Drainage Study

San Pasqual Valley Road

April 7, 2020

PREPARED FOR

KAE Investments, LLC

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SDC PDS RCVD 01-07-20

TM5620

Declaration of Responsible Charge

I hereby declare that I am the engineer of work for this project. That I have exercised responsible charge over the design of the project as defined in Section 6703 of the business and professions code, and that the design is consistent with current standards.

I understand that the check of project drawings and specifications by the County of San Diego is confined to a review only and does not relieve me, as engineer of work, of my responsibilities for project design.

William Lundstrom
Registered Civil Engineer 61630
Exp. Date: 06/30/21

Date

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Introduction

Purpose and Scope

To provide guidelines for preparation and review of preliminary hydrology/drainage study associated with discretionary projects under various County of San Diego Ordinances.

Development of permanent improved drainage facilities relies in part, on early identification of any adverse drainage conditions that are caused or worsened by new development projects. To avoid sub-standard drainage facilities, (difficult and costly to replace) sufficient information is needed early, when the project is being considered for approval. The County's application process requires a hydrology/ drainage study on all development projects at the time of application. This study provides the needed information to ensure that the proposed drainage facilities are located appropriately.

The study compares storm runoff under existing conditions versus proposed conditions (100 year event) and identifies existing drainage problems that may be caused, or aggravated, by project development. The study is further used to determine impacts that might be caused downstream (erosion) and to identify proposed mitigation measures.

Section 1. Project Information

1.1.Project Description

1.1.1 Project Location

The project site is located in the County of San Diego, California. The project is located northwest of the intersection of San Pasqual Valley Road and Highgrove Drive. **Exhibit B** provides a location map for the site.

1.1.2 Project Activities Description

The proposed project is on an 18-acres parcel in the County of San Diego. The project will consist of the grading of the site into fourteen single family residential pads, a private road for access and necessary utility and street improvements.

1.2.Hydrologic Setting

This section summarizes the project's size and location in the context of the larger watershed perspective, topography, soil and vegetation conditions, percent impervious area, natural and infrastructure drainage features, and other relevant hydrologic and environmental factors to be protected specific to the project area's watershed.

1.2.1 Topography

The site is bounded to the south by San Pasqual Valley Road (Highway 78), to the west by a southwesterly trending drainage channel, and to the north and east by existing single-family residential properties. In general, the site exhibits moderately sloping topography toward the south and west, with a hill in the central portion of the site. Approximate elevations within the overall site limits range from a low elevation of 655 msl at the southwesterly boundary to a high of 770 msl near the northeasterly boundary. The site currently supports an existing single-family residence on the hill in the central portion of the site, and the rest of the site is currently vacant and undeveloped with the exception of a few dirt roads. The site is covered with a light to moderate growth of weeds and grass with localized small trees and bushes. Runoff generated on site is conveyed naturally via overland flow to an existing drainage channel. The natural drainage channel flows in a southwesterly direction along the westerly property line.

1.2.2 FEMA Flood Insurance Rate Map

The project site is located in Zone X of the Flood Insurance Rate Map (FIRM) Panel 06073C1081G, effective date May 16, 2012. Zone X is designated to be areas determined to be outside the 500-year floodplain. **Exhibit C** illustrates the project site within Flood Zone X.

1.2.3 Current and Adjacent Land Use

The project site currently consists of one single family house with access to San Pasqual Velley Road through an existing asphalt paved driveway. Adjacent land use are single family residential and agriculture.

1.2.4 Soil and Vegetation Conditions

Geotechnical investigation, "Preliminary Geotechnical Investigation, 2260 San Pasqual Valley Road Project", by AGS, dated July 27, 2016, indicates the site consists of silty fine sand (SM).
Published regional geologic maps indicate the site is underlain by Mid-Cretaceous Granodiorite of Woodson Mountain. For the purposes of this report, the simple nomenclature of "granitic rock" will be used. This unit is mantled by relatively thin veneers of surficial soils including undocumented artificial fill, older alluvium, colluvium and topsoil. The following section contains a summary of the soil and bedrock units encountered onsite.

The project site is categorized as having Diegan Coastal Sage Scrub and non-native vegetation habitat.

1.2.5 Existing Drainage Patterns and Facilities (Narrative)

The site is bounded to the south by San Pasqual Valley Road (Highway 78), to the west by a southwesterly trending drainage channel, and to the north and east by existing single-family residential properties. In general, the site exhibits moderately sloping topography toward the south and west, with a hill in the central portion of the site. Approximate elevations within the overall site limits range from a low elevation of 655 msl at the southwesterly boundary to a high of 770 msl near the northeasterly boundary. The site currently supports an existing single-family residence on the hill in the central portion of the site, and the rest of the site is currently vacant and undeveloped with the exception of a few dirt roads. The site is covered with a light to moderate growth of weeds and grass with localized small trees and bushes. Runoff generated on site is conveyed naturally via overland flow to an existing drainage channel. The natural drainage channel flows in a southwesterly direction along the westerly property line.

1.2.6 Downstream Conditions

Runoff generated from the site is currently conveyed downstream towards Lake Hodges through a serious of drainage channels and public storm drain.

1.3.Proposed Runoff Management Facilities

The proposed facilities managing runoff from the site include:

- Appropriate grading of pads to direct runoff away from future structures on the site.
- Storm drain systems to direct on-site runoff to appropriate outfalls.

Section 2. Design Criteria and Methodology

This section summarizes the design criteria and methodology applied during drainage analysis of the project site. The design criteria and methodology follow the County of San Diego County Hydrology Manual (June 2003), San Diego County Hydraulic Drainage Design Manual (September 2014), and Storm Water Standards as appropriate for the project site.

2.1. Hydrologic Design Methodology

2.1.1 Rational Method: Peak Flow

Runoff calculations for this study were accomplished using the Rational Method. The Rational Method is a physically-based numerical method where runoff is assumed to be directly proportional to rainfall and area, less losses for infiltration and depression storage. Flows were computed based on the Rational formula:

$$Q = CiA$$

where ...
- Q = Peak discharge (cfs);
- C = runoff coefficient, based on land use and soil type;
- i = rainfall intensity (in/hr);
- A = watershed area (acre)

The runoff coefficient represents the ratio of rainfall that runs off the watershed versus the portion that infiltrates to the soil or is held in depression storage. The runoff coefficient is dependent on the land use coverage and soil type.

For a typical drainage study, rainfall intensity varies with the watershed time of concentration. The watershed time of concentration at any given point is defined as the time it would theoretically take runoff to travel from the most upstream point in the watershed to a concentration point, as calculated by equations in the San Diego County Hydrology Manual.

Table 2-1 Rational Method Runoff Coefficients.

		RUNOFF COEFFICIENT			
	(%)	Hydrologic Soil Type			
LAND USE (County Elements)	**Imperv.**	**A**	**B**	**C**	**D**
Permanent Open Space		0.20	0.25	0.30	0.35
Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Neighborhood Commercial	80	0.76	0.77	0.78	0.79
General Commercial	85	0.80	0.80	0.81	0.82
Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Limited Industrial	90	0.83	0.84	0.84	0.85
General Industrial	95	0.87	0.87	0.87	0.87

Rational Method calculations were accomplished using the Advanced Engineering Software Rational Method Analysis (Southern California County Methods) (AES-RATSCx) computer software packages. Peak discharges were computed for 100-year and 50-year storm return frequencies. The final use for this project site is unknown at this time. Therefore, for conservative purposes, a runoff "C" coefficient of 0.90 (paved surface) was used.

