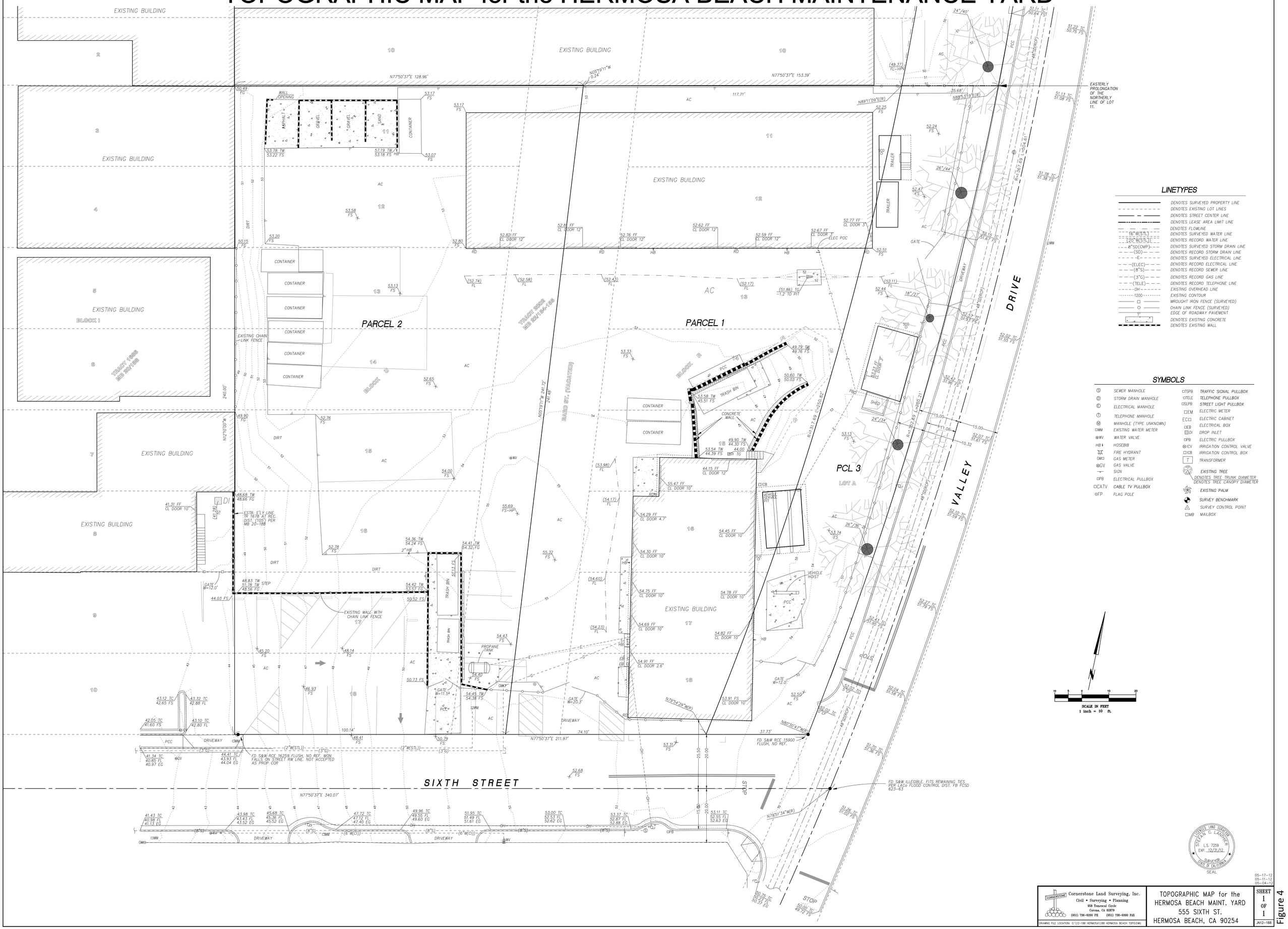
RECOMMENDED BY: C. F. Gilbelly, DIVISION ENGINEER (SEWERS)
APPROVAL RECOMMENDED BY: William A. Ramson, ASST. CHIEF DEPUTY ENGINEER
APPROVED BY: Walter E. Wood, CHIEF ENGINEER

| SCALE | DATE | DWG. NO. 364-623-D4.5 |
|---|---|---|
| AS SHOWN | AUG. '67 | SHEET 5 OF 8 |

"AS BUILT" DRAWING

Figure 3

# TOPOGRAPHIC MAP for the HERMOSA BEACH MAINTENANCE YARD




05-17-12
05-11-12
05-04-12

Cornerstone Land Surveying, Inc.
Civil • Surveying • Planning
958 Temescal Circle
Corona, CA 92879
(951) 736-0200 PH (951) 736-0300 FAX

DRAWING FILE LOCATION: C:\12-188 HERMOSA\188 HERMOSA BEACH TOPO.DWG

TOPOGRAPHIC MAP for the
HERMOSA BEACH MAINT. YARD
555 SIXTH ST.
HERMOSA BEACH, CA 90254

SHEET 1 OF 1

JN12-188

Figure 4

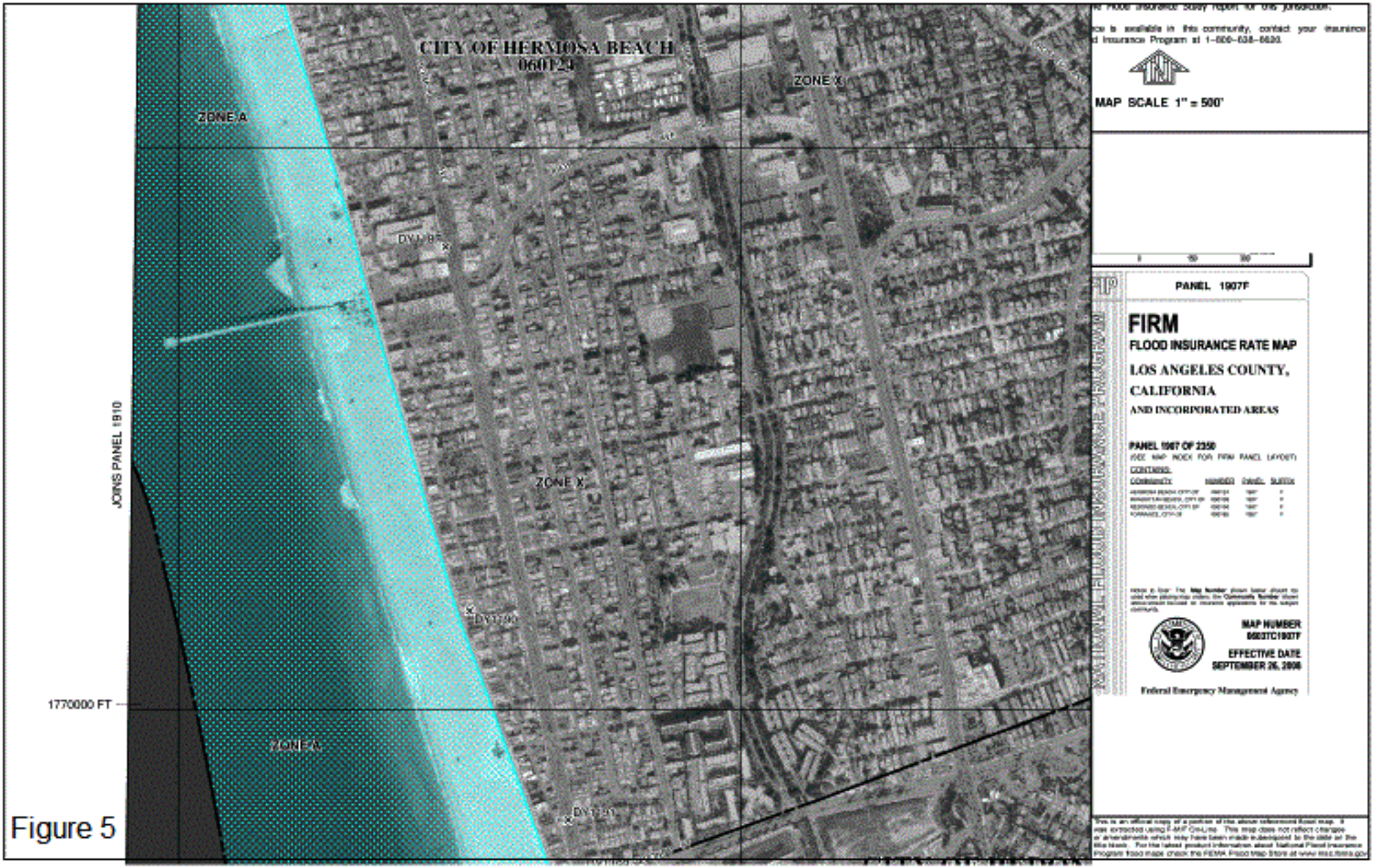
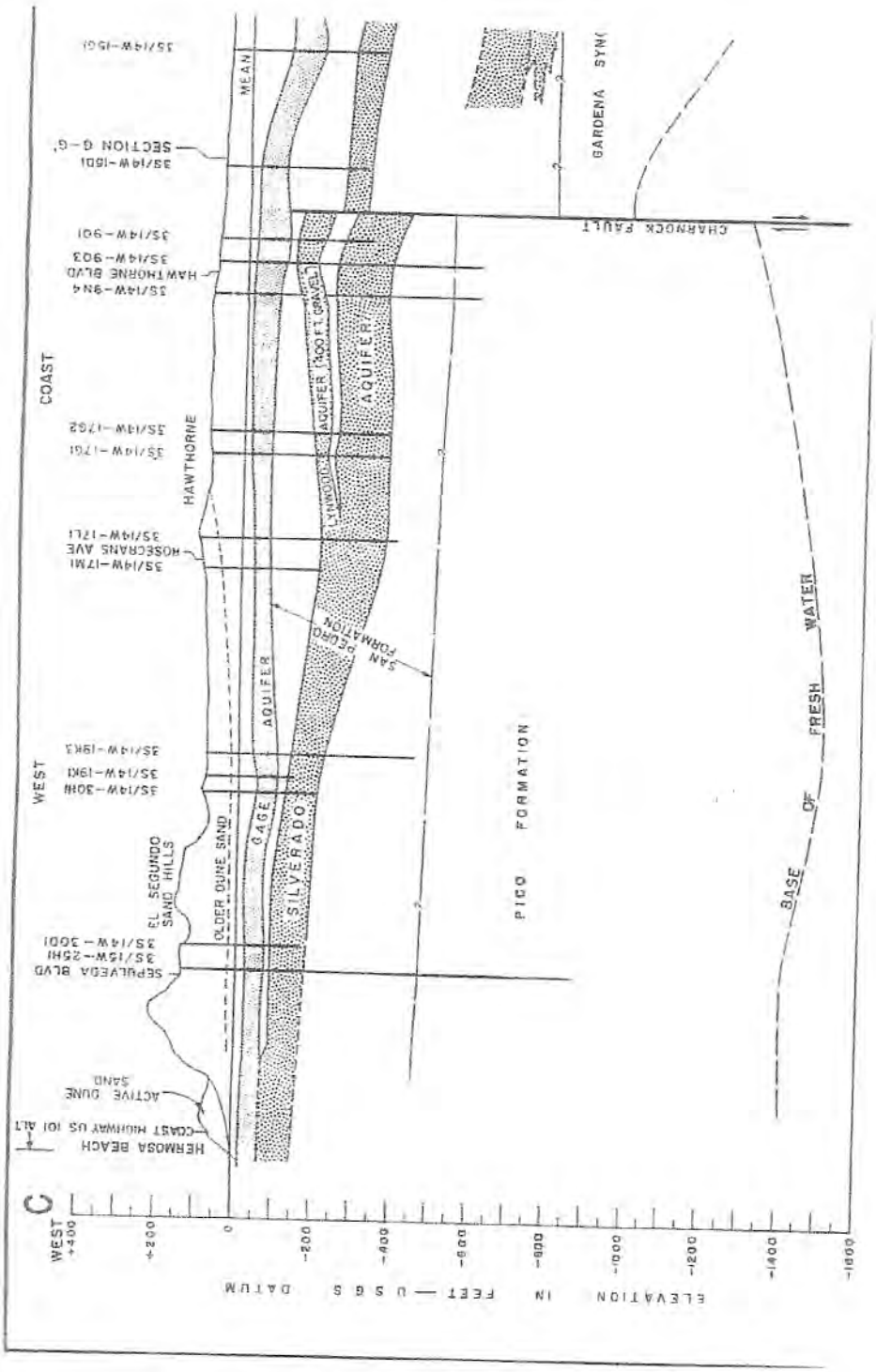

CITY OF HERMOSA BEACH
060124
ZONE A
ZONE X
ZONE X
ZONE A
JOINS PANEL 1910
1770000 FT
MAP SCALE 1" = 500'
PANEL 1907F
FIRM
FLOOD INSURANCE RATE MAP
LOS ANGELES COUNTY,
CALIFORNIA
AND INCORPORATED AREAS
PANEL 1907 OF 2350
MAP NUMBER
06037C1907F
EFFECTIVE DATE
SEPTEMBER 26, 2008
Federal Emergency Management Agency

Figure 5




PORTION OF PLATE 6B
GROUNDWATER GEOLOGY
COASTAL PLAIN OF
LOS ANGELES
BULLETIN 104, WRD

Figure 6

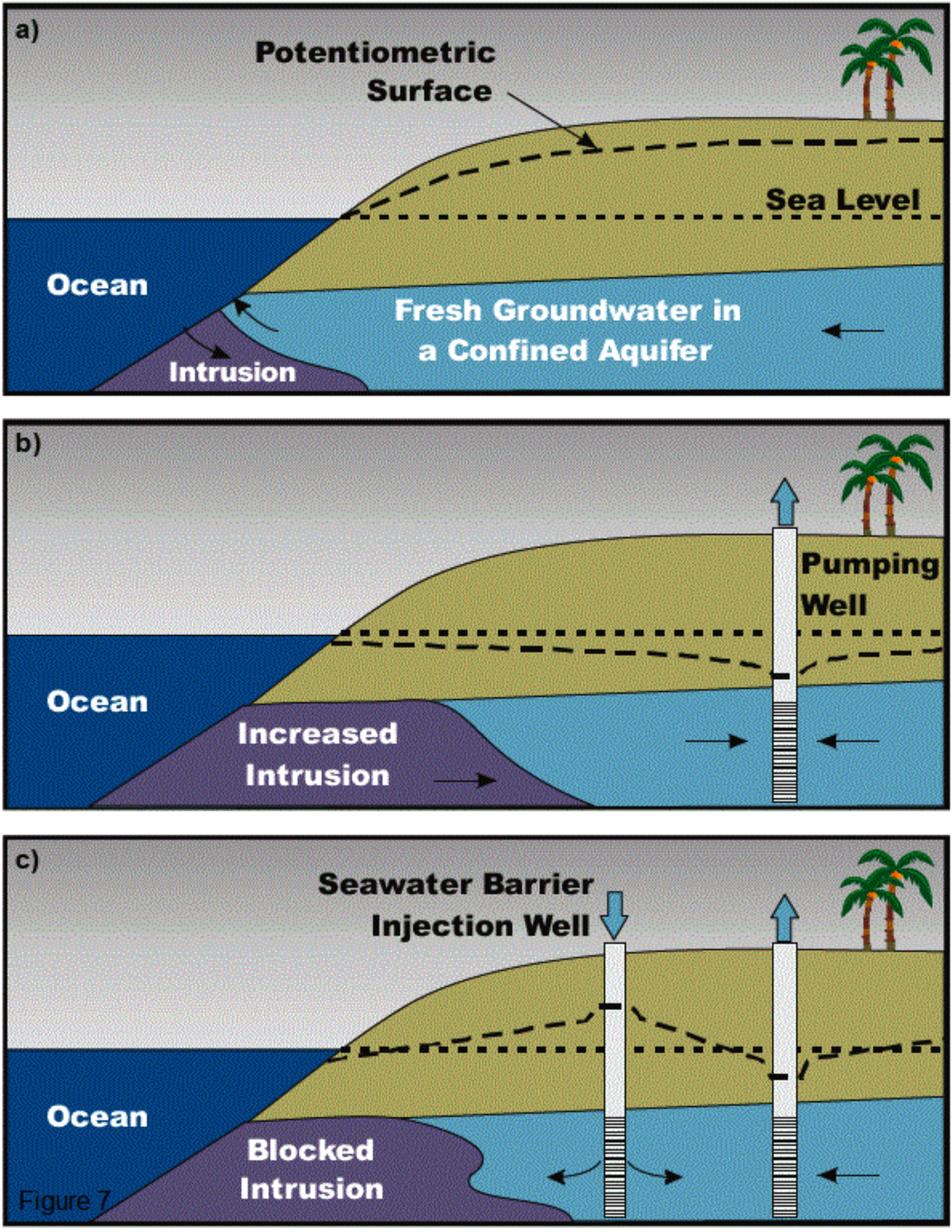

a)
Potentiometric Surface
Sea Level
Ocean
Fresh Groundwater in a Confined Aquifer
Intrusion
b)
Pumping Well
Ocean
Increased Intrusion
c)
Seawater Barrier Injection Well
Ocean
Blocked Intrusion