2.1.2 Time of Concentration

The Time of Concentration (T_c) is the time required for runoff to flow from the most remote part of the drainage area to the point of interest. The T_c is composed of two components: initial time of concentration (T_i) and the travel time (T_t). The T_i is the time required for runoff to travel across the surface of the most remote subarea in the study, or "initial subarea". Guidelines for designation the initial subarea are provided within the discussion of computation of T_i. The T_i is the time required for the runoff to flow in a watercourse (e.g., swale, channel, gutter, pipe) or series of watercourses from the initial subarea to the point of interest. For the Rational Method, the T_c at any point within the drainage area is given by:

$$T_c = T_i + T_t$$

Methods of calculation differ for natural watersheds (nonurbanized) and for urban drainage systems. When analyzing storm drain systems, the designer must consider the possibility that an existing natural watershed may become urbanized during the useful life

of the storm drain system. Future land uses must be used for T_c and runoff calculations, and can be determined from the local Community General Plan.

2.1.3 Initial Time of Concentration

The initial time of concentration is typically based on sheet flow at the upstream end of a drainage basin. The Overland Time of Flow is approximated by an equation developed by the Federal Aviation Agency (FAA) for analyzing flow on runways (FAA, 1970). The usual runway configuration consists of a crown, like most freeways, with sloping pavement that directs flow to either side of the runway. This type of flow is uniform in the direction perpendicular to the velocity and is very shallow. Since these depths are ¼ of an inch in magnitude, the relative roughness is high. Some higher relative roughness values for overland flow are presented in the ***HEC-1 Flood Hydrograph Package User's Manual*** (USACE, 1990).

The sheet flow that is predicted by the FAA equation is limited to conditions that are similar to runway topography. Some considerations that limit the extent to which the FAA equation applies are identified below:

- Urban Areas – This "runway type" runoff includes:
  - Flat roofs, sloping at 1% +/-
  - Parking lots at the extreme upstream drainage basin boundary (at the "ridge" of a catchment area.) Even a parking lot is limited in the amounts of sheet flow. Parked or moving vehicles would "break-up" the sheet flow, concentrating runoff into streams that are not characteristic of sheet flow.
  - Driveways are constructed at the upstream end of catchment areas in some developments. However, if flow from a roof is directed to a driveway through a downspout or other conveyance mechanism, flow would be concentrated.
  - Flat slopes are prone to meandering flow that tends to be disrupted by minor irregularities and obstructions. Maximum Overland Flow lengths are shorter for the flatter slopes.
- Rural or Natural Areas –The FAA equation is applicable to these conditions since (0.5% to 10%) slopes that are uniform in width of flow have slow velocities consistent with the equation. Irregularities in terrain limit the length of application.
  - Most hills and ridge lines have a relatively flat area near the drainage divide. However, with flat slopes of 0.5% +/-, minor irregularities would cause flow to concentrate into streams.

- Parks, lawns and other vegetated areas would have slow velocities that are consistent with the FAA Equation.

The Initial Time of Concentration is reflective of the general land-use at the upstream end of a drainage basin.

2.1.4 Travel Time

The T_t is the time required for the runoff to flow in a watercourse or series of watercourses from the initial subarea to the point of interest. The T_t is computed by dividing the length of the flow path by the computed flow velocity. Since the velocity normally changes as a result of each change in flow rate or slope, such as at an inlet or grade break, the total T_t must be computed as the sum of the T_t's for each section of the flow path.

2.1.5 Rational Method: Runoff Volume

For designs that are dependent on the total storm volume, a hydrograph must be generated to account for the entire volume of runoff from the 6-hour storm event. The hydrograph for the entire 6-hour storm event is generated by creating a rainfall distribution consisting of blocks of rain, creating an incremental hydrograph for each block of rain, and adding the hydrographs from each block of rain. This process creates a hydrograph that contains runoff from all the blocks of rain and accounts for the entire volume of runoff from the 6-hour storm event. The total volume under the resulting hydrograph is equal to the following equation:

$$VOL = CP_6A$$

Where:
VOL = volume of runoff (acres-inches)
P_6 = 6-hour rainfall (inches)
C = runoff coefficient
A = area of the watershed (acres)

Section 3. Characterization of Project Runoff

3.1.Hydrologic Effects of Project

The proposed project will not significantly alter drainage patterns on the site. **Exhibit E** illustrates the proposed condition hydrology map. Table 3-1 summarizes the hydrologic effects of the project.

Table 3-1 Summary of Hydrology Analysis.

EXISTING

NODE	C	TC (MIN.)	INTENSITY (IN/HR)	AREA (ACRES)	VELOCITY (FPS)	RUN-OFF (CFS)
6	0.41	24.2	3.24	215.4	9.20	286.5
10	0.41	16.5	4.14	27.3	9.0	46.4

PROPOSED

NODE	C	TC (MIN.)	INTENSITY (IN/HR)	AREA (ACRES)	VELOCITY (FPS)	MITIGATED RUN-OFF (CFS)	UNMITIGATED RUN-OFF (CFS)
6	0.41	24.2	3.24	215.4	9.20	286.5	288.7
10	0.41	16.5	4.14	27.3	9.0	46.4	47.3

The existing and proposed condition analyses illustrate that there is an increase in the amount of unmitigated runoff generated from the proposed condition. Proposed bioretention basins shall mitigate peak runoff rates from the project site to match exiting runoff rates downstream.

Post construction storm water BMPs for the project are listed below (please see "Storm Water Quality Management Plan for San Pasqual Valley Road Property" for sizing calculations and product performance/manufacturer's specifications):

- Bioretention Basins with HMP Flow Control

Section 4. Summary and Conclusions

This hydrology and hydraulic study has evaluated the potential effects of runoff on the proposed project. In addition, the report has addressed the methodology used to analyze the pre- and post-construction condition, which was based on the San Diego County Hydrology and Design Manual. This section provides a summary discussion that evaluates the potential effects of the proposed project.

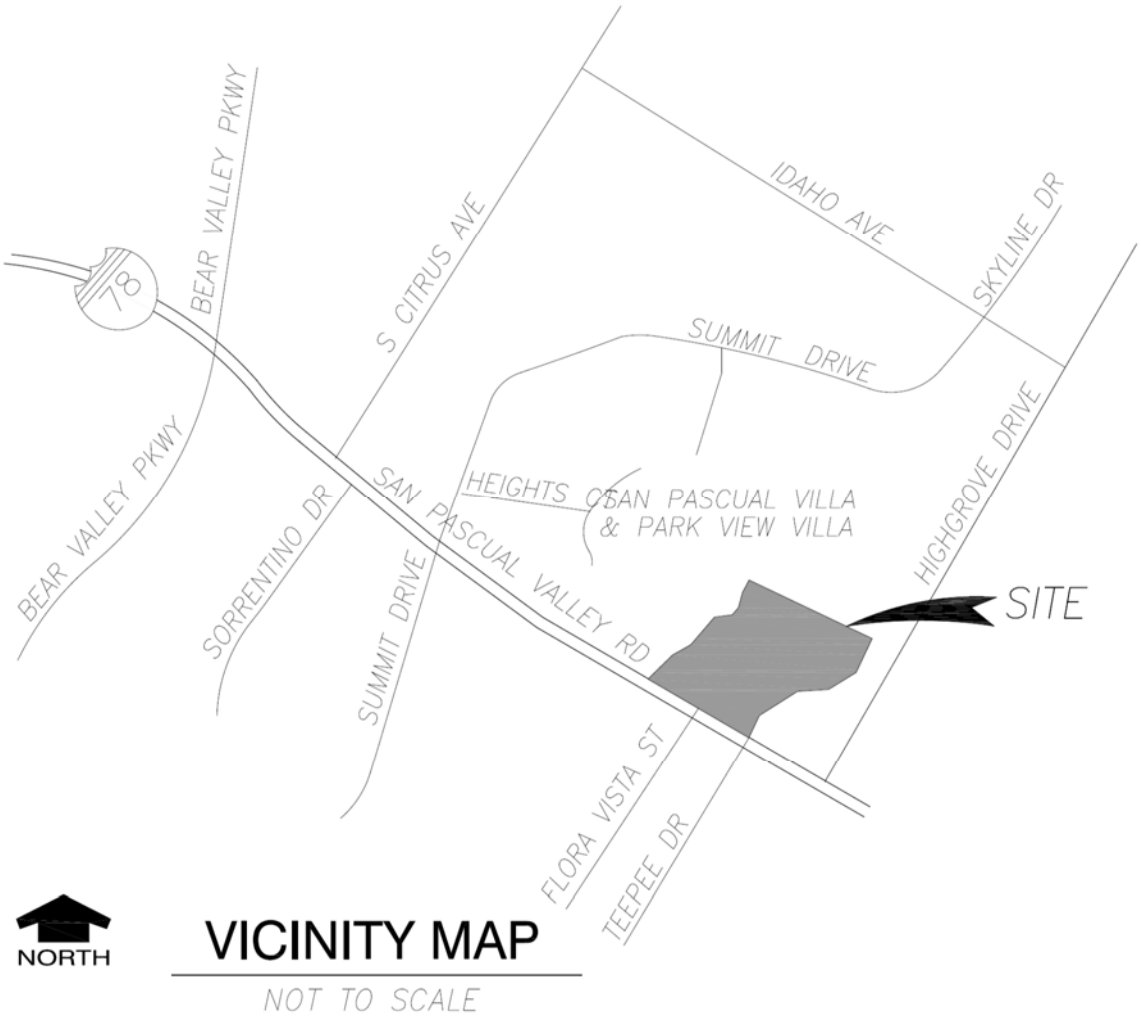
- The proposed project will not substantially alter the existing drainage patterns on the site or area, including through the alteration of the existing drainage course, in which would not result in substantial erosion or siltation on- or off-site and not exceed the capacity of downstream storm drain.
- The proposed project does not place housing or structures within 100-year flood area.
- The proposed project does not expose people or structures to significant risk of loss, injury, or death involving flooding as a result of the failure of a levee or dam.
- The project will add new impervious area to the site, increasing unmitigated storm water runoff rates and volume from the existing condition. Proposed bioretention basins shall mitigate peak runoff rates from the project site to match exiting runoff rates down stream.
- The proposed emergency access road shall have two 24-inch storm drain culverts to allow drainage to pass under.

EXHIBITS

Project Vicinity Map

Project Name: [San Pasqual Valley Road]
Record ID: PDS2016-MPA-16-008, PDS2017-REZ-17-001, PDS2017-TM-5620

[



]

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) **and/or floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations (BFEs) shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) Zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, NNGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (301) 713-3242 or visit its website at http://www.ngs.noaa.gov/.

Base map information shown on this FIRM was provided in digital format by the USDA National Agriculture Imagery Program (NAIP). This information was photogrammetrically compiled at a scale of 1:24,000 from aerial photography dated 2009.

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

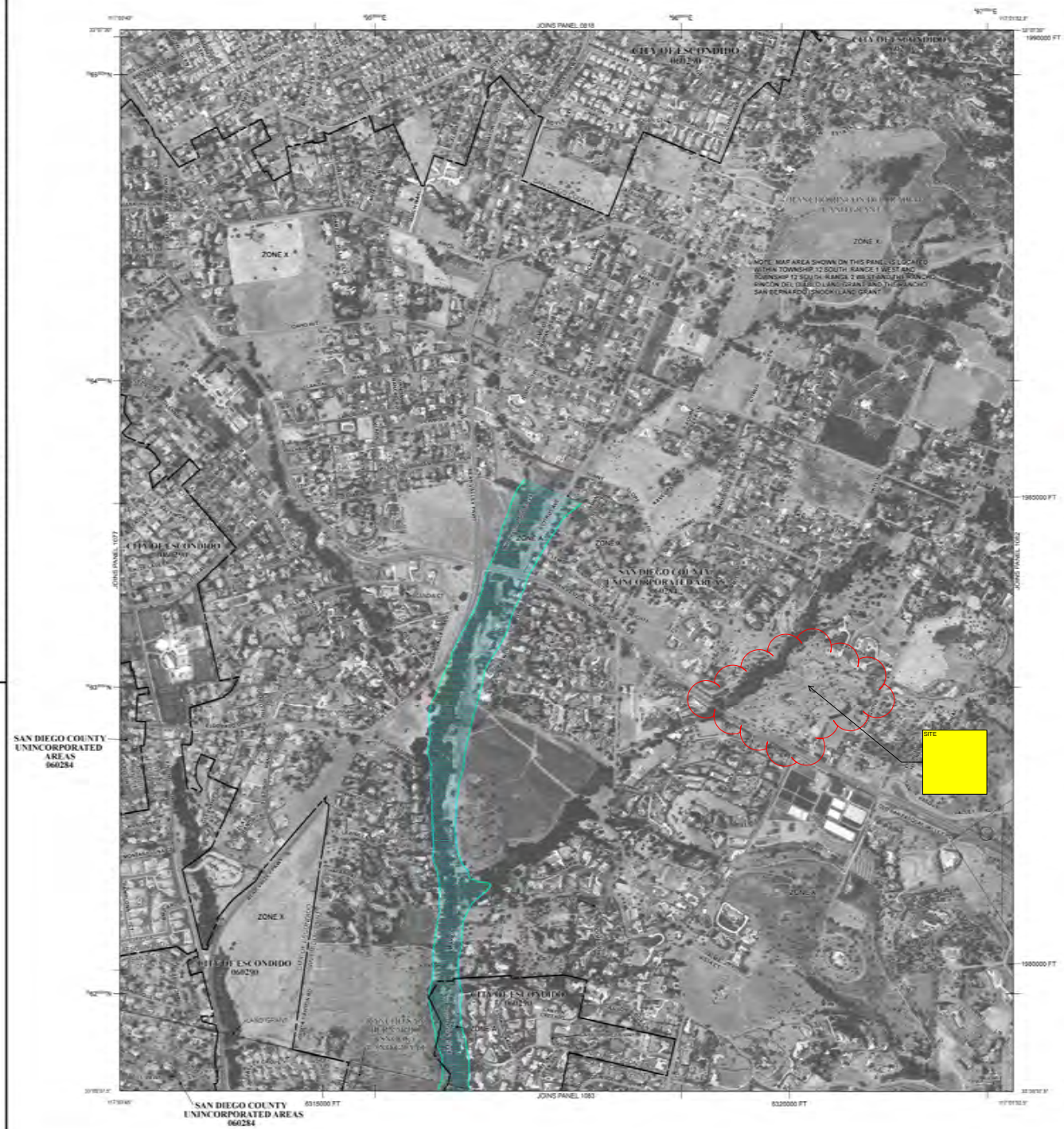
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-877-FEMA MAP (1-877-336-2627) for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://msc.fema.gov/.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov/business/nfip.