Figure 7

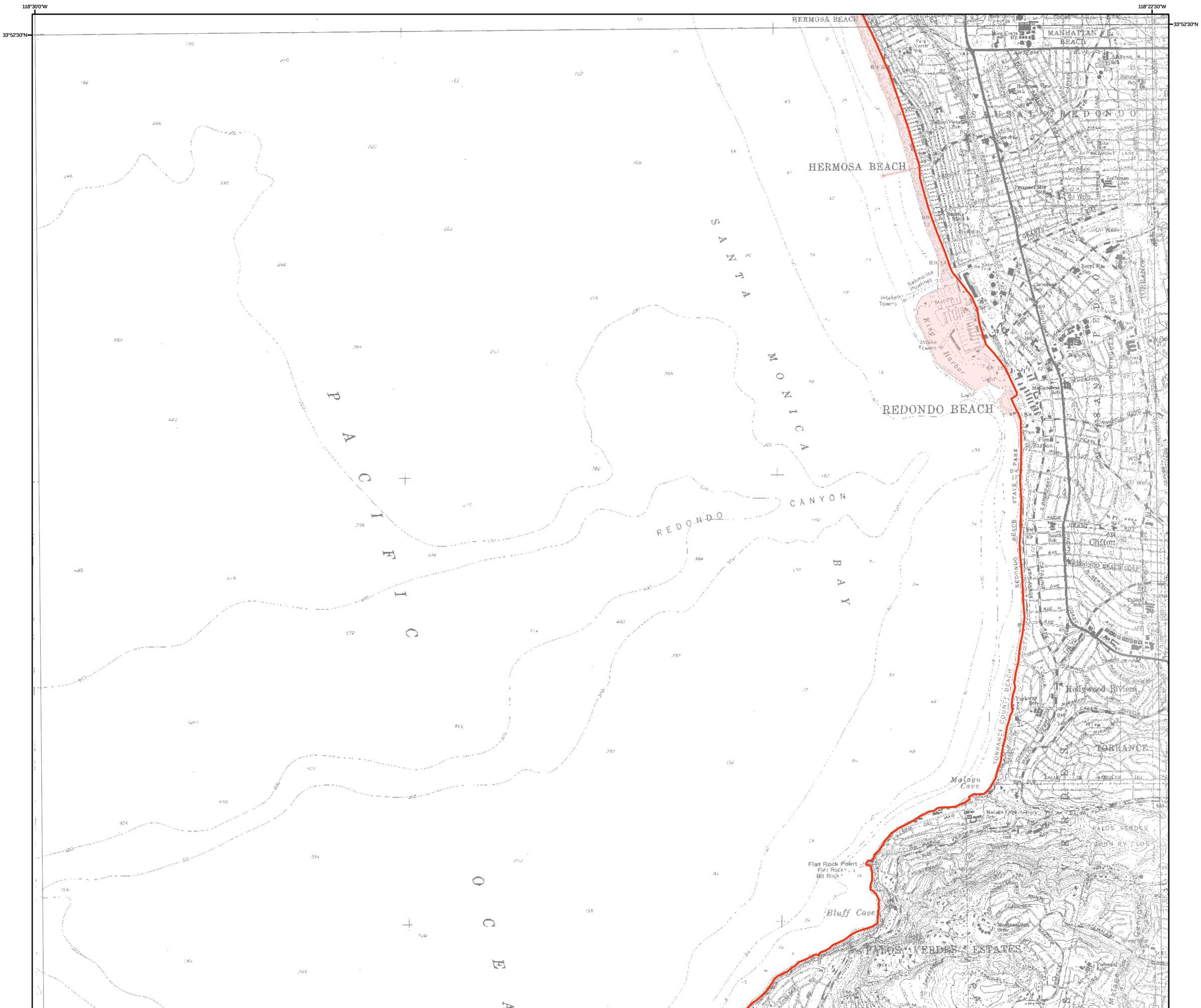
WRD Boundary
Santa Monica
Los Angeles
Central
West
Inglewood
Newport
Inglewood
Uplift
Los Angeles River
Rio Hondo
San Gabriel River
Downey
Santa Fe Springs
El Segundo
Compton
West Coast Basin
Pacific Ocean
Manhattan Beach
Redondo Beach
Torrance
Carson
Basin
Lakewood
Cerritos
LOS ANGELES COUNTY
ORANGE COUNTY
Dominguez Gap Barrier Project
Long Beach
Alamitos Gap Barrier Project
N
W
E
S
California
0
5
Miles

Figure 8

California Emergency Management Agency
California Geological Survey
University of Southern California

# Tsunami Inundation Map for Emergency Planning
## Redondo Beach Quadrangle

State of California
County of Los Angeles




# TSUNAMI INUNDATION MAP FOR EMERGENCY PLANNING

## State of California ~ County of Los Angeles

## REDONDO BEACH QUADRANGLE

March 1, 2009

SCALE 1:24,000

0.5 0.25 0 0.5 1 Miles

1,000 500 0 1,000 2,000 3,000 4,000 5,000 Feet

0.5 0.25 0 0.5 1 Kilometers

## METHOD OF PREPARATION

Initial tsunami modeling was performed by the University of Southern California (USC) Tsunami Research Center funded through the California Emergency Management Agency (CalEMA) by the National Tsunami Hazard Mitigation Program. The tsunami modeling process utilized the MOST (Method of Splitting Tsunamis) computational program (Version 0), which allows for wave evolution over a variable bathymetry and topography used for the inundation mapping (Titov and Gonzalez, 1997; Titov and Synolakis, 1998).

The bathymetric/topographic data that were used in the tsunami models consist of a series of nested grids. Near-shore grids with a 3 arc-second (75- to 90-meters) resolution or higher, were adjusted to "Mean High Water" sea-level conditions, representing a conservative sea level for the intended use of the tsunami modeling and mapping.

A suite of tsunami source events was selected for modeling, representing realistic local and distant earthquakes and hypothetical extreme undersea, near-shore landslides (Table 1). Local tsunami sources that were considered include offshore reverse-thrust faults, restraining bends on strike-slip fault zones and large submarine landslides capable of significant seafloor displacement and tsunami generation. Distant tsunami sources that were considered include great subduction zone events that are known to have occurred historically (1960 Chile and 1964 Alaska earthquakes) and others which can occur around the Pacific Ocean "Ring of Fire."

In order to enhance the result from the 75- to 90-meter inundation grid data, a method was developed utilizing higher-resolution digital topographic data (3- to 10-meters resolution) that better defines the location of the maximum inundation line (U.S. Geological Survey, 1993; Intermap, 2003; NOAA, 2004). The location of the enhanced inundation line was determined by using digital imagery and terrain data on a GIS platform with consideration given to historic inundation information (Lander, et al., 1993). This information was verified, where possible, by field work coordinated with local county personnel.

The accuracy of the inundation line shown on these maps is subject to limitations in the accuracy and completeness of available terrain and tsunami source information, and the current understanding of tsunami generation and propagation phenomena as expressed in the models. Thus, although an attempt has been made to identify a credible upper bound to inundation at any location along the coastline, it remains possible that actual inundation could be greater in a major tsunami event.

This map does not represent inundation from a single scenario event. It was created by combining inundation results for an ensemble of source events affecting a given region (Table 1). For this reason, all of the inundation region in a particular area will not likely be inundated during a single tsunami event.

References:

Intermap Technologies, Inc., 2003, Intermap product handbook and quick start guide: Intermap NEXTmap document on 5-meter resolution data, 112 p.

Lander, J.F., Lockridge, P.A., and Kozuch, M.J., 1993, Tsunamis Affecting the West Coast of the United States 1806-1992: National Geophysical Data Center Key to Geophysical Record Documentation No. 29, NOAA, NESDIS, NGDC, 242 p.

National Atmospheric and Oceanic Administration (NOAA), 2004, Interferometric Synthetic Aperture Radar (IfSAR) Digital Elevation Models from GeoSAR platform (EarthData): 3-meter resolution data.

Titov, V.V., and Gonzalez, F.I., 1997, Implementation and Testing of the Method of Tsunami Splitting (MOST): NOAA Technical Memorandum ERL PMEL – 112, 11 p.

Titov, V.V., and Synolakis, C.E., 1998, Numerical modeling of tidal wave runup: Journal of Waterways, Port, Coastal and Ocean Engineering, ASCE, 124 (4), pp 157-171.

U.S. Geological Survey, 1993, Digital Elevation Models: National Mapping Program, Technical Instructions, Data Users Guide 5, 48 p.

Table 1: Tsunami sources modeled for the Los Angeles County coastline.

| Sources (M = moment magnitude used in modeled event) | | Areas of Inundation Map Coverage and Sources Used | | |
|---|---|---|---|---|
| | | Malibu | Santa Monica | Los Angeles Harbor |
| Local Sources | Anacapa-Dume Fault | X | X | |
| | Catalina Fault | X | X | X |
| | Channel Island Thrust Fault | | X | |
| | Newport-Inglewood Fault | | | X |
| | Santa Monica Fault | X | X | |
| | Palos Verdes Landslide #1 | | X | X |
| | Palos Verdes Landslide #2 | | | X |
| Distant Sources | Cascadia Subduction Zone #2 (M9.2) | | X | X |
| | Central Aleutians Subduction Zone#1 (M8.9) | | X | X |
| | Central Aleutians Subduction Zone#2 (M8.9) | | X | X |
| | Central Aleutians Subduction Zone#3 (M9.2) | X | X | X |
| | Chile North Subduction Zone (M9.4) | X | X | X |
| | 1960 Chile Earthquake (M9.3) | | X | X |
| | 1964 Alaska Earthquake (M9.2) | X | X | X |
| | Japan Subduction Zone #2 (M8.8) | | X | X |
| | Kuril Islands Subduction Zone #2 (M8.8) | | X | X |
| | Kuril Islands Subduction Zone #3 (M8.8) | | X | X |
| | Kuril Islands Subduction Zone #4 (M8.8) | | X | X |

## MAP EXPLANATION

Tsunami Inundation Line

Tsunami Inundation Area

## PURPOSE OF THIS MAP

This tsunami inundation map was prepared to assist cities and counties in identifying their tsunami hazard. It is intended for local jurisdictional, coastal evacuation planning uses only. This map, and the information presented herein, is not a legal document and does not meet disclosure requirements for real estate transactions nor for any other regulatory purpose.

The inundation map has been compiled with best currently available scientific information. The inundation line represents the maximum considered tsunami runup from a number of extreme, yet realistic, tsunami sources. Tsunamis are rare events; due to a lack of known occurrences in the historical record, this map includes no information about the probability of any tsunami affecting any area within a specific period of time.

Please refer to the following websites for additional information on the construction and/or intended use of the tsunami inundation map:

State of California Emergency Management Agency, Earthquake and Tsunami Program:
http://www.oes.ca.gov/WebPage/oeswebsite.nsf/Content/B1EC51BA215931768825741F005E8D80?OpenDocument

University of Southern California – Tsunami Research Center:
http://www.usc.edu/dept/tsunamis/2005/index.php

State of California Geological Survey Tsunami Information:
http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/index.htm

National Oceanic and Atmospheric Agency Center for Tsunami Research (MOST model):
http://nctr.pmel.noaa.gov/time/background/models.html

## MAP BASE

Topographic base maps prepared by U.S. Geological Survey as part of the 7.5-minute Quadrangle Map Series (originally 1:24,000 scale). Tsunami inundation line boundaries may reflect updated digital orthophotographic and topographic data that can differ significantly from contours shown on the base map.

## DISCLAIMER

The California Emergency Management Agency (CalEMA), the University of Southern California (USC), and the California Geological Survey (CGS) make no representation or warranties regarding the accuracy of this inundation map nor the data from which the map was derived. Neither the State of California nor USC shall be liable under any circumstances for any direct, indirect, special, incidental or consequential damages with respect to any claim by any user or any third party on account of or arising from the use of this map.

Figure 9

# APPENDIX A – HYDROLOGY STUDY

# HYDROLOGY STUDY

## E&B Oil Development Project
## 555 6th Street
## Hermosa Beach, CA 90254

Prepared at the Request of
E & B Natural Resource Management Corporation
1600 Norris Road
Bakersfield, CA 93308
(661) 679-1730

Prepared Under the Supervision of:
Ashba Engineers Ltd.
P.O. Box 90833
Long Beach, CA 90809-0833
(562) 989-9154

Project Number: 8036
Revised: October 25, 2012
Issued Date: November 2, 2012

# HYDROLOGY STUDY

## E & B Oil Development Project

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| Figure 3 | Existing Site Hydrology Map |
| Figure 4 | Storm Drain Plans |
| Figure 5 | Interim Hydrology Map |
| Figure 6 | Final Hydrology Map |

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| | |
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| Tsunami Map | B |
| I HI.3 Isohyet | C |
| Runoff Coefficient | D |
| Hydrology Summary | E |
| TC Calculator Results | F |
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## INTRODUCTION

The E & B Oil Development Project in Hermosa Beach encompasses a phased re-development of an existing 1.3 acre site. Redevelopment activities are proposed to include:

- Demolition of existing Site Improvement,
- Rough grading, Fencing and Sound Walls,
- Construction of Initial Oil Well Cellar and Temporary Production Support Activities,
- Drilling and Feasibility Testing,
- Soils Remediation and/or Removals of Contaminated Soils,
- Construction of Final Site Improvements, for Final Oil Well Drilling, and for Permanent Production and Support Facilities

Throughout these construction activities, the construction will be monitored under an NPDES Permit for construction activities to control the potential of discharge of materials from the site during a rain event.

During early construction phases, Storm Water Pollution Prevention, SWPPP, efforts will be made to separate rainfall exposure to construction materials. Standard and specific Best Management Practices, BMPs, will be used to achieve source control of the material and effectively separate them from the surface flow stream. They may include:

- Sandbags
- Construction Entrance
- Berming
- Covering
- Containing

Phase 2 site development will include construction of a small concrete well cellar, 40 feet long by 8 feet wide and 8 feet in depth, minimum. The remainder of the site within the fence will be graded to surface drain towards a detention basin. Surface paving will be pervious crushed aggregate base. The rainwater runoff will be intercepted by BMPs and directed to detention basins for future disposal. Areas occupied by production equipment will be bermed to contain any potential spill as well as storm water. These wastewaters will be processed and combined with production waters. These will in turn be re-injected.

With the construction of the ultimate improvements, Phase 4, on site grading and storm drain systems will direct all storm runoff to the depression tank farm containment area. The tank farm will be sized to detain a 100-year, 24-hour storm event over the site in addition to the Tank displacement and Processing facilities as well as 110% of the largest tank volume. All detained runoff in this event will be processed and re-injected. The net effect will be that all site runoff interior of the site walls will be injected and only a small exterior amount of runoff from landscape areas will be discharged from the site.

**Purpose and Scope**

The purpose of this study is to determine the amount of anticipated rain fall over the site and to demonstrate adequate storm water drainage for the proposed site improvements at the proposed E & B Oil Development site at 555 6th Street Hermosa Beach, with no impact to the downstream areas; or any existing storm drain facilities. In addition this calculation will be used to assist in sizing of SWPPP BMPs.

The first calculations are to determine the amount of runoff currently leaving the site and their distribution to the surrounding streets and/or drainage facilities. This establishes the baseline for measuring the effect of any discharges.

Secondly, the analysis will determine the amount of runoff that will be handled by the two primary hydraulic cases during the phased development.

Finally, an analysis of the amount of runoff to be handled under SUSMP requirements, to mitigate the pollutants from entering the discharge stream is included. This calculation is for reference, since the net effect is to have no discharge and to use all of the anticipated storm water for injection.

Calculations will also be used to assist in the determination of the runoff quantities to be addressed in the SWPPP plan for the control of pollutants during construction and for sizing of temporary detention facilities.

With this in mind, there are three analyses to this study. The first analysis is the analysis of the existing condition. How much rainwater runoff is contributing to each existing discharge point from the site.

The second is the analysis of the proposed on-site drainage during the early phases of construction. During these phases onsite drainage will be detained, infiltrated, evaporated and any remainder allow to runoff the site.

The third analysis is for sizing the ultimate onsite detention facilities. The two conditions vary in that ultimately the site will be completely paved while until that time the site will be covered with base material. Consequently, the pervious to impervious ratio changes significantly. And thereby the amount of rainfall that becomes runoff varies significantly from the early phases to the final site disposition. E&B Resources has conservatively selected 100-year frequency, 24-hour storm event to use in determining detainment volumes for site design.

**Existing Site Conditions**

555 6th Street is at the northwest corner of 6th Street and Valley Drive, see Figure 2 Topographic Boundary Map. It is used as the Hermosa Beach City Maintenance Yard. It is fully developed with two large buildings and surface asphalt or concrete paving throughout with the exception of a small area on the west side. The buildings are serviced by underground water, gas and sewer services from 6th Street. Power and telephone are supplied from overhead lines along 6th Street.

Portions of the site slopes to the west with a slight embankment along the west property line. Some areas of the site slope to the south before turning and descending to the west along 6th Street.

There are two areas of localized sump conditions on the site, each with an existing drain at their low points.

One is at the low point of the entry drive from Valley Drive in front of the long maintenance building. This drain is believed to be connected to the existing Los Angeles County Flood Control District storm drain in Valley Drive. The other is at the bottom of a ramp drive down to the lower level of the auto maintenance shop. The outlet to this sump drain has not been determined.

Except for existing operations inside of the building, the site is used for outdoor storage of materials, supplies and furnishings such as trash receptacles, light standards, concrete

bumpers, sand and gravel. Additional storage is provided by several onsite containers. No inventory of materials has been made.

For the most part, rainwater runoff is conducted by surface sheet flow across these paved surfaces to the west and south to Sixth Street. A small portion of the westerly property line is an unimproved embankment and a small portion of the existing runoff may have an opportunity to infiltrate before overflowing south along the property line to 6th Street. Figure 3, Existing Hydrology Map.

A significant contributory area drains to the existing sump/drain near the entry drive from Valley Drive in front of the long maintenance building.

Finally a minor amount of the site paralleling Valley Drive flows east through a small border of existing planting with trees across the public sidewalk and into Valley Drive. This flow runs north and south along Valley Drive via its curbs and enters the existing Los Angeles County Flood Control District Project storm drain.

This storm drain consists of reinforced concrete pipe (RCP) with catch basins and connecting pipes along its length, ultimately discharging to the Pacific Ocean at an outfall at the projection of Herondo Street as a 9' X 11' Reinforced Concrete box. Recent efforts to improve the quality of discharge from this storm drain have been installed by Los Angeles County Department of Public Works. LACFCD Project Number 1105 appears to create a low flow diversion to the sanitary sewer system and, thereby the most potentially polluted flows to the ocean are averted, Figure 4, LACFCD.

The project is seven blocks uphill from the beach. The site contains an existing high point from which all areas drain. There are no existing run-on to the site. The California Tsunami Map indicates that the site is not within the influence zone of a Tsunami wave. There are no rivers or streams in the vicinity of the site. Nor is the site within a flood hazard zone. As determined by FEMA Map, the site is above the 500-year flood plain, and is not in an area protected by levees or dams, see Appendices.

The topography of the site as determined by a land survey reveals a relatively flat site with a general differential in surface levels of three feet over the usable paved surface at the

City's Maintenance Yard. The elevation of the site is at approximately 55 feet above mean seal level. This surface has been created by embankment and filling along the westerly portion of the site leaving a small unimproved bank along this property line. Other areas of the site have been raised by filling the northeast portion of the site over time (former landfill area).

This leveling of the site is very apparent at the southwest corner of the property where employee parking is available directly off of 6th Street. Approximately half way along the project's 6th Street frontage, 6th Street grade breaks and descends steeply to the west, creating a differential in elevation between this parking area and the maintenance yard of eight feet. This difference is compensated for by an existing eight foot high retaining wall.

**Hydrology Analysis and Methodology**

Hydrology analysis is based on Los Angeles County Department of Public Works Standards and Procedures of the January 2006 Hydrology Manual and Modified Rational Method computer program (MODRAT and TC_Calculator Files). This together with the existing conditions survey establish the amounts and distribution of existing runoff.

These analysis make use of the existing conditions survey map, and the proposed Phase 2 and 3 grading plans. These establish the contributory subareas for calculation of the anticipated rainfall runoff. They also establish the length of the path of travel of the runoff and its slope.

With the proposed site re-contouring and removal of paved surfaces the second analysis determines the amount of rain fall that would become runoff for purposed of control and detention, see Figure 5. And, finally with the ultimate paving of the site a third analysis will determine the amount that is to be detained within the tank farm awaiting final processing and injection, see Figure 6.

**Design Frequency and Data**

Redondo Beach ISOYHET map at the Hermosa Beach location indicates a soil type of 003 and 5.1 inches of rain fall for a 50-year frequency, 24-hour storm. Fifty year frequency design is used generally in design to sump condition. E&B Resource Management has selected to use a 100-year frequency in the design of their detention facilities. To determine 100-year rainfall depth the City of Los Angeles factor has been applied to this anticipated rainfall depth to

produce 5.7 inches in 24 hours. This will be used to determine sizing of critical detention facilities.

**Analysis Results**

From the Los Angeles County Department of Public Work Hydrology Manual are the following charts pertinent to a Hermosa Beach location for use in a MODRAT program, see Appendices C and D. Included in Appendix F are the resulting printouts from the programs analysis based on each areas input, both existing, interim and final design.