The **"profile base lines"** depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, the "profile base line", in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

- **ZONE A** No Base Flood Elevations determined.
- **ZONE AE** Base Flood Elevations determined.
- **ZONE AH** Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
- **ZONE AO** Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
- **ZONE AR** Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
- **ZONE A99** Areas to be protected from 1% annual chance flood event by a Federal flood protection system under construction; no Base Flood Elevations determined.
- **ZONE V** Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
- **ZONE VE** Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

- **ZONE X** Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

- **ZONE X** Areas determined to be outside the 0.2% annual chance floodplain.
- **ZONE D** Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% annual chance floodplain boundary
- 0.2% annual chance floodplain boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- B — B — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4175[TIPE] — 1000-meter Universal Transverse Mercator grid ticks, Zone 11
- 6000000 FT — 5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 4406), Lambert projection
- DX55 40 — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
June 19, 1997

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL
May 16, 2012 – to update corporate limits, to add roads and road names, to incorporate previously issued Letters of Map Revision, and to update map elevations to North American Vertical Datum of 1988.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1081G

FIRM

FLOOD INSURANCE RATE MAP

SAN DIEGO COUNTY, CALIFORNIA AND INCORPORATED AREAS

PANEL 1081 OF 2375

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

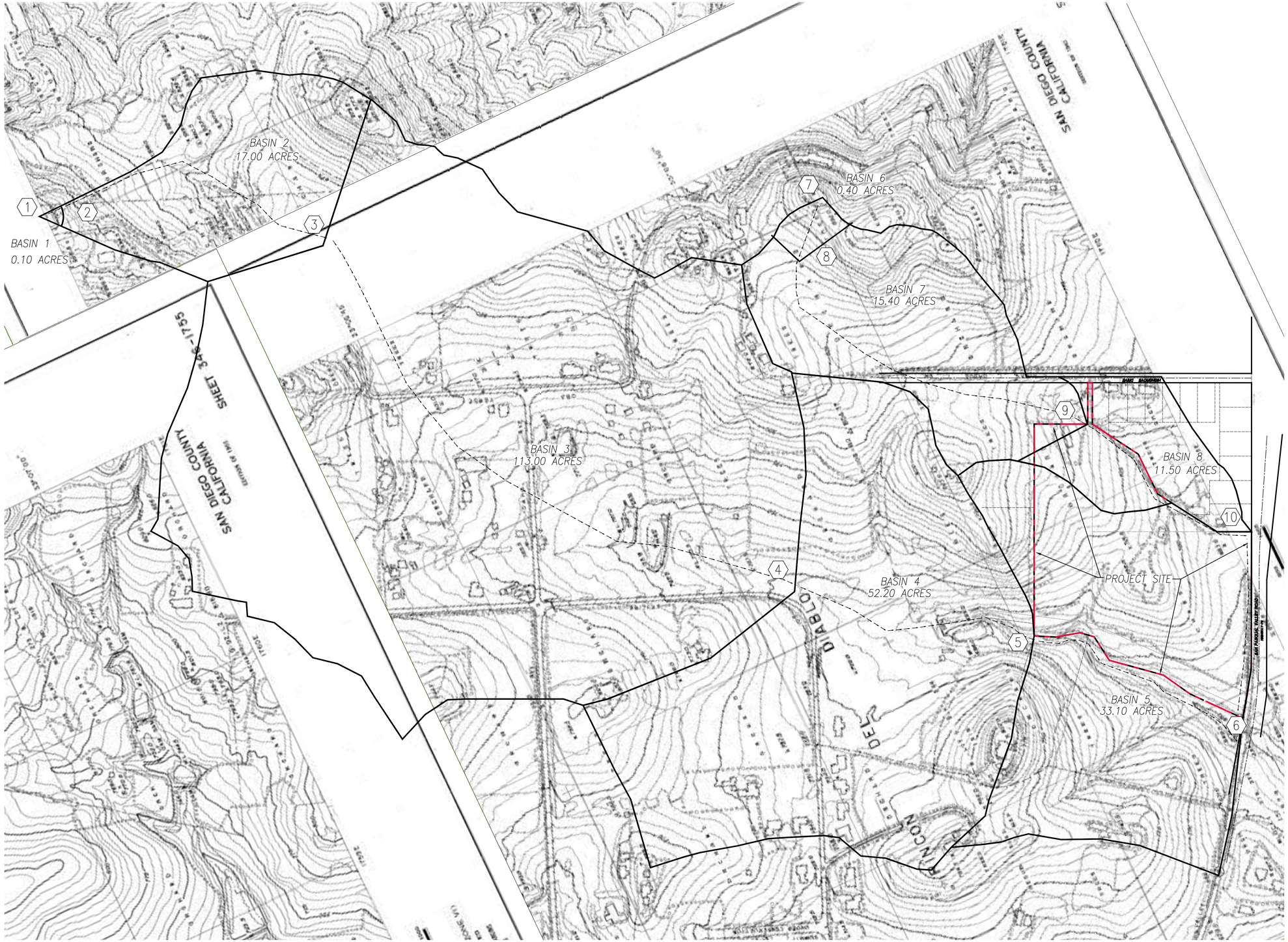
COMMUNITY	NUMBER	PANEL	SUFFIX
ESCONDIDO, CITY OF	060290	1081	G
SAN DIEGO COUNTY	060284	1081	G

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
06073C1081G

MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency



LEGEND

AES NODE (9)

DRAINAGE BASIN LIMITS

DIRECTION OF FLOW

200 0 200 400 600

SCALE: 1"=200'

Lundstrom
Engineering and Surveying, Inc.
5333 Mission Center Road, #115 • San Diego, CA 92108
Phone (619) 814-1220 • Fax (619) 641-5910

SAN PASQUAL VALLEY ROAD

EXISTING WATERSHED MAP

JOB NO.: L321-01

AES NODE
5
Q100=253.2 CFS

50 0 50 100 150
SCALE: 1"=50'

APPROXIMATE Q100 WATER SURFACE SUBJECT TO INUNDATION BY THE 100-YEAR FLOOD

NATURAL DRAINAGE COURSE

CCSYA BY PASS

PRIVATE STREET "A"

PRIVATE STREET "B"

PROPOSED DRIVEWAY

R=150'

R=50'