**Conclusions**

The existing fully improved site subareas produces 4.78 CFS of runoff in total. This amount is distributed 2.31 CFS to 6th Street, 0.26 CFS to South Valley Drive and 0.34 CFS to North Valley Drive, and 1.87 CFS is contributed directly into the LACFCD project via existing drop inlet for a 100-year frequency storm.

In the interim Phases of construction within the walls, the site will be 93% pervious and in those cases, rainfall will produce 1.64 CFS or 4360 CF of runoff for a 100-year frequency storm event. This will be directed detention basins designed based on SWPPP BMP requirements.

With the final site construction, 100% of the site within the walls will be impervious and in this case, rainfall will produce 3.93 CFS or 23,522 CF of runoff that will be directed by the drainage system to the Tank Farm containment area for detention. During the construction phases runoff will be detained on site. These waters will be processed and injected.

The goal of the SUSMP is to mitigate the first 3/4 of an inch of rainfall, with BMP's in order to eliminate pollutants which are washed from the surface of the site by the "first flush". The projects direction is to detain, process and inject the full amounts in a manner approved by the State Department of Gas, Geothermal Resources. SUSMP calculations are included as a measure and check for the minimum amount to be mitigated. The project expects to far exceed these amounts.

These analyses indicate that the final Hermosa Beach site will produce a total of 3.51 CFS runoff based on a 50-year frequency storm. For a 100-year event, it will produce a total of 3.93 CFS or 23,522 CF for a 24 hour period.

**SUSMP Requirements**

Los Angeles County Manual for the Standard Urban Stormwater Mitigation Plan, SUSMP, discussed the development requirements and method of calculations in order to achieve the mitigation goals. The minimum SUSMP amount of discharge is 1.10 CFS or 2943 CF to be treated to meet minimum SUSMP requirements.

Included in this study are the calculations of the SUSMP flow and/or volume to be mitigated, Appendix G.

These calculations employ "Appendix A" of the SUSMP Manual. This calculation reveals a volume of 2942 CF represents the first .75 inches of rainfall that is to be mitigated.

The project will mitigate far larger amounts than required by SUSMP Standards.

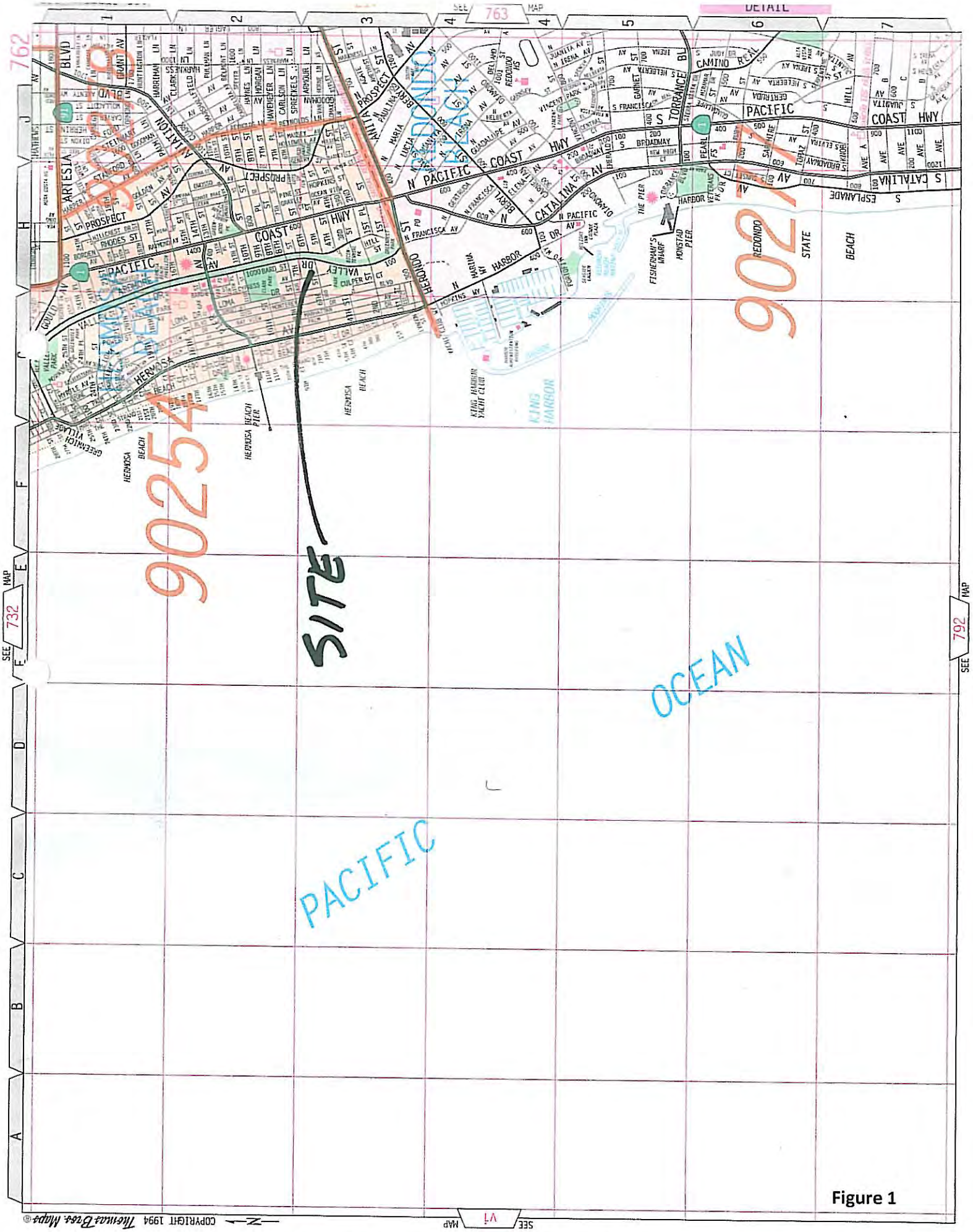
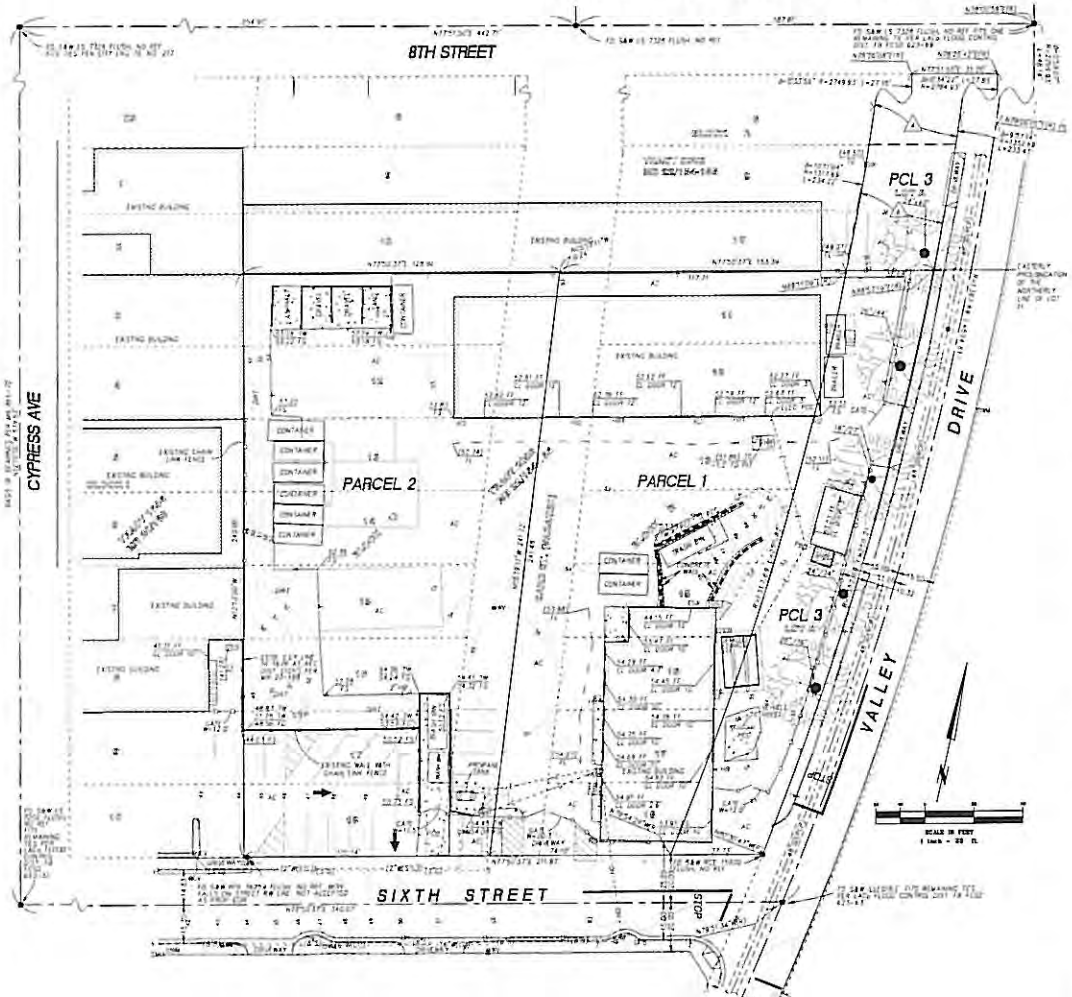

SITE
OCEAN
PACIFIC
90254
90277
762
763
732
792
DETAIL
COPYRIGHT 1994 Thomas Bros. Maps

Figure 1

# TOPOGRAPHIC AND BOUNDARY MAP
## for the HERMOSA BEACH MAINTENANCE YARD



VICINITY MAP
NOT TO SCALE

### SCHEDULE B EXCEPTIONS

LEGAL DESCRIPTIONS AND SCHEDULE B EXCEPTIONS SHOWN HEREON ARE LIMITED PRELIMINARY TITLE REPORT NO. 0201184 - 68 DATED APRIL 23, 2012

1. An easement as the purpose shown below and rights incidental thereto as set forth in a document
   Granted to: Hermosa Beach Land and Water Company
   Purpose: Pipe line
   Recorded: in Book 1417, Page 43, and in Book 8450, Page 51
   Affects: Both of Deeds
   Land area
   The exact location and/or extent of said easement is not disclosed of the public records.

2. Covenants, conditions and restrictions as set forth in the document
   Recorded: in Book 1901, Page 130, of Deeds
   This exception omits any covenant, condition or restriction based on race, color, religion, sex, handicap, familial status or national origin, unless and only to the extent that the covenant, condition or restriction (a) is not in violation of state or federal law, (b) is exempt under 42 U.S.C. Section 3607 or (c) relates to a handicap but does not discriminate against handicapped persons.

3. An oil and gas lease for the term therein provided with certain covenants, conditions and provisions together with easements, if any, as set forth therein
   Dated: February 13, 1930
   Lessor: The City of Hermosa Beach
   Lessee: Continental-Venture Oil Company, a Corporation, now Continental-Venture Oil Company LLC
   Recorded: in Book 10150, Page 375, Official Records
   No assurance is made as to the present ownership of the mineral interest or said date, nor as to other matters affecting the rights or interest of the lessor or lessee of said lease.

4. An easement for the purpose shown below and rights incidental thereto as set forth in a document
   Granted to: Edward W. Henry, Gregory F. Hull and Jennifer Dunbar
   Purpose: Ingress and egress for vehicular and foot traffic
   Recorded: March 25, 1983, as instrument No. 83-325, Official Records
   Affects: Portions of the herein described land, the exact location of which can be determined by examination of the above-mentioned instrument, which contains a complete legal description of the affected portions of said land.

5. Covenants, conditions and restrictions as set forth in the document referred to in the numbered item last above shown. This exception omits any restrictions based on race, color, religion, sex, sexual orientation, familial status, marital status, disability, national origin, source of income as defined in subdivision (p) of Section 12955, or ancestry, that restriction violates state and federal fair housing laws and is void, and may be removed pursuant to Section 12956.2 of the Government Code. Lawful restrictions under state and federal law on the age of occupants in senior housing or housing for older persons shall not be construed as restrictions based on familial status.

6. An oil and gas lease for the term therein provided with certain covenants, conditions and provisions together with easements, if any, as set forth therein
   Dated: October 14, 1965
   Lessor: The City of Hermosa Beach
   Lessee: Wayland Associates, Thorson Co
   Recorded: March 26, 1967, as instrument No. 67-42616, Official Records
   No assurance is made as to the present ownership of the mineral interest or said date, nor as to other matters affecting the rights or interest of the lessor or lessee of said lease.

7. Covenants, conditions and restrictions as set forth in the document referred to in the numbered item last above shown. This exception omits any restrictions based on race, color, religion, sex, sexual orientation, familial status, marital status, disability, national origin, source of income as defined in subdivision (p) of Section 12955, or ancestry, that restriction violates state and federal fair housing laws and is void, and may be removed pursuant to Section 12956.2 of the Government Code. Lawful restrictions under state and federal law on the age of occupants in senior housing or housing for older persons shall not be construed as restrictions based on familial status.

8. An oil and gas lease for the term therein provided with certain covenants, conditions and provisions together with easements, if any, as set forth therein
   Dated: October 14, 1965
   Lessor: The City of Hermosa Beach
   Lessee: Wayland Associates, Thorson Co
   Recorded: March 26, 1967, as instrument No. 67-42616, Official Records
   No assurance is made as to the present ownership of the mineral interest or said date, nor as to other matters affecting the rights or interest of the lessor or lessee of said lease.

9. Covenants, conditions and restrictions as set forth in the document referred to in the numbered item last above shown. This exception omits any restrictions based on race, color, religion, sex, sexual orientation, familial status, marital status, disability, national origin, source of income as defined in subdivision (p) of Section 12955, or ancestry, that restriction violates state and federal fair housing laws and is void, and may be removed pursuant to Section 12956.2 of the Government Code. Lawful restrictions under state and federal law on the age of occupants in senior housing or housing for older persons shall not be construed as restrictions based on familial status.
   Modification(s) of said covenants, conditions and restrictions
   Recorded: March 26, 1967, as instrument No. 67-42616, Official Records

10. An unrecorded oil and gas lease for the term therein provided with certain covenants, conditions and provisions together with easements, if any, as set forth therein
    Dated: January 14, 1982
    Lessor: City of Hermosa Beach, a California Municipal Corporation
    Lessee: Wayland Associates, a California Limited Partnership
    Evidenced by: Memorandum of Oil & Gas Lease
    Recorded: April 9, 1998, as instrument No. 98-587474, Official Records
    No assurance is made as to the present ownership of the mineral interest or said date, nor as to other matters affecting the rights or interest of the lessor or lessee of said lease.

11. A document subject to all the terms, provisions and conditions therein contained
    Entitled: Notice of Completion for Permit and Acceptance of Easements, City of Hermosa Beach
    Dated: March 17, 1998
    Executed by: Wayland Associates, a California Limited Partnership
    Recorded: April 9, 1998, as instrument No. 98-587475, Official Records

12. A document subject to all the terms, provisions and conditions therein contained
    Entitled: Lease Restriction
    Dated: January 14, 1982
    Executed by: Wayland Associates, a California Limited Partnership
    Recorded: April 9, 1998, as instrument No. 98-587476, Official Records

13. A document subject to all the terms, provisions and conditions therein contained
    Entitled: Agreement to be Bound
    Dated: April 1, 1998
    Executed by: City of Hermosa Beach, a Municipal Corporation
    Recorded: April 9, 1998, as instrument No. 98-587477, Official Records

14. Water rights, claims or title to water, whether or not shown by the public records.

15. This search discloses no open deeds of trust. Please confirm prior to close of escrow.

### PREPARED FOR

EAB NATURAL RESOURCES MGMT. CORP.
ATTN: MAX VINCH, VICE MANAGER
7600 HOWE RD
BAKERSFIELD, CA 93308
PH (661) 397-7575 EXT. 104

### LEGAL DESCRIPTION

At that certain real property situated in the County of Los Angeles, State of California, described as follows:

PARCEL 1:

Lots 11 to 18 inclusive, Block 6, Tract No. 2002, in the City of Hermosa Beach, County of Los Angeles, State of California, as per Map recorded in Book 22, Pages 154 and 155 of Maps, in the Office of the County Recorder of said County, together with the Easterly half of Bard Street vacated adjoining said Lots on the West.

PARCEL 2:

Lots 11 to 18 inclusive, Block 6, Tract No. 2002, in the City of Hermosa Beach, County of Los Angeles, State of California, as per Map recorded in Book 22, Pages 154 and 155 of Maps, in the Office of the County Recorder of said County, together with the Westerly half of Bard Street vacated adjoining said Lots on the East.

Except therefrom Lots 11 and 12 of Parcel 2, all oil, gas, petroleum, asphaltum, hydrocarbon substances and other minerals lying 200 feet below the surface of said property and that may be produced or reached therefrom together with an easement only up to that sub-surface portion of said land which lies 200 feet below the surface of said land for the purpose of prospecting for, mining and drilling through, drilling, mining, developing, removing and extracting oil, gas, petroleum, asphaltum, hydrocarbon substances and other minerals from said land but only insofar as such minerals or substances may be produced from any land that lies in the subsurface of said land and not through or with the surface of said land, provided, however, all drilling and mining operations shall be in compliance with the then requirements of the law and provided further that the right to enter upon the surface of said land is expressly not reserved or excepted, but excepted and reserved by Public Site Company a Deed recorded March 22, 1967, as instrument No. 541, of Official Records of Los Angeles County.

PARCEL 3:

That portion of Lot "A" of Tract No. 2002, in the City of Hermosa Beach, County of Los Angeles, State of California, as per Map recorded in Book 22, Pages 154 and 155 of Maps, in the Office of the County Recorder of said County, lying Northerly of the Easterly prolongation of the Northerly line of 8th Street, 40 feet wide, and Southerly of the Easterly prolongation of the Southerly line of 8th Street, 40 feet wide, as shown on said Map.

**LEASE AREA DOES NOT INCLUDE THAT PORTION OF LOT A NORTH OF THE EASTERLY PROLONGATION OF LOT 11, BLOCK 6, TRACT NO. 2002, AS SHOWN HEREON.**

Except therefrom the title and exclusive right to all of the minerals and mineral ores of every kind and character now known to exist or hereafter discovered upon, within or underlying said land or that may be produced therefrom including without limiting the generality of the foregoing, all petroleum, oil, natural gas and other hydrocarbon substances and products derived therefrom together with the exclusive and perpetual right to and granted to successors and assigns of grantor and lessees between the surface of said land to beyond the vertical, more and remove the same, and to make such use of the said land between the surface as is reasonably or useful in connection therewith, which use may include drilling or slant drilling, digging, boring, or sinking of wells, shafts or tunnels, provided however that such grantor, its successors and assigns shall not use the surface of said land in the exercise of any of said rights and shall not disturb the surface of said land or any improvements thereon or thereon or impair the lateral or subjacent support of said land or any improvements thereon as reserved in Deed from Pacific Electric Railway Company, a Corporation, recorded as Document No. 3.08, Official Records.