2-24" RCP CULVERT
Q100=28.7 CFS

14' EMERGENCY

PROPOSED 20' WATER EASEMENT

PROPOSED 50' OPEN SPACE BUFFER

LIMIT OF OAK WOODLAND

LIMIT OF OPEN SPACE EASEMENT

EXISTING DRIVEWAY TO BE REMOVED

EXISTING CONCRETE DITCH TO REMAIN

EXISTING ROCK LINED DITCH TO BE REMOVED

EX. 30" SD HEAD

NEW PAVEMENT AREA
7,800 SF TOTAL

10,120 SF
ALTERNATIVE COMPLIANCE
OFFSET NEW PVMT AREA

SAN PASQUAL VALLEY ROAD

HIGHWAY-78

EX. 48" STORM DRAIN

EX. 24" STORM DRAIN

EX. 30" STORM DRAIN

Q100=286.5 CFS
V100=9.2 FPS

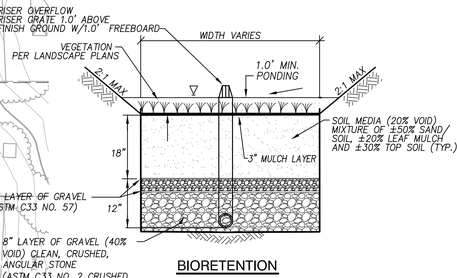
AES NODE
6

POC#1

Q100=46.4 CFS
10

LEGEND

BMP NUMBER	(1) THRU (16)
DMA NUMBER	[1] THRU [28]
DMA LIMITS	
DIRECTION OF FLOW	
PROPOSED STORM DRAIN	
BIORETENTION BASIN	
ASPHALT PAVEMENT (IMPERVIOUS)	
ROOF AREA (IMPERVIOUS)	
PROPOSED CONCRETE DITCH	



BIORETENTION
NOT TO SCALE

SOURCE CONTROL BMPs (TABLE 4.2.6 SWQMP)

SOURCE CONTROL BMPS	PROJECT IMPLEMENTATION
(1) STORM DRAIN INLETS	MARK ALL INLETS WITH THE WORDS "NO DUMPING! DRAINS TO WATERWAYS" IN ENGLISH AND "NO CONTAMINE" IN SPANISH. MAINTAIN AND PERIODICALLY REPLACE INLET MARKINGS. SEE APPLICABLE OPERATIONAL BMPS IN CASQA FACT SHEET SC-44, "DRAINAGE SYSTEM MAINTENANCE."
LANDSCAPE/OUTDOOR PESTICIDE USE	LANDSCAPE HAS BEEN DESIGNED PER CITY OF SAN SAN DIEGO LANDSCAPE STANDARDS TO MINIMIZE IRRIGATION AND RUNOFF, AND TO MINIMIZE THE USE OF FERTILIZERS AND PESTICIDES THAT CAN CONTRIBUTE TO STORMWATER POLLUTION. SEE APPLICABLE BMPS IN CASQA FACT SHEETS SC-41, "BUILDING AND GROUNDS MAINTENANCE."
DRIVEWAYS, SIDEWALKS, ROADS	DRIVEWAYS SIDEWALKS, AND ROADS SHALL BE SWEPT REGULARLY AND ONCE PRIOR TO OCTOBER 1ST TO PREVENT THE ACCUMULATION OF LITTER AND DEBRIS. SEE CASQA FACT SHEET SC-41, "BUILDING AND GROUNDS MAINTENANCE."

SITE DESIGN BMPs (4.3.1 TRHOUGH 4.3.8 SWQMP)

CONSERVE NATURAL DRAINAGE FEATURES & VEGETATION: DRAINAGE COURSE AND VEGETATION WILL BE PRESERVED.

MINIMIZE IMPERVIOUS AREA: RESIDENTIAL STREETS ARE AT THE MINIMUM REQUIRED WIDTH PER COUNTY STANDARDS.

MINIMIZE SOIL COMPACTION: RE-TILL SOILS COMPACTED BY CONSTRUCTION VEHICLES. COLLECT AND RE-USE UPPER SOIL LAYERS DEVELOPMENT SITE CONTAINING ORGANIC MATERIALS.

RUNOFF FROM WALKS AND ROOF DRAIN DOWNSPOUTS SHALL DISCHARGE ONTO SPLASH BLOCKS AND FLOW THROUGH ADJACENT LANDSCAPE AREA BEFORE ENTERING BIORETENTION BASINS

LANDSCAPING WITH DROUGHT TOLERANT SPECIES

HYDROLOGIC SOIL GROUP C
GROUND WATER DEPTH > 20FT

DMA	Post-project Surface Type	DMA Area (SF)	Drains to
1	Asphalt Road	26300	BMP #1
2	Asphalt Road	21020	BMP #2
3	Asphalt Road	29200	BMP #12
4	Asphalt Road	16580	BMP #6
5	Pad with 3500 sf Roof	12725	BMP #1
6	Landscape (self-mitigating)	22260	
7	Landscape (self-mitigating)	20050	
8	Landscape (self-mitigating)	14810	
9	Pad with 3500 sf Roof	21300	BMP #3
10	Pad with 3500 sf Roof	12410	BMP #4
11	Landscape (self-mitigating)	115033	
12	Pad with 3500 sf Roof	13110	BMP #7
13	Pad with 3500 sf Roof	19560	BMP #8
14	Landscape	17780	BMP #8
15	Pad with 3500 sf Roof	18625	BMP #9
16	Landscape	18100	BMP # 9
17	Pad with 3500 sf Roof	22135	BMP #10
18	Landscape	18280	BMP #10
19	Pad with 3500 sf Roof	21730	BMP #11
20	Pad with 3500 sf Roof	14035	BMP #12
21	Landscape (self-mitigating)	222140	
22	Pad with 3500 sf Roof	15420	BMP #12
23	Landscape (self-mitigating)	28880	
24	Pad with 3500 sf Roof	16325	BMP #5
25	Pad with 3500 sf Roof	8200	BMP #15
26	Pad with 3500 sf Roof	21675	BMP #13
27	Pad with 3500 sf Roof	9115	BMP #14
28	San Pasquall Valley Rd	10120	BMP #16

SLEF-MITIGATING DMA's

SELF-MITIGATING DMAS CONSIST OF NATURAL OR LANDSCAPED AREAS THAT DRAIN DIRECTLY OFFSITE OR TO THE PUBLIC STORM DRAIN SYSTEM. SELF-MITIGATING DMAS MUST MEET ALL OF THE FOLLOWING TO BE ELIGIBLE FOR EXCLUSION:

VEGETATION IN THE NATURAL OR LANDSCAPED AREA IS NATIVE AND/OR NON-NATIVE/NON-INVASIVE DROUGHT TOLERANT SPECIES THAT DO NOT REQUIRE REGULAR APPLICATION OF FERTILIZERS AND PESTICIDES.

SOILS ARE UNDISTURBED NATIVE TOPSOIL, OR DISTURBED SOILS THAT HAVE BEEN AMENDED AND AERATED TO PROMOTE WATER RETENTION CHARACTERISTICS EQUIVALENT TO UNDISTURBED NATIVE TOPSOIL.

THE INCIDENTAL IMPERVIOUS AREAS ARE LESS THAN 5 PERCENT OF THE SELF-MITIGATING AREA.

IMPERVIOUS AREA WITHIN THE SELF-MITIGATED AREA SHOULD NOT BE HYDRAULICALLY CONNECTED TO OTHER IMPERVIOUS AREAS UNLESS IT IS A STORM WATER CONVEYANCE SYSTEM (SUCH AS A BROW DITCH).