### BENCHMARK

LOS ANGELES COUNTY PUBLIC WORKS BENCHMARK NO. 17-2179 (ELEV. 62.101 FEET ABOVE MSL) BEING A 1-1/2" BRASS DISK IN A 4" CIP MONUMENT 0.10 FEET N OF THE CENTER OF PACIFIC COAST HIGHWAY AND PER ASPHALT

### ASSESSOR'S PARCEL NUMBER

APN 4181-026-900

### BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS EXPRESS AS THE BEARING N17°05'00"W FOR TRACT NO. 2002 MB 22/PAGES 154-155

### DATE OF SURVEY

APRIL 23, 2012

### GENERAL PLAN

NC - INDUSTRIAL

### ZONING

M1 - LIGHT MANUFACTURING
BUILDING SETBACKS: NONE EXCEPT AS REQUIRED BY A PRIOR PLANS BUILDING HEIGHT = 30' MAX

### FLOOD ZONE

ZONE X - SUBSAREA(S) AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN. PER FIRM MAP NO. 06037C1601F EFFECTIVE 9-26-08

### AREA OF CITY PARCEL

PARCEL 1 = 23,993 SQ. FT.
PARCEL 2 = 27,147 SQ. FT.
PARCEL 3 = 17,914 SQ. FT.
TOTAL AREA = 68,994 SQ. FT. (1.583 ACRES)

### LEASE AREA

PARCEL 1 = 23,993 SQ. FT.
PARCEL 2 = 27,147 SQ. FT.
PARCEL 3 (SOUTHERLY LEASE AREA) = 8,914 SQ. FT.
TOTAL AREA = 60,054 SQ. FT. (1.383 ACRES)

### LEGAL OWNER

CITY OF HERMOSA BEACH, A MUNICIPAL CORPORATION
1315 VALLEY DRIVE
HERMOSA BEACH, CA 90254

### LINETYPES

- DENOTES SURVEYED PROPERTY LINE
- DENOTES EXISTING LOT LINES
- DENOTES STREET CENTER LINE
- DENOTES LEASE AREA LIMIT LINE
- DENOTES FLOW LINE
- DENOTES SURVEYED WATER LINE
- DENOTES RECORD WATER LINE
- DENOTES SURVEYED STORM DRAIN LINE
- DENOTES RECORD STORM DRAIN LINE
- DENOTES SURVEYED ELECTRICAL LINE
- DENOTES RECORD ELECTRICAL LINE
- DENOTES RECORD SEWER LINE
- DENOTES RECORD GAS LINE
- DENOTES RECORD TELEPHONE LINE
- EXISTING EMBANKED LINE
- EXISTING CONTOUR
- WROUGHT IRON FENCE (SURVEYED)
- CHAIN LINK FENCE (SURVEYED)
- EDGE OF ROADWAY PAVEMENT
- DENOTES EXISTING CONCRETE
- DENOTES EXISTING WALL

### SYMBOLS

- SEWER MANHOLE
- STORM DRAIN MANHOLE
- ELECTRICAL MANHOLE
- TELEPHONE MANHOLE
- MANHOLE (TYPE UNKNOWN)
- EXISTING WATER METER
- WATER VALVE
- HYDRANT
- FIRE HYDRANT
- GAS METER
- GAS VALVE
- SIGN
- ELECTRICAL PULLBOX
- CABLE TV PULLBOX
- FLAG POLE
- TRAFFIC SIGNAL PULLBOX
- TELEPHONE PULLBOX
- STREET LIGHT PULLBOX
- ELECTRIC METER
- ELECTRIC CABINET
- ELECTRICAL BOX
- DROP INLET
- ELECTRIC PULLBOX
- IRRIGATION CONTROL VALVE
- IRRIGATION CONTROL BOX
- TRANSFORMER
- EXISTING TREE
- EXISTING PALM
- SURVEY BENCHMARK
- SURVEY CONTROL POINT
- MAILBOX

### SURVEYORS NOTES

Item 1- Surveyor's Note: 1. Document 1417-43 is not an easement. It is a deed to Hermosa Beach for pipelines, appurtenances and rights of way that were then owned by Hermosa Beach Land & Water Co. It contains descriptions that can be located. However, we don't have enough information at this time to locate Item 2. Document 8450-51 is a deed to Herbert E. Cullen of all oil and mineral rights for pipelines for that described deed. Deed describes that grantee, successors, heirs, and assigns shall not drill or explore for oil, petroleum, etc.

Item 2- Surveyor's Note: Document specifies that grantee, successors, and assigns shall not drill, explore or bore for oil or petroleum, etc.

Item 3- Surveyor's Note: Oil & Gas lease together with easements for pipelines, powerlines, telephone, and reception over Lots 11-18 Block 6, Lots 13-18 Block 5, Bard Street (abandoned) of Tract No. 2002, MB 22, pages 154-155.

Item 4- Surveyor's Note: Oil & Gas lease over Lots 11-18, Block 6, Lots 11-18, Block 5, & a portion of Lot A & a portion of Bard Street, vacated adjoining said lots of Tract No. 2002, MB 22, pages 154-155.

Item 5- Surveyor's Note: Amendment to oil and gas lease.

Item 10- Surveyor's Note: Oil Site Lots 11-18 Block 6, Lots 11-18 Block 5, Bard Street (abandoned), Lot A (abandoned) of Tract No. 2002, MB 22, pages 154-155.

Cornerstone Land Surveying, Inc.
Civil • Surveying • Planning
Phone (310) 798-0900 FAX (310) 798-0906

TOPOGRAPHIC AND BOUNDARY MAP
HERMOSA BEACH MAINT. YARD
555 SIXTH ST.
HERMOSA BEACH, CA 90254

SHEET 1 OF 1

Figure 2

# TOPOGRAPHIC MAP for the HERMOSA BEACH MAINTENANCE YARD

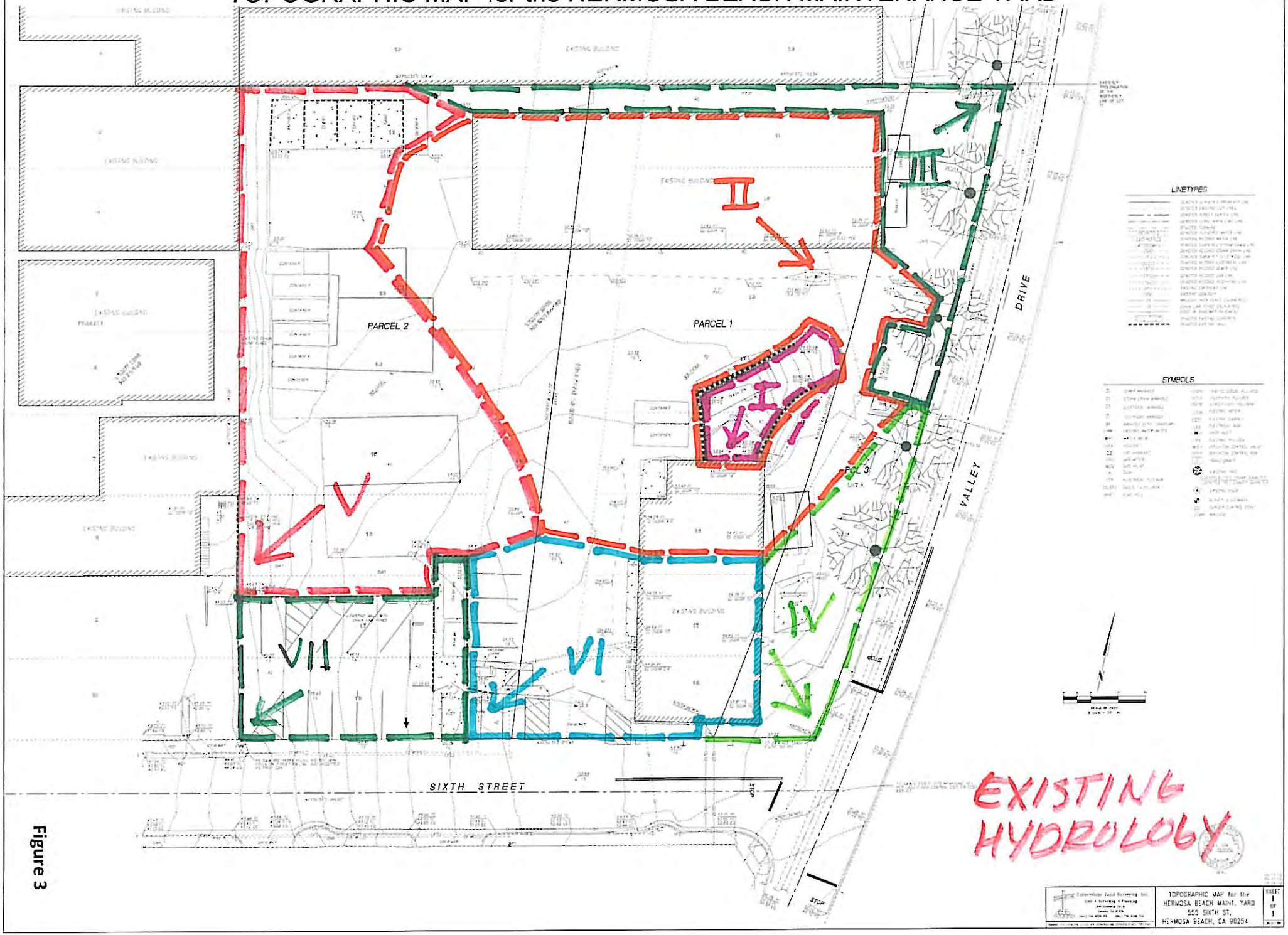



Figure 3

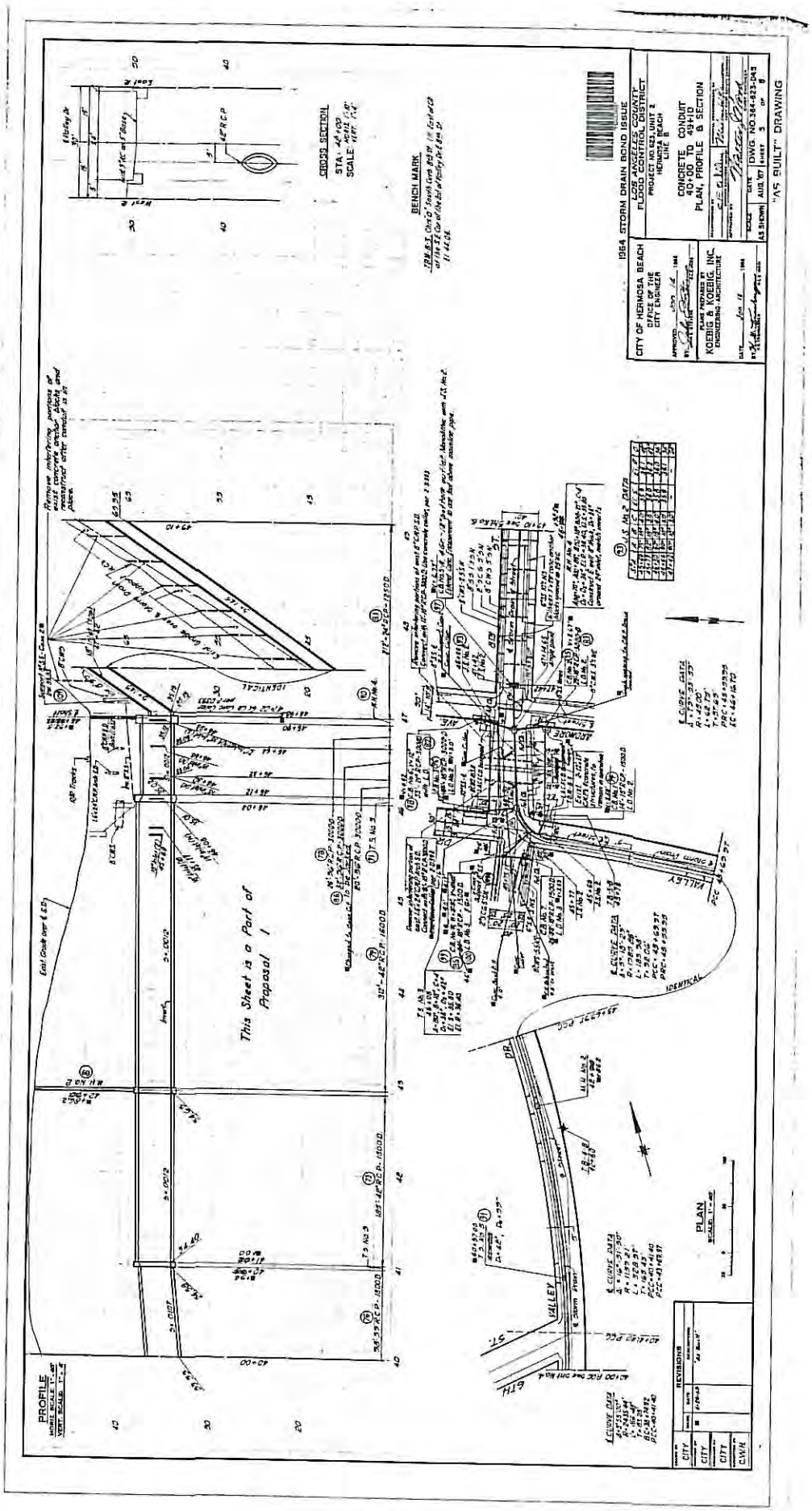
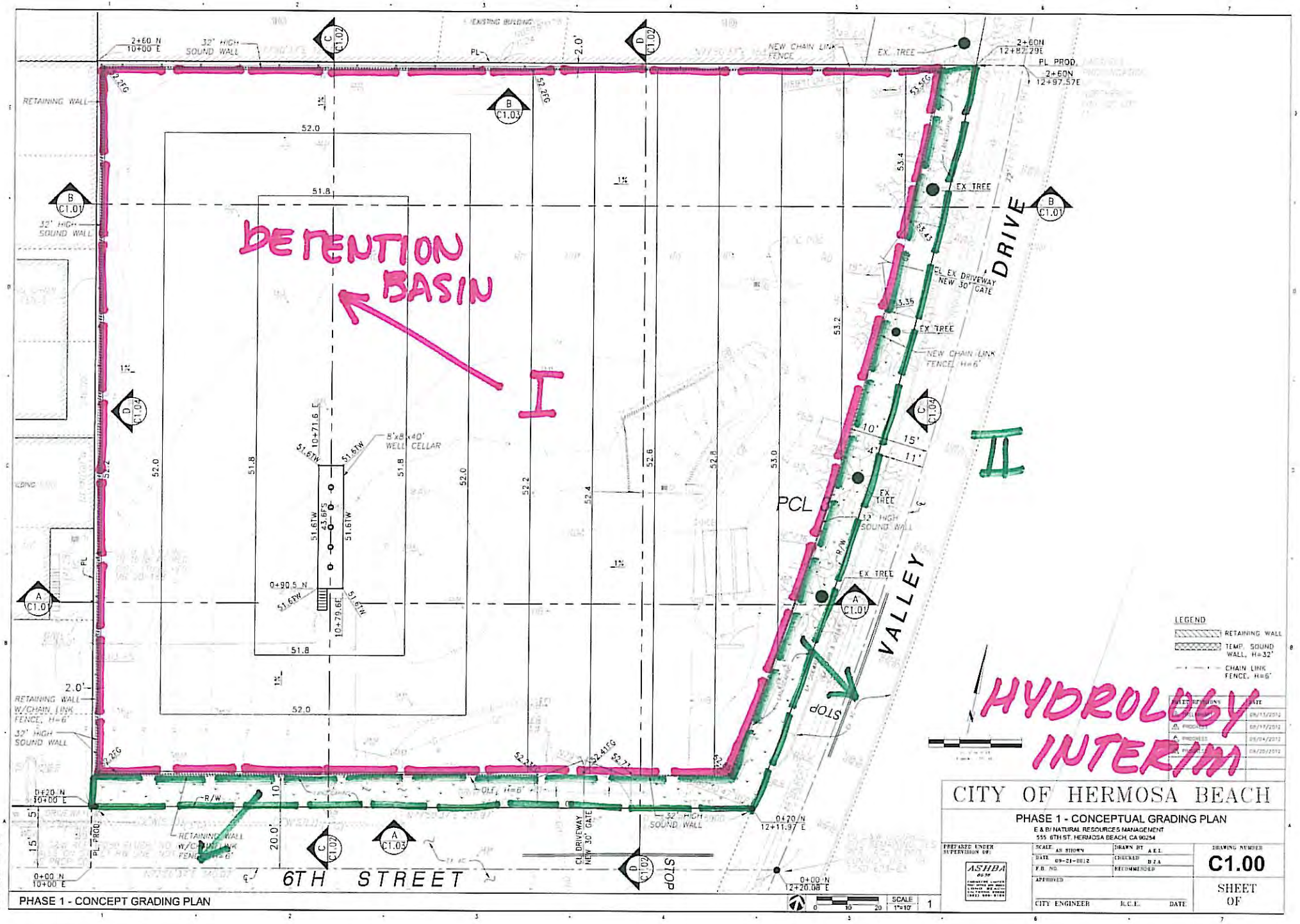

CITY OF HERMOSA BEACH
CITY ENGINEER
1964 STORM DRAIN BOND ISSUE
LOS ANGELES COUNTY
FLOOD CONTROL DISTRICT
CONCRETE CONDUIT
40+00 TO 49+10
PLAN, PROFILE & SECTION
KOEBIG & KOEBIG, INC.
ENGINEERING ARCHITECTURE
"AS BUILT" DRAWING
CROSS SECTION
BENCH MARK
This Sheet is a Part of
Proposal 1
PROFILE
PLAN
REVISIONS
VALLEY
IDENTICAL

Figure 4


DETENTION BASIN
I
II
HYDROLOGY INTERIM
6TH STREET
PCL
VALLEY DRIVE
STOP
RETAINING WALL
32' HIGH SOUND WALL
NEW CHAIN LINK FENCE
EX. TREE
PL PROD.
CL EX DRIVEWAY NEW 30' GATE
NEW CHAIN LINK FENCE, H=6'
12' HIGH SOUND WALL
8'x8'x40' WELL CELLAR
RETAINING WALL W/CHAIN LINK FENCE, H=6'
LEGEND
RETAINING WALL
TEMP. SOUND WALL, H=32'
CHAIN LINK FENCE, H=6'
CITY OF HERMOSA BEACH
PHASE 1 - CONCEPTUAL GRADING PLAN
E & B/ NATURAL RESOURCES MANAGEMENT
555 6TH ST. HERMOSA BEACH, CA 90254
PREPARED UNDER SUPERVISION OF:
ASHBA
SCALE AS SHOWN
DATE 09-21-2012
DRAWN BY A.E.L.
CHECKED D.Z.A.
RECOMMENDED
APPROVED
CITY ENGINEER R.C.E. DATE
DRAWING NUMBER
C1.00
SHEET OF
SCALE 1"=10'
PHASE 1 - CONCEPT GRADING PLAN

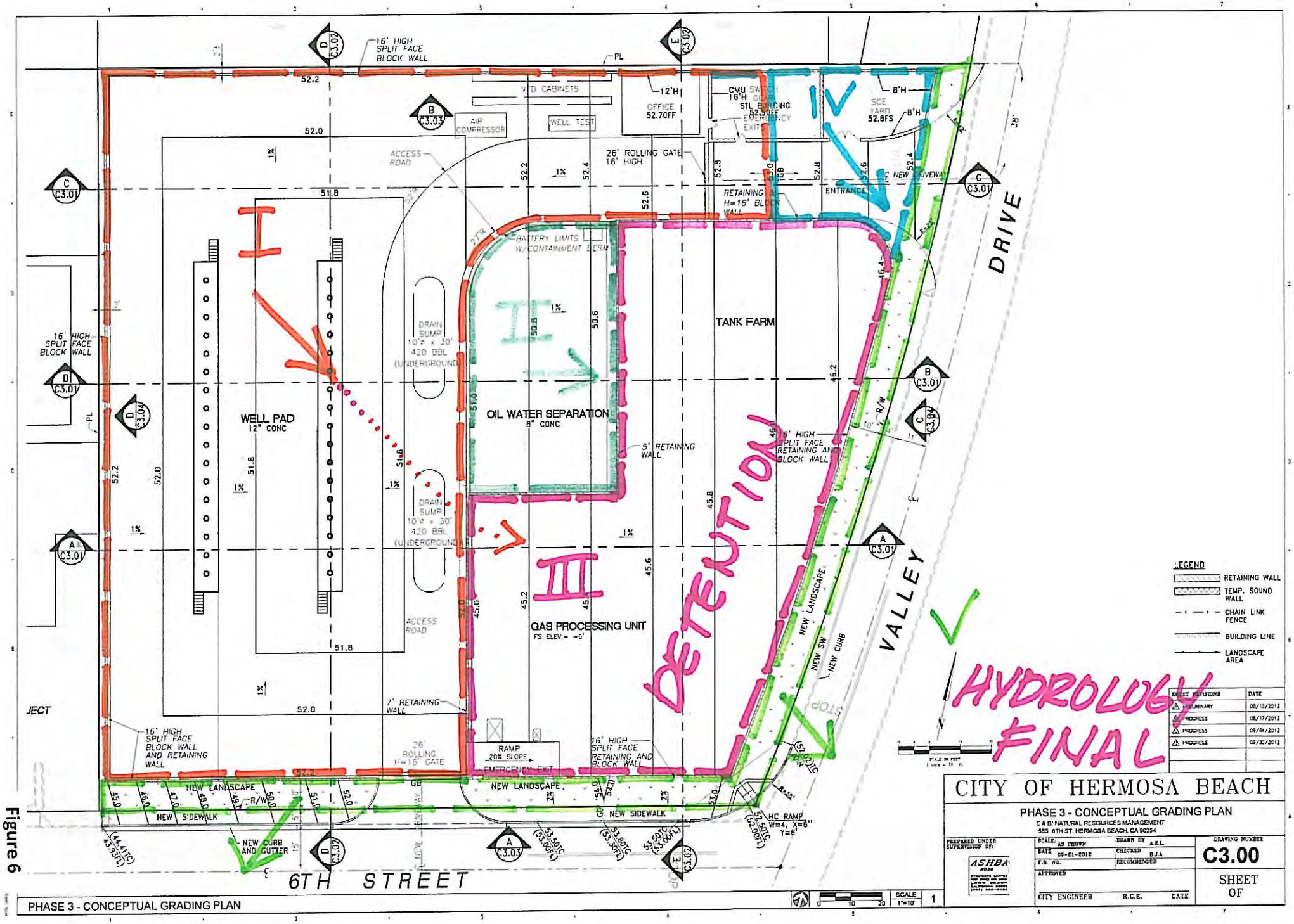
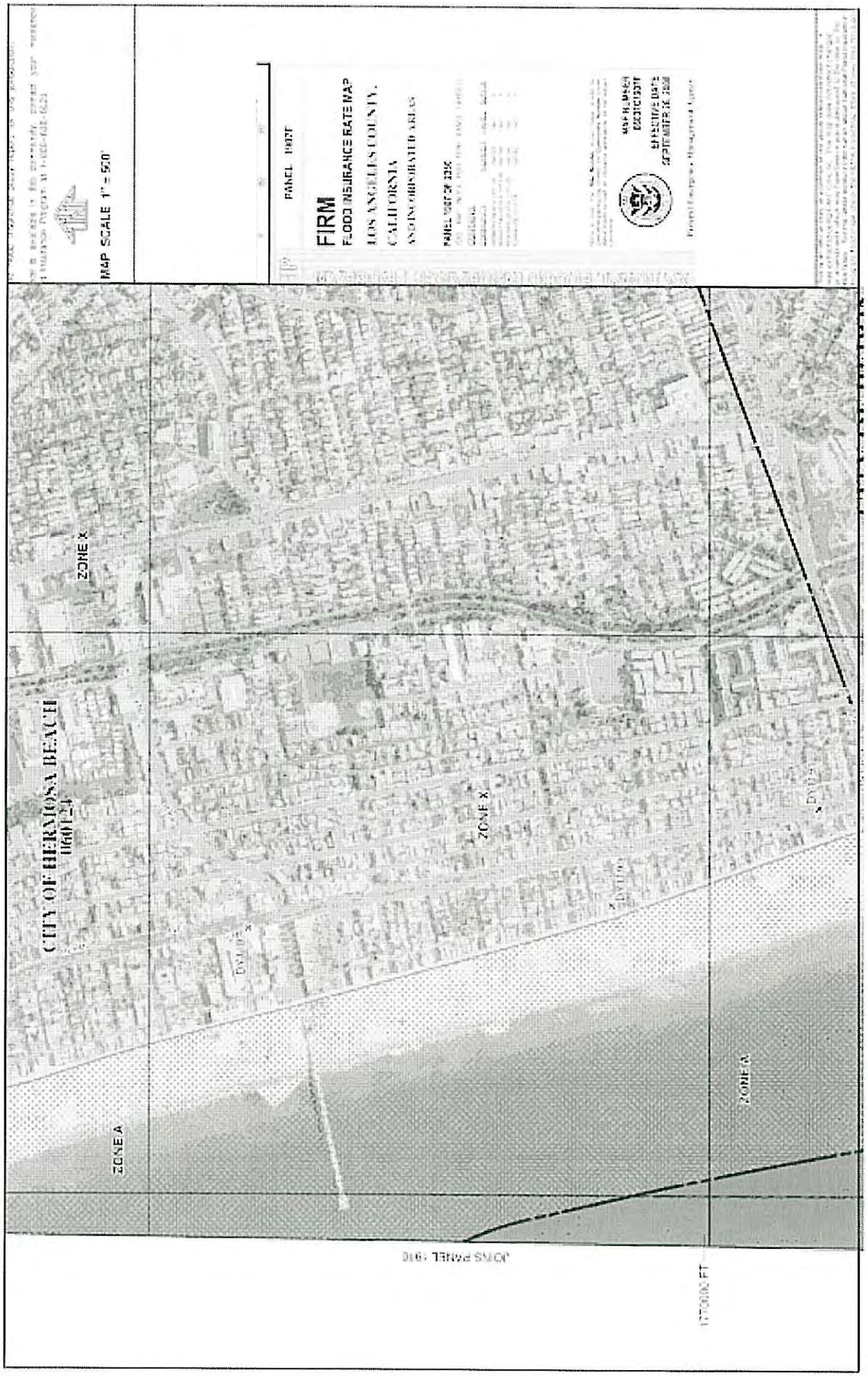
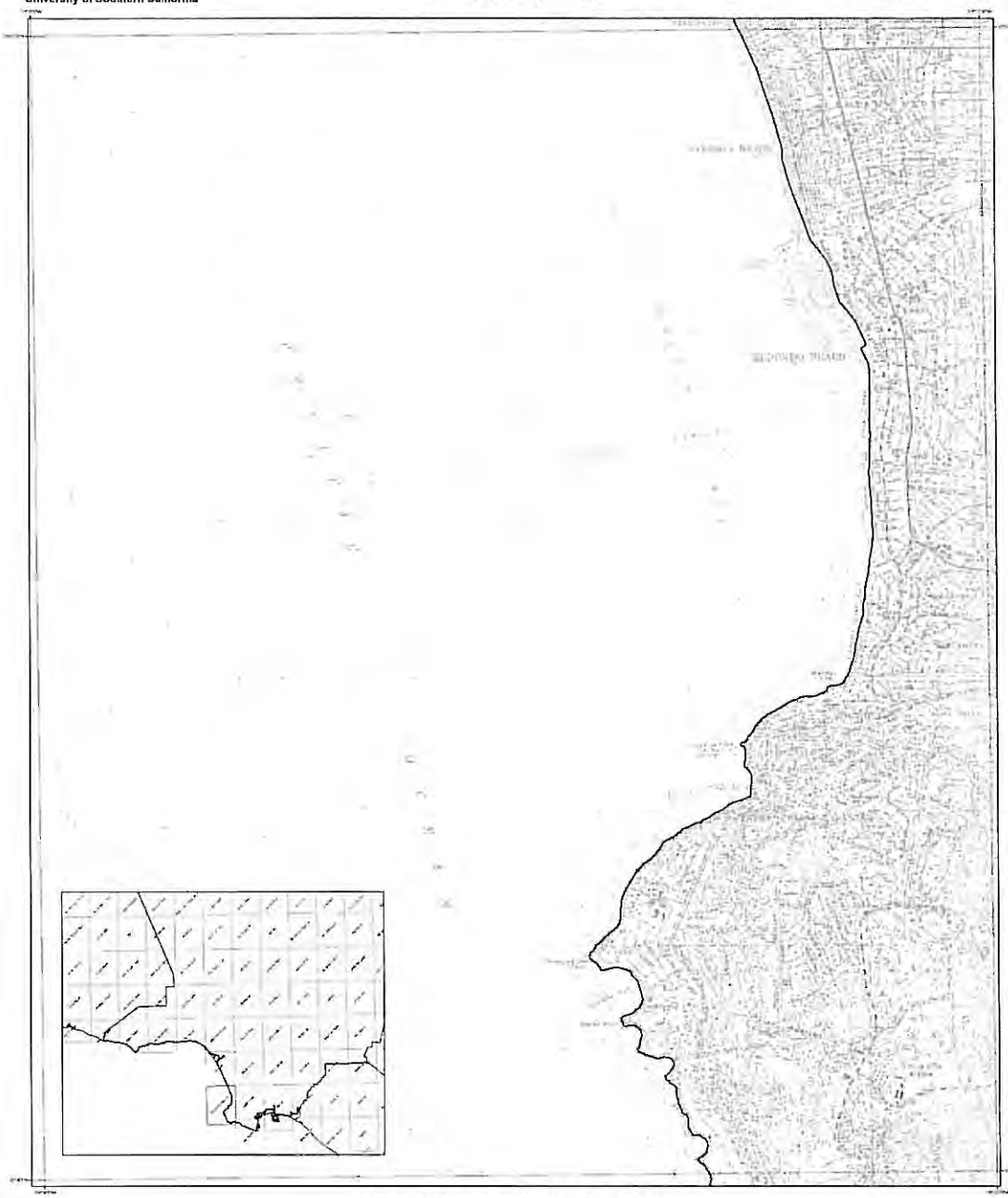

16' HIGH SPLIT FACE BLOCK WALL
PL
V/D CABINETS
12'H
OFFICE 52.70FF
CMU SWITCH 16'H
STL BUILDING 52.90FF
EMERGENCY EXIT
8'H
SCE YARD 52.8FS
8'H
AIR COMPRESSOR
WELL TEST
ACCESS ROAD
26' ROLLING GATE 16' HIGH
NEW DRIVEWAY
ENTRANCE
RETAINING H=16' BLOCK WALL
BATTERY LIMITS W/CONTAINMENT BERM
DRAIN SUMP 10'± x 30' 420 BBL (UNDERGROUND)
TANK FARM
WELL PAD 12" CONC
OIL WATER SEPARATION 8" CONC
5' RETAINING WALL
5' HIGH SPLIT FACE RETAINING AND BLOCK WALL
DETENTION
GAS PROCESSING UNIT
FS ELEV. = -6'
7' RETAINING WALL
16' HIGH SPLIT FACE BLOCK WALL AND RETAINING WALL
26' ROLLING H=16' GATE
RAMP 20% SLOPE
EMERGENCY EXIT
16' HIGH SPLIT FACE RETAINING AND BLOCK WALL
NEW LANDSCAPE
NEW SIDEWALK
NEW CURB AND GUTTER
HC RAMP W=4, X=6" Y=6'
6TH STREET
VALLEY DRIVE
NEW LANDSCAPE
NEW SW
NEW CURB
STOP
LEGEND
RETAINING WALL
TEMP. SOUND WALL
CHAIN LINK FENCE
BUILDING LINE
LANDSCAPE AREA
HYDROLOGY FINAL
CITY OF HERMOSA BEACH
PHASE 3 - CONCEPTUAL GRADING PLAN
E & B/ NATURAL RESOURCES MANAGEMENT
555 6TH ST. HERMOSA BEACH, CA 90254
PREPARED UNDER SUPERVISION OF:
ASHBA
SCALE: AS SHOWN
DATE 09-01-2012
F.B. NO.
DRAWN BY A.E.L.
CHECKED B.J.A.
RECOMMENDED
APPROVED
CITY ENGINEER R.C.E. DATE
DRAWING NUMBER
C3.00
SHEET OF
SCALE 1"=10'
PHASE 3 - CONCEPTUAL GRADING PLAN

Figure 6


MAP SCALE 1" = 500'
PANEL 1907
FIRM
FLOOD INSURANCE RATE MAP
LOS ANGELES COUNTY,
CALIFORNIA
AND INCORPORATED AREAS
PANEL 1907 OF 2350
CITY OF HERMOSA BEACH
060124
ZONE A
ZONE X
ZONE X
ZONE X
ZONE A
JOINS PANEL 1910
17500 FT

**Appendix A**



# TSUNAMI INUNDATION MAP FOR EMERGENCY PLANNING

## State of California ~ County of Los Angeles
## REDONDO BEACH QUADRANGLE

March 1, 2009

SCALE 1:24 000

Table 1. Tsunami sources modeled for the Los Angeles County coastline

| Sources (M = moment magnitude used in modeled event) | | Areas of Inundation Map Coverage and Sources Used | | |
|---|---|---|---|---|
| | | Malibu | Santa Monica | Los Angeles Harbor |
| Local Sources | Anacapa-Dume Fault | X | X | |
| | Cabrillo Fault | X | X | X |
| | Channel Island Thrust Fault | | X | |
| | Newport-Inglewood Fault | | | X |
| | Santa Monica Fault | X | X | |
| | Palos Verdes Lineament #1 | | X | X |
| | Palos Verdes Lineament #2 | | | X |
| Distant Sources | Cascadia Subduction Zone #1 (M9.2) | | X | X |
| | Central Aleutians Subduction Zone#1 (M9.1) | | X | X |
| | Central Aleutians Subduction Zone#2 (M9.1) | | X | X |
| | Central Aleutians Subduction Zone#3 (M9.1) | X | X | X |
| | Chile North Subduction Zone (M9.4) | X | X | X |
| | Chile Chiloé Earthquake (M9.5) | | X | X |
| | Alaska Earthquake (M9.2) | X | X | X |
| | Japan Subduction Zone #1 (M9.0) | | X | X |
| | Kuril Islands Subduction Zone #1 (M9.0) | | X | X |
| | Kuril Islands Subduction Zone #2 (M9.0) | | X | X |
| | Kuril Islands Subduction Zone #3 (M9.0) | | X | X |

## METHOD OF PREPARATION

Initial tsunami modeling was performed by the University of Southern California (USC) Tsunami Research Center funded through the California Emergency Management Agency (CalEMA) by the National Tsunami Hazard Mitigation Program. The tsunami modeling process utilized the MOST (Method of Splitting Tsunamis) computational program (Version 0), which allows for wave evolution over a variable bathymetry and topography used for the inundation mapping (Titov and Gonzalez, 1997; Titov and Synolakis, 1998).

The bathymetric/topographic data that were used in the tsunami models consist of a series of nested grids. Near shore grids with a 3 arc second (75- to 90-meters) resolution or higher, were adjusted to "Mean High Water" sea level conditions, representing a conservative sea level for the intended use of the tsunami modeling and mapping.

A suite of tsunami source events was selected for modeling, representing realistic local and distant earthquakes and hypothetical extreme underwater, near shore landslides (Table 1). Local tsunami sources that were considered include offshore reverse thrust faults, restraining bends on strike slip fault zones and large submarine landslides capable of significant seafloor displacement and tsunami generation. Distant tsunami sources that were considered include great subduction zone events that are known to have occurred historically (1960 Chile and 1964 Alaska earthquakes) and others which can occur around the Pacific Ocean "Ring of Fire."

In order to enhance the result from the 75- to 90-meter inundation grid data, a method was developed utilizing higher resolution digital topographic data (3- to 10-meters resolution) that better defines the location of the maximum inundation line (U.S. Geological Survey, 1993; Intermap, 2003; NOAA, 2004). The location of the enhanced inundation line was determined by using digital imagery and terrain data on a GIS platform with consideration given to historic inundation information (Lander et al., 1993). This information was verified, where possible, by field work coordinated with local county personnel.

The accuracy of the inundation line shown on these maps is subject to limitations in the accuracy and completeness of available terrain and tsunami source information, and the current understanding of tsunami generation and propagation phenomena as expressed in the models. Thus, although an attempt has been made to identify a credible upper bound to inundation at any location along the coastline, it remains possible that actual inundation could be greater in a major tsunami event.

This map does not represent inundation from a single scenario event. It was created by combining inundation results for an ensemble of source events affecting a given region (Table 1). For this reason, all of the inundation region in a particular area will not likely be inundated during a single tsunami event.

References

Intermap Technologies, Inc. 2003. Intermap product handbook and quick start guide: Intermap NEXTmap: document on 5-meter resolution data, 112 p.

Lander, J.F., Lockridge, P.A., and Kozuch, M.J., 1993. Tsunamis Affecting the West Coast of the United States 1806-1992. National Geophysical Data Center Key to Geophysical Record Documentation No. 29. NOAA, NESDIS, NGDC, 242 p.

National Atmospheric and Oceanic Administration (NOAA), 2004. Interferometric Synthetic Aperture Radar (IfSAR) Digital Elevation Models From GeoSAR platform (Earth Data): 5 meter resolution data.

Titov, V.V., and Gonzalez, F.I. 1997. Implementation and Testing of the Method of Tsunami Splitting (MOST). NOAA Technical Memorandum ERL PMEL – 112, 11 p.

Titov, V.V., and Synolakis, C.E., 1998. Numerical modeling of tidal wave runup. Journal of Waterways, Port, Coastal and Ocean Engineering, ASCE, 124 (4): pp. 157-171.

U.S. Geological Survey, 1993. Digital Elevation Models. National Mapping Program, Technical Instructions, Data Users Guide 5, 46 p.

## MAP EXPLANATION

Tsunami Inundation Line

Tsunami Inundation Area

## PURPOSE OF THIS MAP

This tsunami inundation map was prepared to assist cities and counties in identifying their tsunami hazard. It is intended for local jurisdictional coastal evacuation planning uses only. This map, and the information presented herein, is not a legal document and does not meet disclosure requirements for real estate transactions, nor for any other regulatory purpose.

The inundation map has been compiled with best currently available scientific information. The inundation line represents the maximum considered tsunami runup from a number of extreme, yet realistic tsunami sources. Tsunamis are rare events, due to a lack of known occurrences in the historical record, this map includes no information about the probability of any tsunami affecting any area within a specific period of time.