THE SELF-MITIGATING AREA IS HYDRAULICALLY SEPARATE FROM DMAS THAT CONTAIN PERMANENT STORM WATER POLLUTANT CONTROL BMPS.

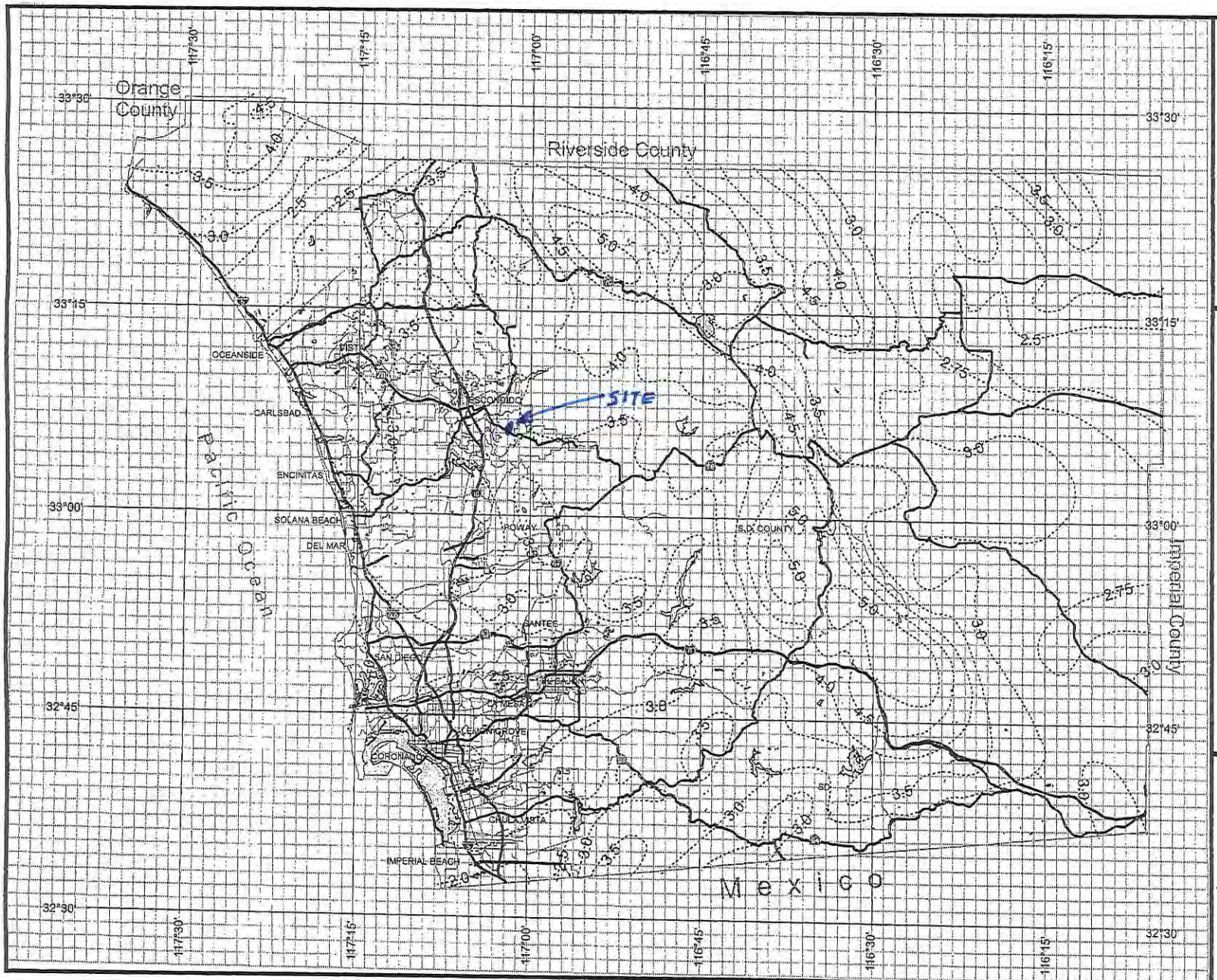
HV 2
Δ
702.72

Lundstrom
Engineering and Surveying, Inc.
5333 Mission Center Road, #115 • San Diego, CA 92108
Phone (619) 814-1220 • Fax (619) 641-5910

SAN PASQUAL VALLEY ROAD

DMA/HMP EXHIBIT

JOB NO.: L321-01 | DATE: 3-02-16



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

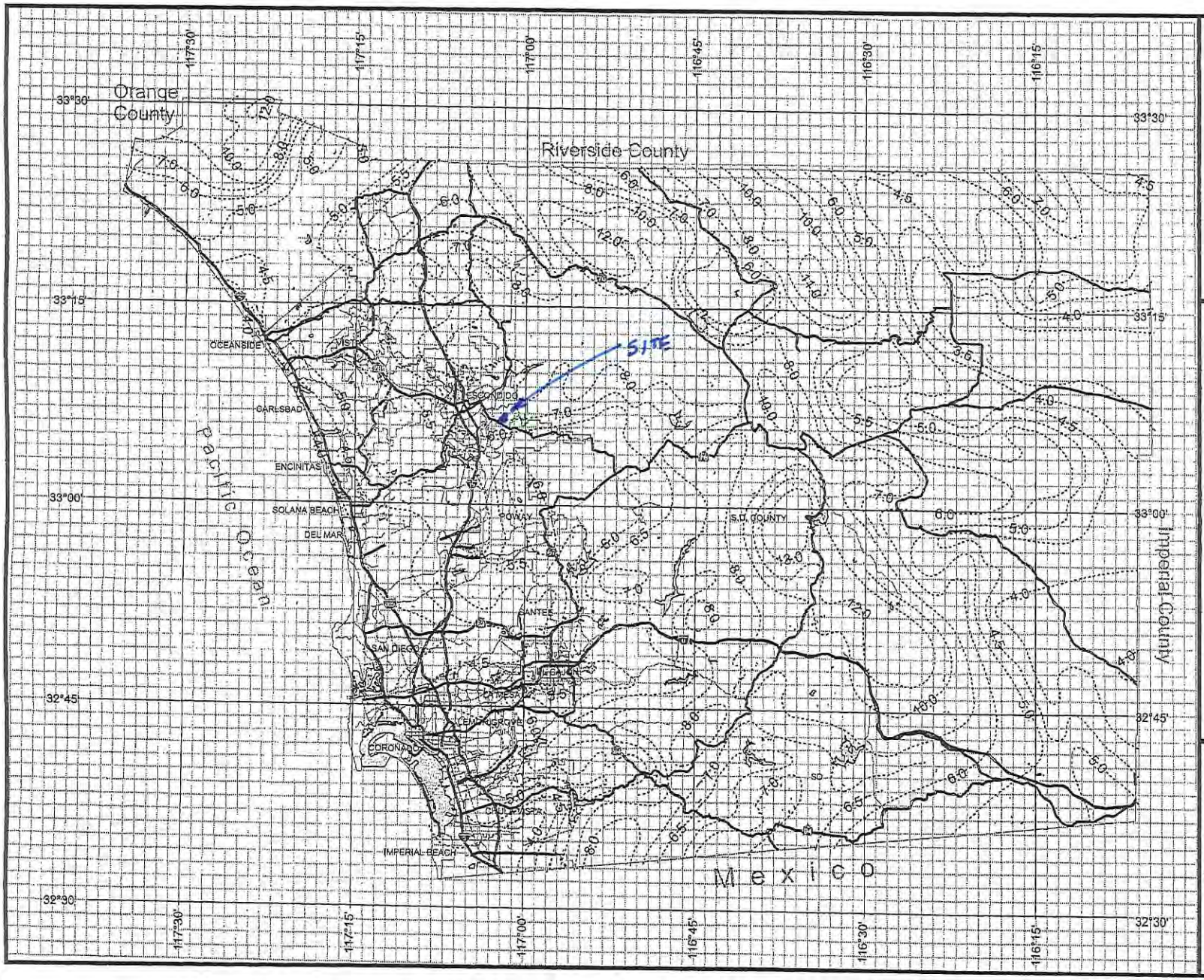
$P_{6\,100yr.} = 3.4$ in.