Please refer to the following websites for additional information on the construction and/or intended use of the tsunami inundation map:

State of California Emergency Management Agency, Earthquake and Tsunami Program:
http://www.oes.ca.gov/WebPageBuilder/site/oes/Content/0116C5180A215915705C57415D2E3D57/Cover-Document

University of Southern California – Tsunami Research Center:
http://www.usc.edu/dept/tsunami/2005/index.php

State of California Geological Survey Tsunami information:
http://www.conservation.ca.gov/cgs/geologic_hazards/Tsunami/index.htm

National Oceanic and Atmospheric Agency Center for Tsunami Research (MOST model):
http://nctr.pmel.noaa.gov/time/background/models.html

## MAP BASE

Topographic base maps prepared by U.S. Geological Survey as part of the 7.5-minute Quadrangle Map Series (originally 1:24 000 scale). Tsunami inundation line boundaries may reflect updated digital orthophotographic and topographic data that can differ significantly from contours shown on the base map.

## DISCLAIMER

The California Emergency Management Agency (CalEMA), the University of Southern California (USC), and the California Geological Survey (CGS) make no representation or warranties regarding the accuracy of the inundation map nor the data from which the map was derived. Neither the State of California nor USC shall be liable under any circumstances for any direct, indirect, special, incidental or consequential damages with respect to any claim by any user or any third party on account of or arising from the use of this map.

Appendix B

N
W E
S

016 SOIL CLASSIFICATION AREA

7.2 INCHES OF RAINFALL

DPA - 6 DEBRIS POTENTIAL AREA

1 0 1 2 Miles

25-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.878
10-YEAR 24-HOUR ISOHYET REDUCTION FACTOR: 0.714

# REDONDO BEACH
# 50-YEAR 24-HOUR ISOHYET

1-H1.3

LOS ANGELES COUNTY PUBLIC WORKS Public Service That Works

CITY OF LOS ANGELES STORM INDEX

| FREQUENCY | PER CENT |
|---|---|
| 1 YEAR | 42.8 % |
| 5 | 65.9 |
| 10 | 76.2 |
| 25 | 89.8 |
| 50 | 100.0 |
| 100 | 110.8 |

| GIVEN STORM | 1 | 5 | 10 | 25 | 50 | 100 |
|---|---|---|---|---|---|---|
| 1 | 1 | 1.54 | 1.780 | 2.098 | 2.336 | 2.612 |
| 5 | .649 | 1 | 1.156 | 1.363 | 1.517 | 1.697 |
| 10 | .562 | .865 | 1 | 1.178 | 1.312 | 1.467 |
| 25 | .477 | .734 | .849 | 1 | 1.114 | 1.245 |
| 50 | .428 | .659 | .762 | .898 | 1 | 1.118 |
| 100 | .383 | .589 | .682 | .803 | .894 | 1 |

CORPS OF ENGINEERS STANDARD PROJECT STORM, ASSUME IT TO BE EQUAL TO A 100 YEAR FREQUENCY STORM. USING THE CITY OF LOS ANGELES STORM INDEX CONVERT TO THE DESIRED FREQUENCY.

Ashba Engineers Limited
Post Office Box 90833
Long Beach, California 90809

$C_D = (0.9 * IMP) + (1.0 - IMP) * C_U$

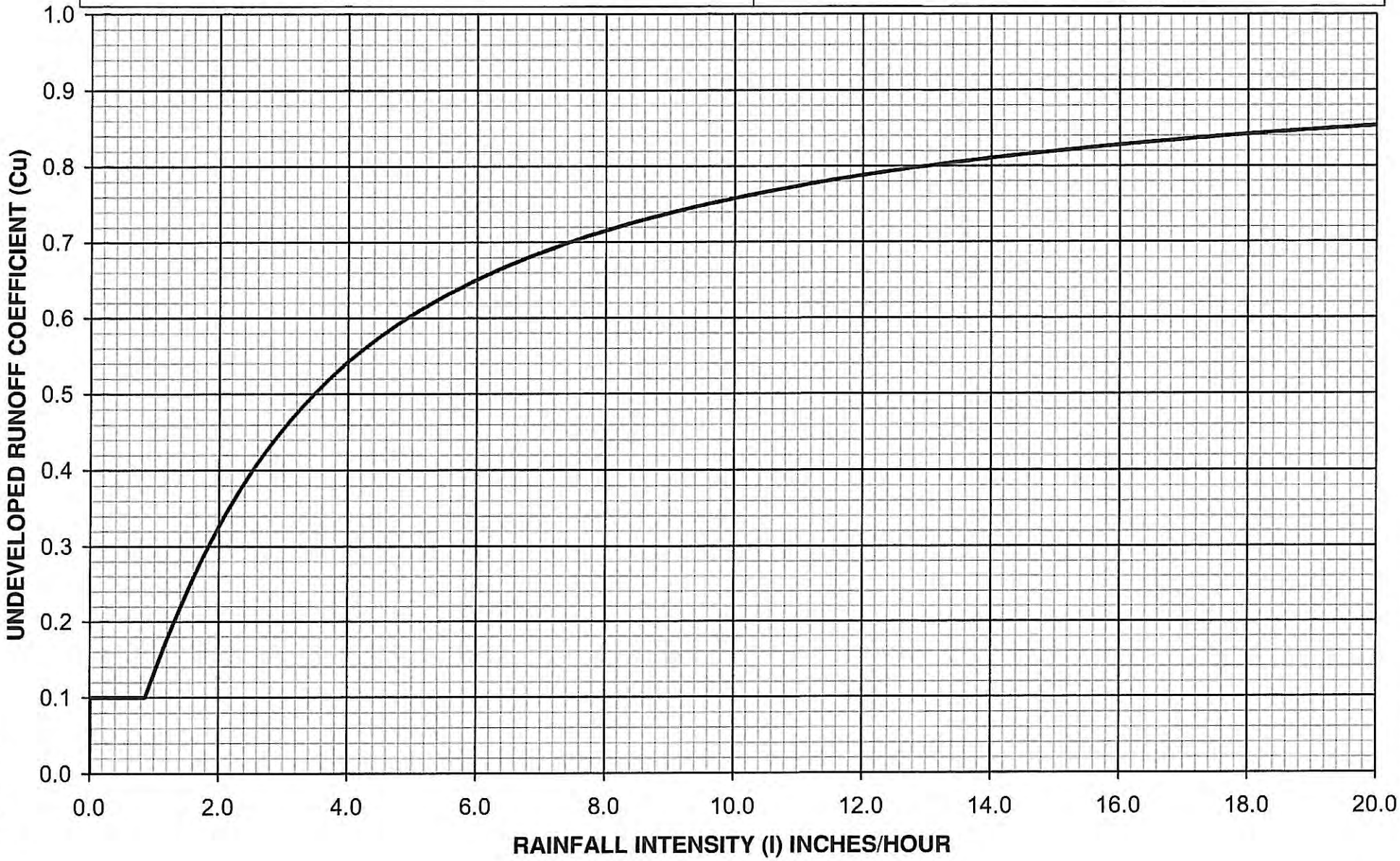
Where: $C_D$ = Developed Runoff Coefficient

IMP = Proportion Impervious

$C_U$ = Undeveloped runoff coefficient

Los Angeles County Department of Public Works

RUNOFF COEFFICIENT CURVE
SOIL TYPE NO. 003



**HERMOSA BEACH MAINTENANCE YARD**

General information
Redondo Beach Isohyet-1-H1.3
50 year ~ 5.1 inches in 24-hours
25 year ~ .878 factor
10 year ~ .714 factor
100 year~1.118 factor (CLA)
Soil type 003

*Ashba Engineers Ltd*

HERMOSA BEACH MAINTENANCE YARD

Existing Conditions

Length-Slope Calculation

Reference Hydrology Map Figure No. 4

Based on Cornerstone Survey Figure 1

| Reach | Length | Slope |
|---|---|---|
| I | 55' | 0.1445 |
| II | 225' | 0.0160 |
| III | 215' | 0.0074 |
| IV | 130' | 0.0231 |
| V | 260' | 0.0177 |
| VI | 175' | 0.0229 |
| VII | 150' | 0.0475 |

Interim Graded Site

Length-Slope Calculation

Based on Phase 2 Grading with CAB Site Landscaping

| Reach | Length | Slope |
|---|---|---|
| I | 240 | 0.0100 |
| II | 250 | 0.0100 |

Final Constructed Site

Length-Slope Calculation

Based on Phase 3 Grading & Paving

| Reach | Length | Slope | |
|---|---|---|---|
| I | 240 | 0.0100 | Site |
| II | 50 | 0.0100 | Site |
| III | 240 | 0.0100 | Site |
| IV | 60 | 0.0100 | Site |
| V | 250 | 0.0100 | Outside of Wall |

*Ashba Engineers Ltd*

HERMOSA BEACH MAINTENANCE YARD

Planimetered Area Summary — Reference Hydrology Map Figure No. 4

Existing Conditions — Based on Cornerstone Survey Figure 1

| Subarea | Area (Ac.) |
|---|---|
| I | 0.0288 |
| II | 0.5893 |
| III | 0.1120 |
| IV | 0.0845 |
| V | 0.3049 |
| VI | 0.1602 |
| VII | 0.1033 |

Interim Graded Site — Based on Phase 2 Grading with CAB

| Subarea | Area (Ac.) | |
|---|---|---|
| I | 1.3252 | Site |
| II | 0.1038 | Landscaping |

Final Constructed Site — Based on Phase 3 Grading & Paving

| Subarea | Area (Ac.) | |
|---|---|---|
| I | 0.7813 | Site |
| II | 0.1005 | Site |
| III | 0.3860 | Site |
| IV | 0.0574 | Site |
| V | 0.1038 | Outside of Wall |

Exist

50year

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | | |
|---|---|---|---|
| I | 1 | | |
| Area (Acres) | Proportion Impervious | Soil Type | |
| .0288 | .98 | 3 | |
| Rainfall Isohyet (in.) | Flow Path Length (ft.) | Flow Path Slope | |
| 5.1 | 55 | .1445 | |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | | |
|---|---|---|---|
| 1a | 1 | | |
| Area (Acres) | Proportion Impervious | Soil Type | |
| 0.0288 | 0.98 | 3 | |
| Rainfall Isohyet (in.) | Flow Path Length (ft.) | Flow Path Slope | |
| 5.7 | 55 | 0.1445 | |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| I | 3.04 | 0.45 | 0.89 |

[✓] Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.08 | n/a | 0.01 |

Q50

EXIST

50year

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| II | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .5893 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 225 | .016 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.5893 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 225 | 0.016 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| II | 3.04 | 0.45 | 0.89 |

[✓] Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 1.59 | n/a | 0.22 |

Q50

EXIST

50yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| III | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .112 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 215 | .0074 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.112 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 215 | 0.0074 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| III | 3.04 | 0.45 | 0.89 |

[✓] Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.3 | n/a | 0.04 |

Q50

Exist

50yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| IV | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .0848 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 130 | .0231 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.0848 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 130 | 0.0231 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

- [x] Calculate Runoff Volume

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| IV | 3.04 | 0.45 | 0.89 |

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.23 | n/a | 0.03 |

$Q_{50}$

Exist

50yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| V | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .3049 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 260 | .0177 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.3049 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 260 | 0.0177 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| V | 3.04 | 0.45 | 0.89 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.82 | n/a | 0.11 |

Q50

Exist

50yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| VI | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .1602 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 175 | .0229 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.1602 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 175 | 0.0229 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| VI | 3.04 | 0.45 | 0.89 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.43 | n/a | 0.06 |

$Q_{50}$

Exist

50yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | | |
|---|---|---|---|
| VII | 1 | | |
| Area (Acres) | Proportion Impervious | Soil Type | |
| .1033 | .98 | 3 | |
| Rainfall Isohyet (in.) | Flow Path Length (ft.) | Flow Path Slope | |
| 5.1 | 150 | .0475 | |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| Area (Acres) | Proportion Impervious | Soil Type |
| 0.1033 | 0.98 | 3 |
| Rainfall Isohyet (in.) | Flow Path Length (ft.) | Flow Path Slope |
| 5.7 | 150 | 0.0475 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| VII | 3.04 | 0.45 | 0.89 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.28 | n/a | 0.04 |

Q50

Exist

100year

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1 | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .0288 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 55 | .1445 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.0288 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 55 | 0.1445 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| 1 | 3.4 | 0.49 | 0.89 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.09 | n/a | 0.01 |

Q100

Exist

100yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| II | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .5893 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 225 | .016 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.5893 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 225 | 0.016 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

- [x] Calculate Runoff Volume

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| II | 3.4 | 0.49 | 0.89 |

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 1.78 | n/a | 0.24 |

Q500

Exist

100 yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| III | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .112 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 215 | .0074 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.112 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 215 | 0.0074 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| III | 3.4 | 0.49 | 0.89 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.34 | n/a | 0.05 |

Q 100

Exist

100 yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| IV | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .0848 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 130 | .0231 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.0848 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 130 | 0.0231 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| IV | 3.4 | 0.49 | 0.89 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.26 | n/a | 0.04 |

$Q_{100}$

Exist

100yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| V | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .3049 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 260 | .0177 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.3049 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 260 | 0.0177 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

- [x] Calculate Runoff Volume

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| V | 3.4 | 0.49 | 0.89 |

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.92 | n/a | 0.13 |

Q100

Exist

100 yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| VI | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .1602 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 175 | .0229 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.1602 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 175 | 0.0229 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| VI | 3.4 | 0.49 | 0.89 |

[✓] Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.48 | n/a | 0.07 |

$Q_{100}$

Exist

100 yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| VII | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .1033 | .98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 150 | .0475 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.1033 | 0.98 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 150 | 0.0475 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| VII | 3.4 | 0.49 | 0.89 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.31 | n/a | 0.04 |

$Q_{100}$

50yr

Tc Calculator

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Interim I | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 1.2 | .07 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 240 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 1.2 | 0.07 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 240 | 0.01 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Interim I | 2.44 | 0.39 | 0.43 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 8 | 1.26 | 1.89 | 0.09 |

$Q_{50}$

50yr

Tc Calculator

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Interim II | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .1038 | .07 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 250 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.1038 | 0.07 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 250 | 0.01 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

☑ Calculate Runoff Volume

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Interim II | 2.31 | 0.37 | 0.41 |

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 9 | 0.1 | 0.15 | 0.01 |

Q50

100yr

Tc Calculator

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Interim I | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 1.2 | .07 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 240 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 1.2 | 0.07 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 240 | 0.01 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

☑ Calculate Runoff Volume

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Interim I | 2.9 | 0.44 | 0.47 |

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 7 | 1.64 | 2.35 | 0.1 |

$Q_{100}$

100 yr

Tc Calculator

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Interim II | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .1038 | .07 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 250 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.1038 | 0.07 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 250 | 0.01 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Interim II | 2.9 | 0.44 | 0.47 |

[✓] Calculate Runoff Volume

Calculate Tc

Cancel

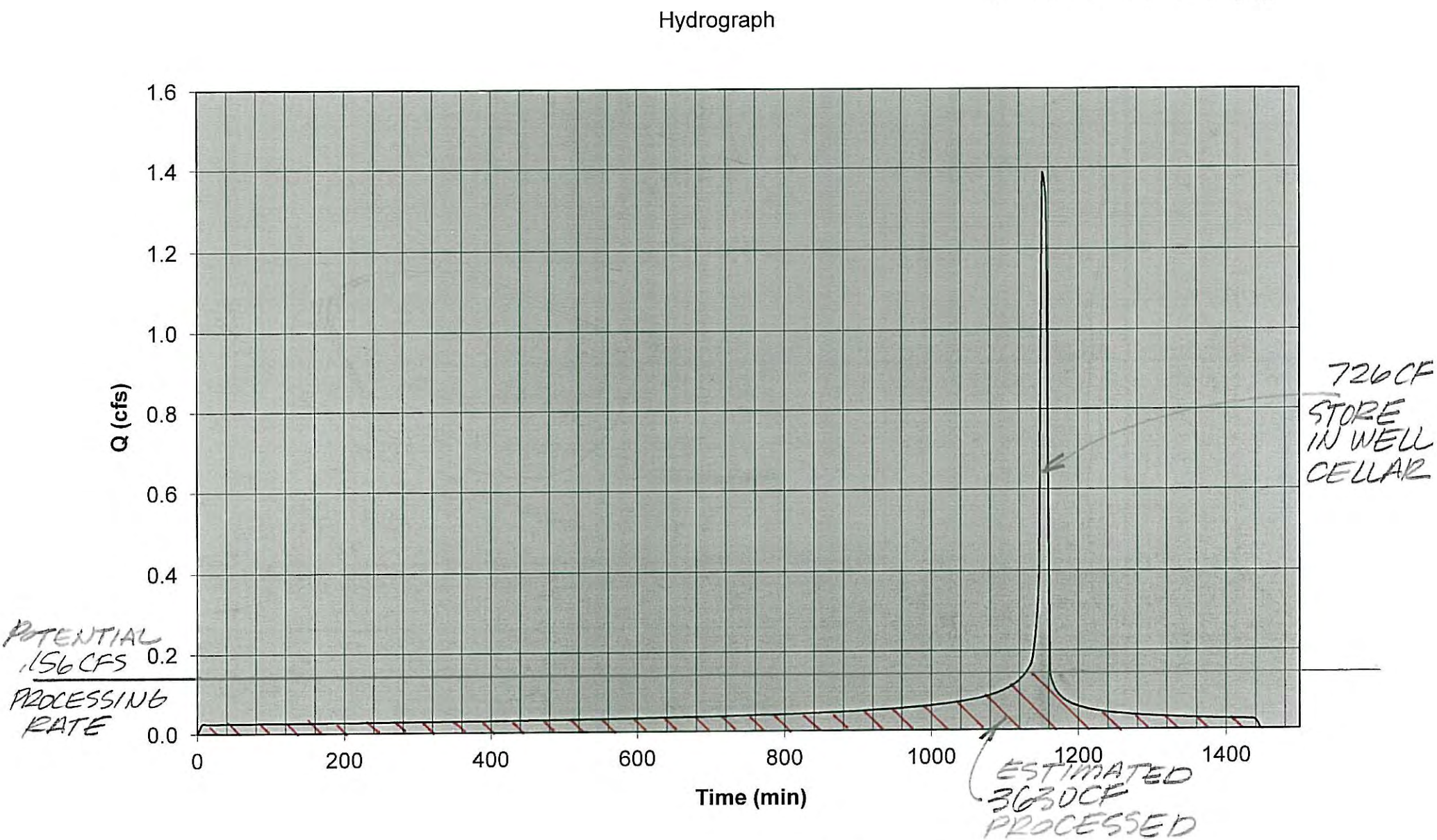
Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

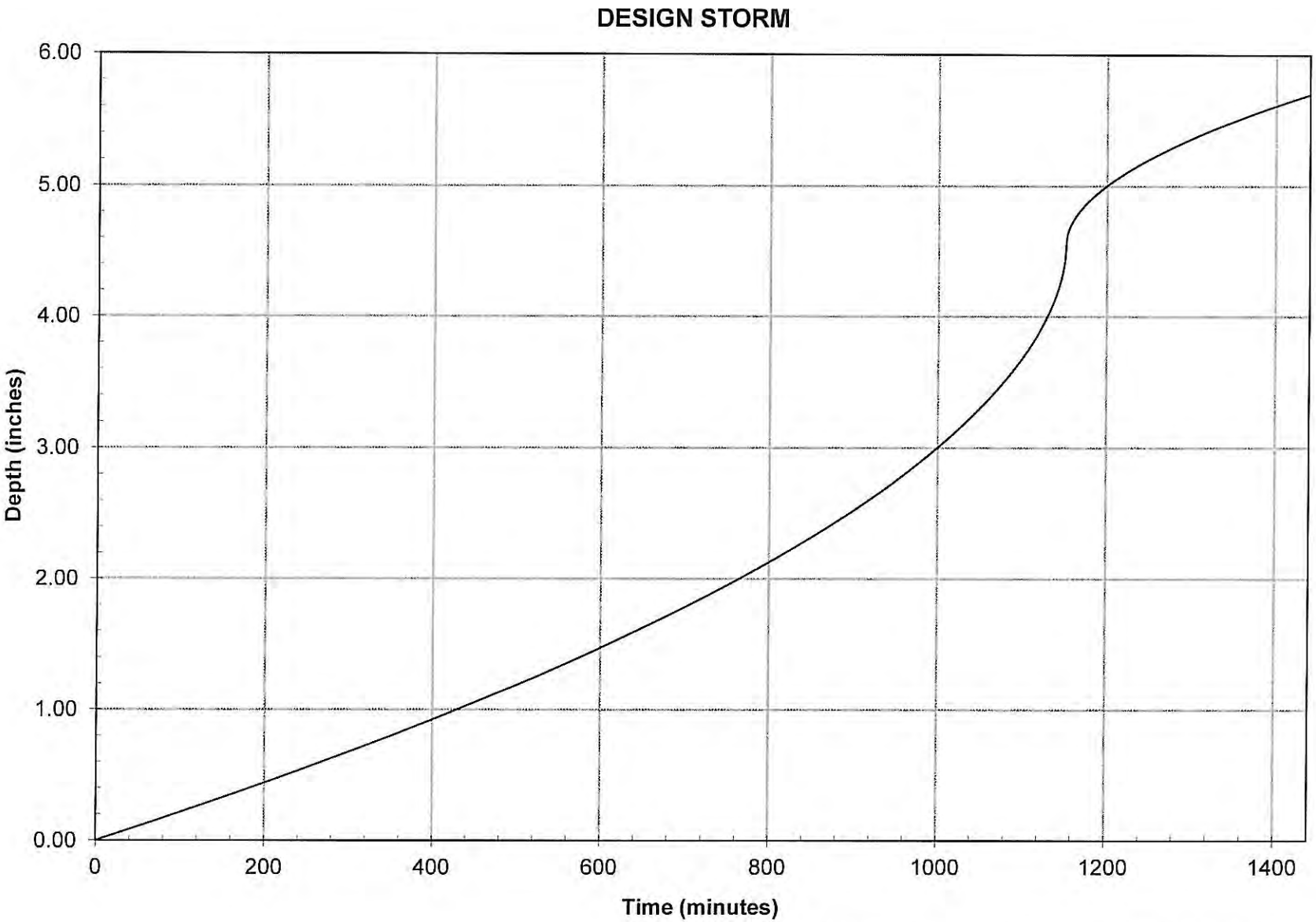
| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 7 | 0.14 | 0.2 | 0.01 |

Q100

.1 AC FT
4356 CF
TOTAL STORAGE




INTERIM 100-YR FREQ




INTERIM 100-YR FREQ

50yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Final I | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .7813 | .93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 240 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.7813 | 0.93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 240 | 0.01 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Final I | 3.04 | 0.45 | 0.87 |

[✓] Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 2.07 | n/a | 0.28 |

$Q_{50}$

50yr

Tc Calculator

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Final II | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .1005 | .93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 50 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.1005 | 0.93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 50 | 0.01 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Final II | 3.04 | 0.45 | 0.87 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.27 | n/a | 0.04 |

$Q_{50}$

50yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Final III | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.3860 | .93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 240 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.386 | 0.93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 240 | 0.01 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Final III | 3.04 | 0.45 | 0.87 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 1.02 | n/a | 0.14 |

Q50

50yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Final IV | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .0574 | .93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 60 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.0574 | 0.93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 60 | 0.01 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Final IV | 3.04 | 0.45 | 0.87 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.15 | n/a | 0.02 |

$Q_{50}$

50yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Final V | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .138 | .93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 250 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.138 | 0.93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 250 | 0.01 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

- [x] Calculate Runoff Volume

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Final V | 3.04 | 0.45 | 0.87 |

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.36 | n/a | 0.05 |

Q50.

100yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Final I | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .7813 | .93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 240 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.7813 | 0.93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 240 | 0.01 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Final I | 3.4 | 0.49 | 0.87 |

[✓] Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 2.31 | n/a | 0.31 |

$Q_{100}$

100yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Final II | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .1005 | .93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 50 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.1005 | 0.93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 50 | 0.01 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

- [x] Calculate Runoff Volume

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Final II | 3.4 | 0.49 | 0.87 |

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.3 | n/a | 0.04 |

$Q_{100}$

100 yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Final III | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.3860 | .93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 240 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.386 | 0.93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 240 | 0.01 |

**Input File**

- [ ] Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

- ( ) Calculate Single Tc From Subarea Parameters Provided In Input File
- (•) Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

- [x] Calculate Runoff Volume

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Final III | 3.4 | 0.49 | 0.87 |

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 1.14 | n/a | 0.15 |

Q 100

100yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Final IV | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .0574 | .93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 60 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.0574 | 0.93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 60 | 0.01 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Final IV | 3.4 | 0.49 | 0.87 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.17 | n/a | 0.02 |

Q 100

100yr

**Subarea Parameters Manual Input**

| Subarea Number | Fire Factor | |
|---|---|---|
| Final V | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| .138 | .93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.7 | 250 | .01 |

**Subarea Parameters Selected**

| Subarea Number | Fire Factor | |
|---|---|---|
| 1a | 1 | |
| **Area (Acres)** | **Proportion Impervious** | **Soil Type** |
| 0.138 | 0.93 | 3 |
| **Rainfall Isohyet (in.)** | **Flow Path Length (ft.)** | **Flow Path Slope** |
| 5.1 | 250 | 0.01 |

**Input File**

☐ Check Here If Subarea Parameters Are Defined In An Input File

Import "tcdata.xls" File

○ Calculate Single Tc From Subarea Parameters Provided In Input File

◉ Calculate Tc's For Multiple Subareas And Create Tc Results File

**Calculation Results**

| Subarea Number | Intensity | Undeveloped Runoff Coefficient (Cu) | Developed Runoff Coefficient (Cd) |
|---|---|---|---|
| Final V | 3.4 | 0.49 | 0.87 |

☑ Calculate Runoff Volume

Calculate Tc

Cancel

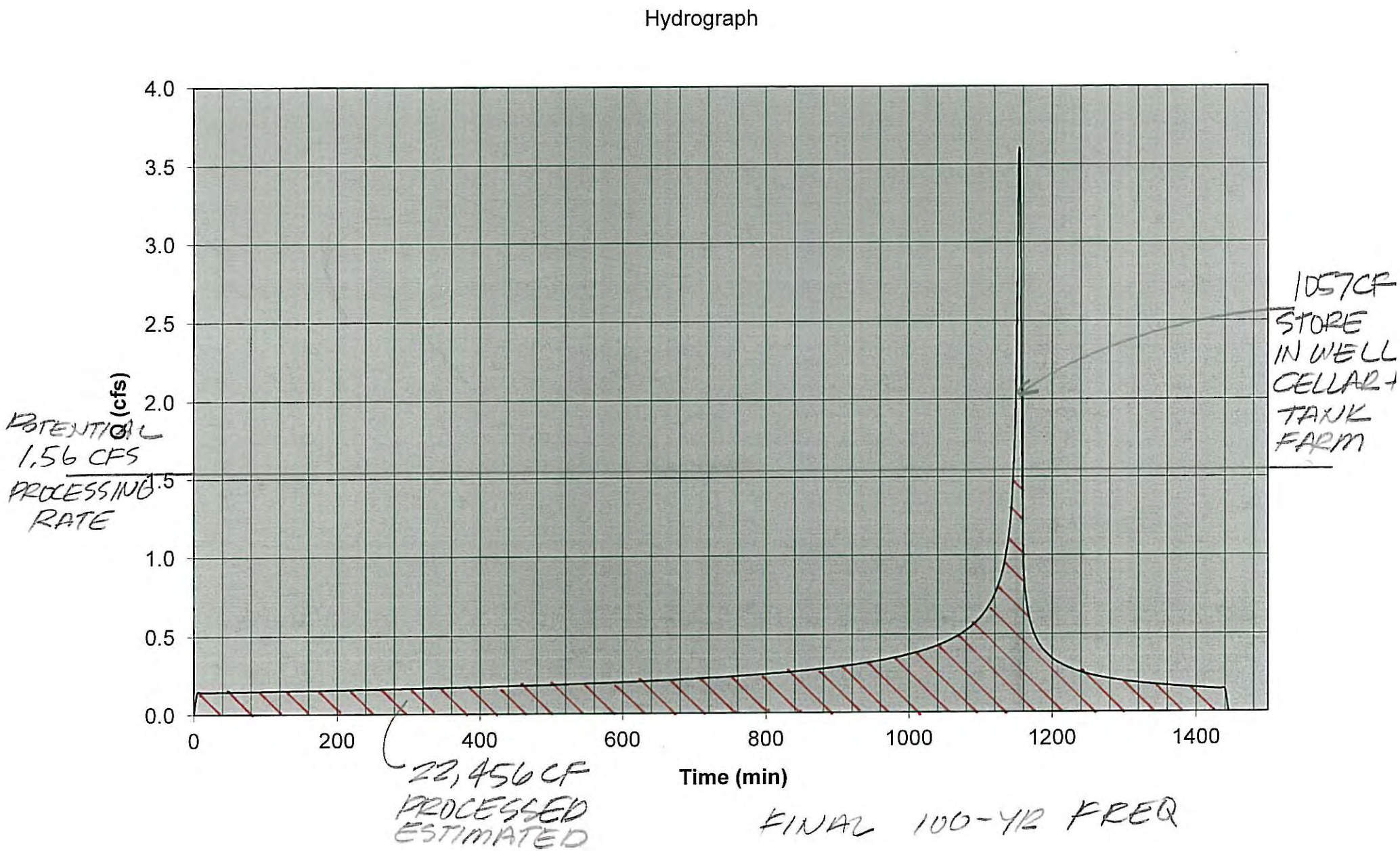
Tc Equation

Tc=(10)^-0.507*(Cd*I)^-0.519*(L)^0.483*(S)^-0.135

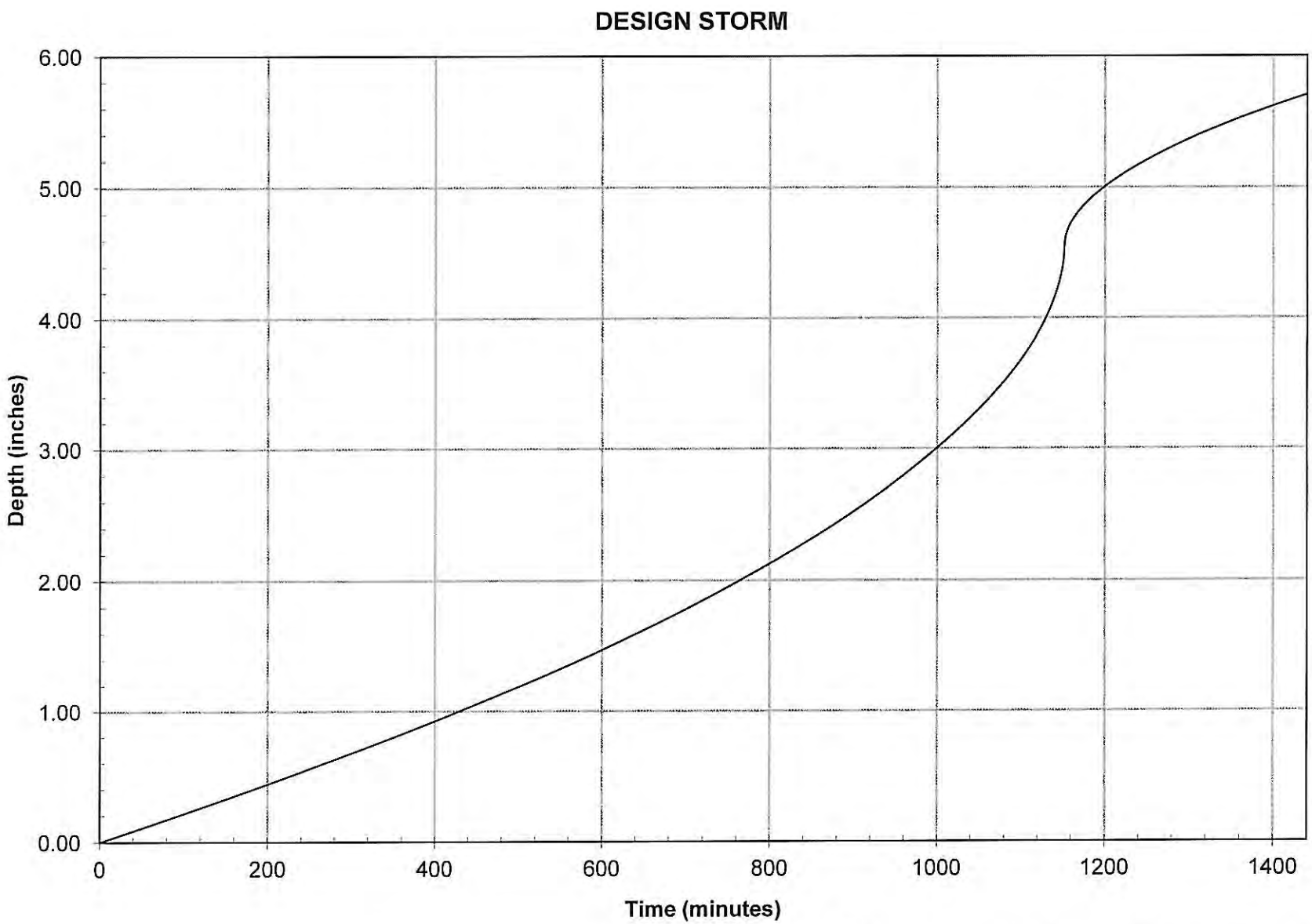
| Tc Value (min.) | Peak Flow Rate (cfs) | Burned Peak Flow Rate (cfs) | 24-Hour Runoff Volume (acre-ft) |
|---|---|---|---|
| 5 | 0.41 | n/a | 0.05 |

$Q_{100}$

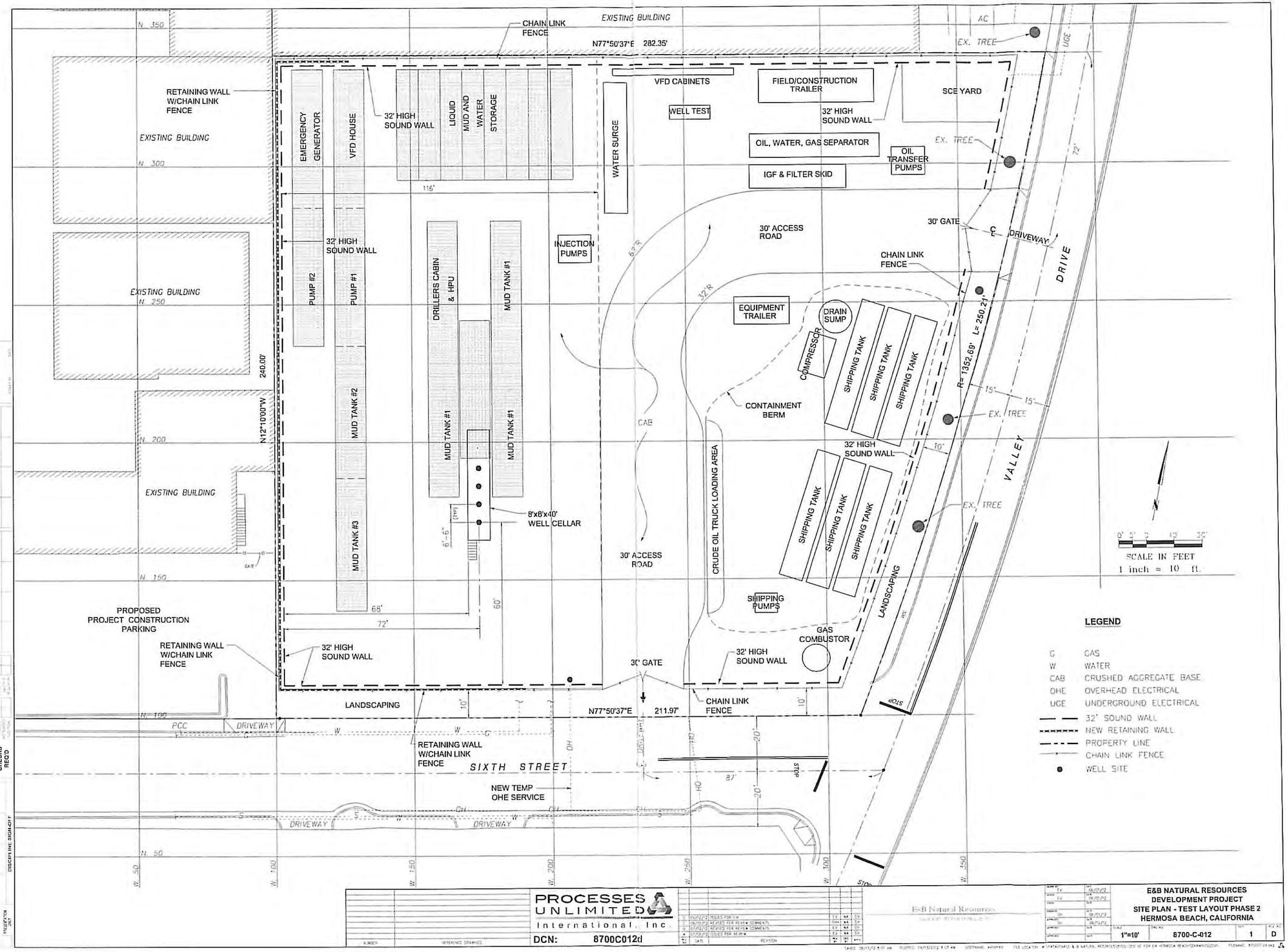
.54 AC FT
23,522 CF
TOTAL STORAGE




FINAL 100-YR FREQ




FINAL 100-YR FREQ


EXISTING BUILDING
CHAIN LINK FENCE
N77°50'37"E 282.35'
AC
EX. TREE
UGE
RETAINING WALL W/CHAIN LINK FENCE
EXISTING BUILDING
N 350
N 300
N 250
N 200
N 150
N 100
N 50
W 50
W 100
W 150
W 200
W 250
W 100
W 350
EMERGENCY GENERATOR
VFD HOUSE
32' HIGH SOUND WALL
LIQUID MUD AND WATER STORAGE
WATER SURGE
VFD CABINETS
WELL TEST
FIELD/CONSTRUCTION TRAILER
SCE YARD
OIL, WATER, GAS SEPARATOR
OIL TRANSFER PUMPS
IGF & FILTER SKID
116'
PUMP #2
PUMP #1
DRILLERS CABIN & HPU
MUD TANK #1
INJECTION PUMPS
30' ACCESS ROAD
30' GATE
DRIVEWAY
DRIVE
CHAIN LINK FENCE
EQUIPMENT TRAILER
DRAIN SUMP
COMPRESSOR
SHIPPING TANK
R= 1352.69'
L= 250.21'
15'
CONTAINMENT BERM
CAB
CRUDE OIL TRUCK LOADING AREA
VALLEY
10'
MUD TANK #2
MUD TANK #3
240.00'
N12°10'00"W
8'x8'x40' WELL CELLAR
6'-6"
68'
72'
60'
SHIPPING PUMPS
LANDSCAPING
GAS COMBUSTOR
PROPOSED PROJECT CONSTRUCTION PARKING
RETAINING WALL W/CHAIN LINK FENCE
32' HIGH SOUND WALL
30' GATE
N77°50'37"E 211.97'
CHAIN LINK FENCE
PCC
DRIVEWAY
W
G
RETAINING WALL W/CHAIN LINK FENCE
SIXTH STREET
NEW TEMP OHE SERVICE
OH
HO
87'
20'
STOP
SCALE IN FEET
1 inch = 10 ft.
LEGEND
G GAS
W WATER
CAB CRUSHED AGGREGATE BASE
OHE OVERHEAD ELECTRICAL
UGE UNDERGROUND ELECTRICAL
32' SOUND WALL
NEW RETAINING WALL
PROPERTY LINE
CHAIN LINK FENCE
WELL SITE
PROCESSES UNLIMITED International, Inc.
DCN: 8700C012d
E&B Natural Resources
E&B NATURAL RESOURCES DEVELOPMENT PROJECT
SITE PLAN - TEST LAYOUT PHASE 2
HERMOSA BEACH, CALIFORNIA
1"=10'
8700-C-012
1
D