DPW GIS
Department of Public Works Geographic Information System

SanGIS
We Have San Diego Covered!

N W E S

3 0 3 Miles



County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

$P_{24\ 100\ yr.} = 7.0$ in.

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

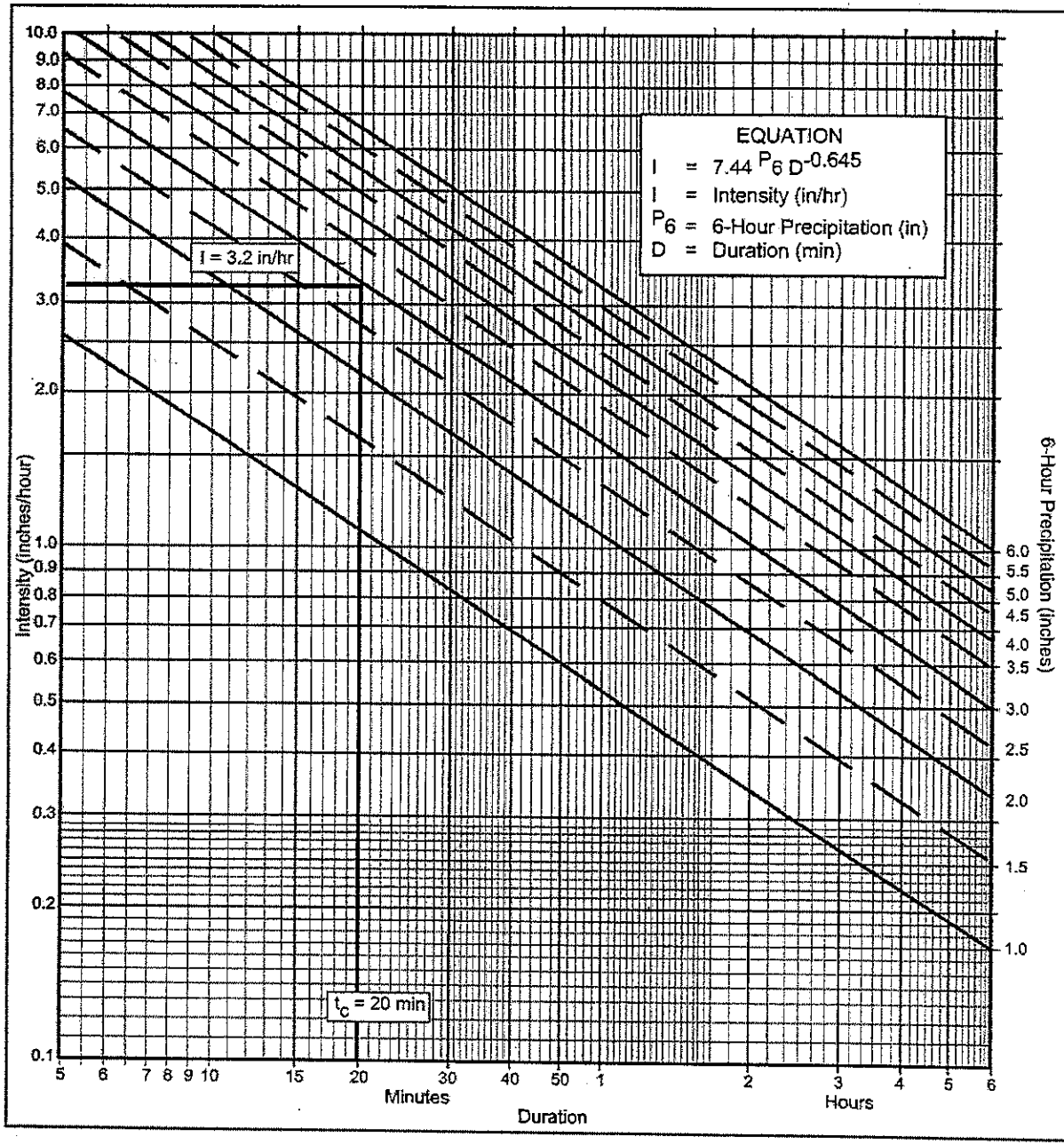
N
W E
S

3 0 3 Miles

Table 3-1
RUNOFF COEFFICIENTS FOR URBAN AREAS

Land Use		Runoff Coefficient "C"				
			Soil Type			
NRCS Elements	County Elements	% IMPER.	A	B	C	D
Undisturbed Natural Terrain (Natural)	Permanent Open Space	0*	0.20	0.25	0.30	0.35
Low Density Residential (LDR)	Residential, 1.0 DU/A or less	10	0.27	0.32	0.36	0.41
Low Density Residential (LDR)	Residential, 2.0 DU/A or less	20	0.34	0.38	0.42	0.46
Low Density Residential (LDR)	Residential, 2.9 DU/A or less	25	0.38	0.41	0.45	0.49
Medium Density Residential (MDR)	Residential, 4.3 DU/A or less	30	0.41	0.45	0.48	0.52
Medium Density Residential (MDR)	Residential, 7.3 DU/A or less	40	0.48	0.51	0.54	0.57
Medium Density Residential (MDR)	Residential, 10.9 DU/A or less	45	0.52	0.54	0.57	0.60
Medium Density Residential (MDR)	Residential, 14.5 DU/A or less	50	0.55	0.58	0.60	0.63
High Density Residential (HDR)	Residential, 24.0 DU/A or less	65	0.66	0.67	0.69	0.71
High Density Residential (HDR)	Residential, 43.0 DU/A or less	80	0.76	0.77	0.78	0.79
Commercial/Industrial (N. Com)	Neighborhood Commercial	80	0.76	0.77	0.78	0.79
Commercial/Industrial (G. Com)	General Commercial	85	0.80	0.80	0.81	0.82
Commercial/Industrial (O.P. Com)	Office Professional/Commercial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (Limited I.)	Limited Industrial	90	0.83	0.84	0.84	0.85
Commercial/Industrial (General I.)	General Industrial	95	0.87	0.87	0.87	0.87

*The values associated with 0% impervious may be used for direct calculation of the runoff coefficient as described in Section 3.1.2 (representing the pervious runoff coefficient, Cp, for the soil type), or for areas that will remain undisturbed in perpetuity. Justification must be given that the area will remain natural forever (e.g., the area is located in Cleveland National Forest).
DU/A = dwelling units per acre
NRCS = National Resources Conservation Service



Directions for Application:

(1) From precipitation maps determine 6 hr and 24 hr amounts for the selected frequency. These maps are included in the County Hydrology Manual (10, 50, and 100 yr maps included in the Design and Procedure Manual).