## A.1 METHOD FOR CALCULATING STANDARD URBAN STORMWATER MITIGATION PLAN FLOW RATES AND VOLUMES BASED ON 0.75-INCHES OF RAINFALL: WORKSHEET

**PROJECT NAME**

E & B OIL DEVELOPMENT
555 6th ST
HERMOSA BEACH, CA
PHASE 2 DRILLING AND
TESTING

## NOMENCLATURE

| | | |
|---|---|---|
| $A_I$ | = | Impervious Area (acres) |
| $A_P$ | = | Pervious Area (acres) |
| $A_U$ | = | Contributing Undeveloped Upstream Area (acres) |
| $A_{Total}$ | = | Total Area of Development and Contributing Undeveloped Upstream Area (acres) |
| $C_D$ | = | Developed Runoff Coefficient |
| $C_U$ | = | Undeveloped Runoff Coefficient |
| $I_X$ | = | Rainfall Intensity (inches / hour) |
| $Q_{PM}$ | = | Peak Mitigation Flow Rate (cfs) |
| $T_C$ | = | Time of Concentration (minutes, must be between 5-30 min.) |
| $V_M$ | = | Mitigation Volume ($ft^3$) |

## EQUATIONS

$A_{Total} = A_I + A_P + A_U$

$A_I = (A_{Total} * \%$ of Development which is Impervious)

$A_P = (A_{Total} * \%$ of Development which is Pervious)

$A_U = (A_{Total} * \%$ of Contributing Undeveloped Upstream Area***)

$C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$ If $C_D < C_U$, use $C_D = C_U$

$Q_{PM} = C_D * I_X * A_{Total} * (1 \text{ hour} / 3{,}600 \text{ seconds}) * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$

$= C_D * I_X * A_{Total} * (1.008333 \text{ ft}^3\text{-hour / acre-inches-seconds})$

$T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$

$V_M = (0.75 \text{ inches}) * [(A_I)(0.9) + (A_P + A_U)(C_U)] * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$

$= (2{,}722.5 \text{ ft}^3 / \text{acre}) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$

***** Contributing Undeveloped Upstream Area is an area where stormwater runoff from an undeveloped upstream area will flow directly or indirectly to the Post-Construction Best Management Practices (BMPs) proposed for the development. This additional flow must be included in the flow rate and volume calculations to appropriately size the BMPs.**

**PROVIDE PROPOSED PROJECT CHARACTERISTICS**

| | | |
|---|---|---|
| $A_{Total}$ | 1.3 | Acres |
| Type of Development | IND | |
| Predominate Soil Type # | 003 | |
| % of Project Impervious | 7% | |
| % of Project Pervious | 93% | |
| % of Project Contributing Undeveloped Area | -0- | |
| $A_I$ | 0.09 | Acres |
| $A_P$ | 1.21 | Acres |
| $A_U$ | -0- | Acres |

ASSUME 20 PCC AROUND WELL CELLAR

## DETERMINING THE PEAK MITIGATED FLOW RATE ($Q_{PM}$):

In order to determine the peak mitigated flow rate ($Q_{PM}$) from the new development, use the Los Angeles County Department of Public Works *Hydrology Manual*. Use the Modified Rational Method for calculating the peak mitigation $Q_{PM}$ for compliance with the Standard Urban Stormwater Mitigation Plan (SUSMP). Use attached **Table 1** for all maximum intensity ($I_X$) values used.

By trial and error, determine the time of concentration ($T_C$), as shown below:

CALCULATION STEPS:

1. Assume an initial $T_C$ value between 5 and 30 minutes.

$T_C$ 20 minutes

2. Using Table 1, look up the assumed $T_C$ value and select the corresponding $I_X$ intensity in inches/hour.

$I_X$ .233 inches/hour

3. Determine the value for the Undeveloped Runoff Coefficient, $C_U$, using the runoff coefficient curve corresponding to the predominant soil type.

.072 + .093 = .165

$C_U$ .1

.9 x .07 + [1 - .9] x .1

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$

$C_D$ .165

5. Calculate the value for $C_D * I_X$

52.48

$C_D * I_X$ .038

.3111 5.4258 (51.095)

6. Calculate the time of concentration, $T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$

Calculated $T_C$ 55 minutes

7. Calculate the difference between the initially assumed $T_C$ and the calculated $T_C$, if the difference is greater than 0.5 minutes. Use the calculated $T_C$ as the assumed initial $T_C$ in the second iteration. If the $T_C$ value is within 0.5 minutes, round the acceptable $T_C$ value to the nearest minute.

TABLE FOR ITERATIONS:

| Iteration No. | Initial $T_C$ (min) | $I_X$ (in/hr) | $C_U$ | $C_D$ | $C_D$*$I_X$ (in/hr) | Calculated $T_C$ (min) | Difference (min) |
|---|---|---|---|---|---|---|---|
| 1 | 20 | .233 | .1 | .165 | .038 | 55 | 35 |
| 2 | 60 | .193 | .1 | .165 | .0318 | 57.9 | 2.5 |
| 3 | 58 | .193 | .1 | .165 | .0318 | 57.9 | .1 |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |

Acceptable $T_C$ value 58 minutes

8. Calculate the Peak Mitigation Flow Rate,
   $Q_{PM} = C_D * I_X * A_{Total} * (1.008333\ ft^3\text{-hour / acre-inches-seconds})$

$Q_{PM}$ 0.0417 cfs

## TABLE 1

INTENSITY - DURATION DATA FOR 0.75-INCHES OF RAINFALL
FOR ALL RAINFALL ZONES

| Duration, $T_C$ (min) | Rainfall Intensity, $I_X$ (in/hr) |
|---|---|
| 5 | 0.447 |
| 6 | 0.411 |
| 7 | 0.382 |
| 8 | 0.359 |
| 9 | 0.339 |
| 10 | 0.323 |
| 11 | 0.309 |
| 12 | 0.297 |
| 13 | 0.286 |
| 14 | 0.276 |
| 15 | 0.267 |
| 16 | 0.259 |
| 17 | 0.252 |
| 18 | 0.245 |
| 19 | 0.239 |
| 20 | 0.233 |
| 21 | 0.228 |
| 22 | 0.223 |
| 23 | 0.218 |
| 24 | 0.214 |
| 25 | 0.210 |
| 26 | 0.206 |
| 27 | 0.203 |
| 28 | 0.199 |
| 29 | 0.196 |
| 30 | 0.193 |

## DETERMINING THE VOLUME ($V_M$)

In order to determine the volume ($V_M$) of stormwater runoff to be mitigated from the new development, use the following equation:

$$V_M = (2{,}722.5\ ft^3 / acre) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$$

$$\times [0.09 \times .9] + [1.21 \times .1]$$

$$[.081 + .121]$$

$$2722.5 \times .202 = \underline{549.95\ CF}$$

TO BE MITIGATED
PHASE 2

## A.1 METHOD FOR CALCULATING STANDARD URBAN STORMWATER MITIGATION PLAN FLOW RATES AND VOLUMES BASED ON 0.75-INCHES OF RAINFALL: WORKSHEET

**PROJECT NAME**

E & B. OIL DEVELOPMENT
555 6TH ST
HERMOSA BEACH, CA
ULTIMATE BUILD OUT-
PHASE 4-

EXISTING BUILDING
16' HIGH SPLIT FACE BLOCK WALL
N77°50'37"E 282.35'
8' HIGH SPLIT FACE BLOCK WALL
VFD CABINETS
OFFICE
SWITCH GEAR BUILDING
SCE YARD
AIR COMPRESSORS
WELL TEST
EMERGENCY EXITS
ACCESS ROAD
26' ROLLING GATE
PCC
℄ NEW DRIVEWAY
BATTERY LIMITS W/CONTAINMENT BERM
EMERGENCY EXIT
6' HT.RETAINING W/ 16' HT. BLOCK WALL
SR
OIL-WATER-GAS SEPARATOR
HEATER TREATER
BACK WASH
WATER SURGE 30'Ø x 16' 1120 BBL
WATER SURGE 30'Ø x 16' 1120 BBL
TANK FARM
FS ELEV.= -6'
IGF
WATER FILTER SYSTEM
VRU
P-3
CLARIFIER 40'Ø x 16' 2900 BBL
OIL WATER SEPARATION
FS ELEV.= -1'
P-1
LACT
P-2
REFRIG
5' HIGH RETAINING WALL
6' HT.RETAINING W/ 16' HT. BLOCK WALL
WELL PAD
FS ELEV.= 0'
DRAIN SUMP 10'Ø x 30' 420 BBL (UNDERGROUND)
GAS COMP.
GAS COMP.
GAS COMP.
SS
OIL SHIPPING 40'Ø x 16' 2900 BBL
GAS PROCESSING UNIT
FS ELEV.= -7'
DEA SKID
LTS
OIL SHIPPING 40'Ø x 16' 2900 BBL
ACCESS ROAD
7' RETAINING WALL
PROPOSED PROJECT CONSTRUCTION PARKING
PARKING
16' HIGH SPLIT FACE BLOCK WALL
26' ROLLING GATE
RAMP 20% SLOPE
GAS COMBUSTOR
EMERGENCY EXIT
6' HT.RETAINING W/ 16' HT. BLOCK WALL
NEW LANDSCAPING
NEW LANDSCAPING
N77°50'37"E 211.97'
PCC SIDEWALK
PCC SIDEWALK
NEW 5' SIDEWALK
NEW CURB & GUTTER
NEW CURB & GUTTER
NEW 5' SIDEWALK
SIXTH STREET
℄ NEW DRIVEWAY
NEW CURB & GUTTER
NEW LANDSCAPING
PCC SIDEWALK
NEW 4' SIDEWALK
VALLEY DRIVE
R=1352.68' L=250.21'
N12°10'00"W 240.00'
SCALE IN FEET
1 inch = 10 ft.

**LEGEND**

| | |
|---|---|
| IGF | INDUCED GAS FLOATION OIL REMOVAL |
| VRU | VAPOR RECOVERY UNIT |
| LACT | LEASE AUTOMATIC CUSTODY TRANSFER |
| UGE | UNDERGROUND ELECTRICAL |
| P-1 | OIL/WATER/GAS SEPARATION PUMPS |
| P-2 | WATER INJECTION PUMPS |
| P-3 | OIL SHIPPING PUMPS |
| DEA | DIETHANOLAMINE $CO_2$ REMOVAL HEATED EQUIPMENT |
| LTS | LOW TEMPERATURE SEPARATION WATER REMOVAL HEATED EQUIPMENT |
| SS | $H_2S$ REMOVAL |
| SR | SOLIDS REMOVAL |
| ● | EXISTING WELL |
| ○ | FUTURE WELL |
| | ACCESS ROAD |
| | 16' HIGH SPLIT-FACE BLOCK W/WO RETAINING WALL |
| | 8' HIGH SPLIT-FACE BLOCK WALL |
| | PROPERTY LINE |

PROCESSES UNLIMITED International, Inc.
DCN: 8700C013-1dd

E&B Natural Resources

**E&B NATURAL RESOURCES DEVELOPMENT PROJECT**
**SITE PLAN - PHASE 3, ALT. 1**
**HERMOSA BEACH, CALIFORNIA**

| SCALE | DRAWING | SHEET | REV |
|---|---|---|---|
| 1"=10' | 8700-C-013 | 1 | D |

## NOMENCLATURE

| | | |
|---|---|---|
| $A_I$ | = | Impervious Area (acres) |
| $A_P$ | = | Pervious Area (acres) |
| $A_U$ | = | Contributing Undeveloped Upstream Area (acres) |
| $A_{Total}$ | = | Total Area of Development and Contributing Undeveloped Upstream Area (acres) |
| $C_D$ | = | Developed Runoff Coefficient |
| $C_U$ | = | Undeveloped Runoff Coefficient |
| $I_X$ | = | Rainfall Intensity (inches / hour) |
| $Q_{PM}$ | = | Peak Mitigation Flow Rate (cfs) |
| $T_C$ | = | Time of Concentration (minutes, must be between 5-30 min.) |
| $V_M$ | = | Mitigation Volume ($ft^3$) |

## EQUATIONS

$A_{Total} = A_I + A_P + A_U$

$A_I = (A_{Total} * \%$ of Development which is Impervious)

$A_P = (A_{Total} * \%$ of Development which is Pervious)

$A_U = (A_{Total} * \%$ of Contributing Undeveloped Upstream Area***)

$C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$ If $C_D < C_U$, use $C_D = C_U$

$Q_{PM} = C_D * I_X * A_{Total} * (1 \text{ hour} / 3{,}600 \text{ seconds}) * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$

$= C_D * I_X * A_{Total} * (1.008333 \text{ ft}^3\text{-hour / acre-inches-seconds})$

$T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$

$V_M = (0.75 \text{ inches}) * [(A_I)(0.9) + (A_P + A_U)(C_U)] * (1 \text{ ft} / 12 \text{ inches}) * (43{,}560 \text{ ft}^2 / 1 \text{ acre})$

$= (2{,}722.5 \text{ ft}^3 / \text{acre}) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$

***** Contributing Undeveloped Upstream Area is an area where stormwater runoff from an undeveloped upstream area will flow directly or indirectly to the Post-Construction Best Management Practices (BMPs) proposed for the development. This additional flow must be included in the flow rate and volume calculations to appropriately size the BMPs.**

**PROVIDE PROPOSED PROJECT CHARACTERISTICS**

| | | |
|---|---|---|
| $A_{Total}$ | 1.3 | Acres |
| Type of Development | IND. | |
| Predominate Soil Type # | 003 | |
| % of Project Impervious | 92.02% | |
| % of Project Pervious | 7.98% | |
| % of Project Contributing Undeveloped Area | 0 | |
| $A_I$ | 1.19 | Acres |
| $A_P$ | .11 | Acres |
| $A_U$ | 0 | Acres |

## DETERMINING THE PEAK MITIGATED FLOW RATE ($Q_{PM}$):

In order to determine the peak mitigated flow rate ($Q_{PM}$) from the new development, use the Los Angeles County Department of Public Works *Hydrology Manual*. Use the Modified Rational Method for calculating the peak mitigation $Q_{PM}$ for compliance with the Standard Urban Stormwater Mitigation Plan (SUSMP). Use attached **Table 1** for all maximum intensity ($I_X$) values used.

By trial and error, determine the time of concentration ($T_C$), as shown below:

CALCULATION STEPS:

1. Assume an initial $T_C$ value between 5 and 30 minutes.

$T_C$ 15 minutes

2. Using Table 1, look up the assumed $T_C$ value and select the corresponding $I_X$ intensity in inches/hour.

$I_X$ .267 inches/hour

3. Determine the value for the Undeveloped Runoff Coefficient, $C_U$, using the runoff coefficient curve corresponding to the predominant soil type.

$C_U$ .1 .92 .92

4. Calculate the Developed Runoff Coefficient, $C_D = (0.9 * \text{Imp.}) + [(1.0 - \text{Imp.}) * C_U]$

$C_D$ .836 .828 + .008 = .836

5. Calculate the value for $C_D * I_X$

$C_D * I_X$ .2232 (.3111) 2.1778 (16.699 x 1.862) 31.095 .6736

6. Calculate the time of concentration, $T_C = 10^{-0.507} * (C_D * I_X)^{-0.519} * \text{Length}^{0.483} * \text{Slope}^{-0.135}$ 340 .01

Calculated $T_C$ 21.07 minutes

7. Calculate the difference between the initially assumed $T_C$ and the calculated $T_C$, if the difference is greater than 0.5 minutes. Use the calculated $T_C$ as the assumed initial $T_C$ in the second iteration. If the $T_C$ value is within 0.5 minutes, round the acceptable $T_C$ value to the nearest minute.

TABLE FOR ITERATIONS:

| Iteration No. | Initial $T_C$ (min) | $I_X$ (in/hr) | $C_U$ | $C_D$ | $C_D$*$I_X$ (in/hr) | Calculated $T_C$ (min) | Difference (min) |
|---|---|---|---|---|---|---|---|
| 1 | 15 | .267 | .1 | .836 | .2232 | 21.07 | 6.07 |
| 2 | 21 | .228 | .1 | .836 | .1906 | 22.87 | 1.87 |
| 3 | 23 | .218 | .1 | .836 | .1822 | 23.40 | .40 |
| 4 | | | | | | | |
| 5 | | | | | | | |
| 6 | | | | | | | |
| 7 | | | | | | | |
| 8 | | | | | | | |
| 9 | | | | | | | |
| 10 | | | | | | | |

Acceptable $T_C$ value 23 minutes

8. Calculate the Peak Mitigation Flow Rate,
   $Q_{PM} = C_D * I_X * A_{Total}$ * (1.008333 ft$^3$-hour / acre-inches-seconds)

$Q_{PM}$ 1.096 cfs .836 x 1.3 x 1.008333

## TABLE 1

INTENSITY - DURATION DATA FOR 0.75-INCHES OF RAINFALL
FOR ALL RAINFALL ZONES

| Duration, $T_C$ (min) | Rainfall Intensity, $I_X$ (in/hr) |
|---|---|
| 5 | 0.447 |
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| 19 | 0.239 |
| 20 | 0.233 |
| 21 | 0.228 |
| 22 | 0.223 |
| 23 | 0.218 |
| 24 | 0.214 |
| 25 | 0.210 |
| 26 | 0.206 |
| 27 | 0.203 |
| 28 | 0.199 |
| 29 | 0.196 |
| 30 | 0.193 |

**DETERMINING THE VOLUME ($V_M$)**

In order to determine the volume ($V_M$) of stormwater runoff to be mitigated from the new development, use the following equation:

$$V_M = (2{,}722.5\ ft^3 / acre) * [(A_I)(0.9) + (A_P + A_U)(C_U)]$$

$2722.5 \times [1.19 \times .9 + (.11 \times .1)]$

$\times [1.071 + .011] = 2943.02$ CF

TO BE MITIGATED

PHASE 4