(2) Adjust 6 hr precipitation (if necessary) so that it is within the range of 45% to 65% of the 24 hr precipitation (not applicaple to Desert).

(3) Plot 6 hr precipitation on the right side of the chart.

(4) Draw a line through the point parallel to the plotted lines.

(5) This line is the intensity-duration curve for the location being analyzed.

Application Form:

(a) Selected frequency 50 year

(b) P_6 = 3 in., P_{24} = 5.5, $\frac{P_6}{P_{24}}$ = 54.5 %(2)

(c) Adjusted P_6(2) = 3 in.

(d) t_x = 20 min.

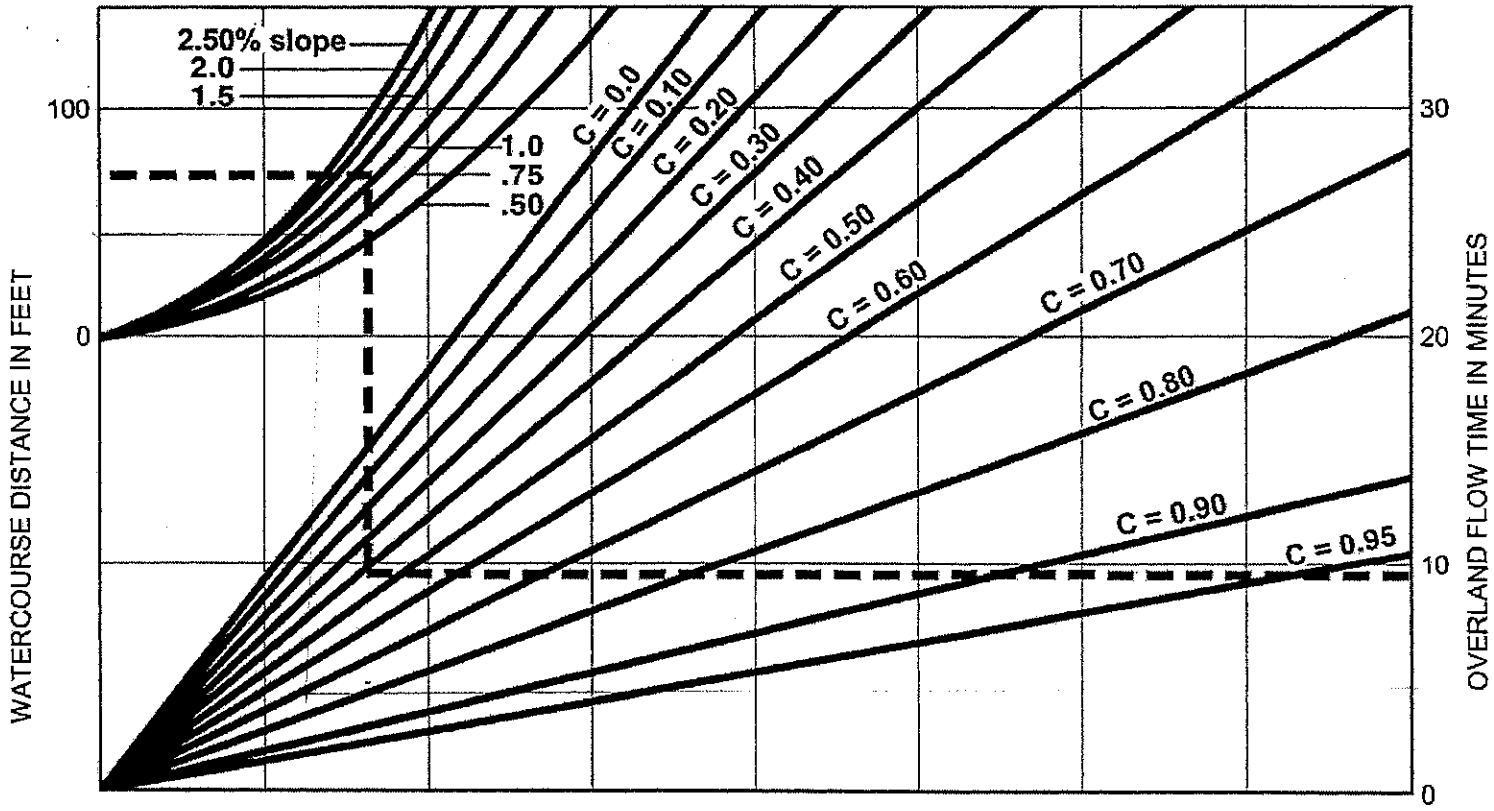
(e) I = 3.2 in./hr.

Note: This chart replaces the Intensity-Duration-Frequency curves used since 1965.

P6	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6
Duration	I	I	I	I	I	I	I	I	I	I	I
5	2.63	3.95	5.27	6.59	7.90	9.22	10.54	11.86	13.17	14.49	15.81
7	2.12	3.18	4.24	5.30	6.36	7.42	8.48	9.54	10.60	11.66	12.72
10	1.68	2.53	3.37	4.21	5.05	5.90	6.74	7.58	8.42	9.27	10.11
15	1.30	1.95	2.59	3.24	3.89	4.54	5.19	5.84	6.49	7.13	7.78
20	1.08	1.62	2.15	2.69	3.23	3.77	4.31	4.85	5.39	5.93	6.46
25	0.93	1.40	1.87	2.33	2.80	3.27	3.73	4.20	4.67	5.13	5.60
30	0.83	1.24	1.66	2.07	2.49	2.90	3.32	3.73	4.15	4.56	4.98
40	0.69	1.03	1.38	1.72	2.07	2.41	2.76	3.10	3.45	3.79	4.13
50	0.60	0.90	1.19	1.49	1.79	2.09	2.39	2.69	2.98	3.28	3.58
60	0.53	0.80	1.06	1.33	1.59	1.86	2.12	2.39	2.65	2.92	3.18
90	0.41	0.61	0.82	1.02	1.23	1.43	1.63	1.84	2.04	2.25	2.45
120	0.34	0.51	0.68	0.85	1.02	1.19	1.36	1.53	1.70	1.87	2.04
150	0.29	0.44	0.59	0.73	0.88	1.03	1.18	1.32	1.47	1.62	1.76
180	0.26	0.39	0.52	0.65	0.78	0.91	1.04	1.18	1.31	1.44	1.57
240	0.22	0.33	0.43	0.54	0.65	0.76	0.87	0.98	1.08	1.19	1.30
300	0.19	0.28	0.38	0.47	0.56	0.66	0.75	0.85	0.94	1.03	1.13
360	0.17	0.25	0.33	0.42	0.50	0.58	0.67	0.75	0.84	0.92	1.00

Intensity-Duration Design Chart - Example

FIGURE 3-2



EXAMPLE:

Given: Watercourse Distance (D) = 70 Feet
Slope (s) = 1.3%
Runoff Coefficient (C) = 0.41
Overland Flow Time (T) = 9.5 Minutes

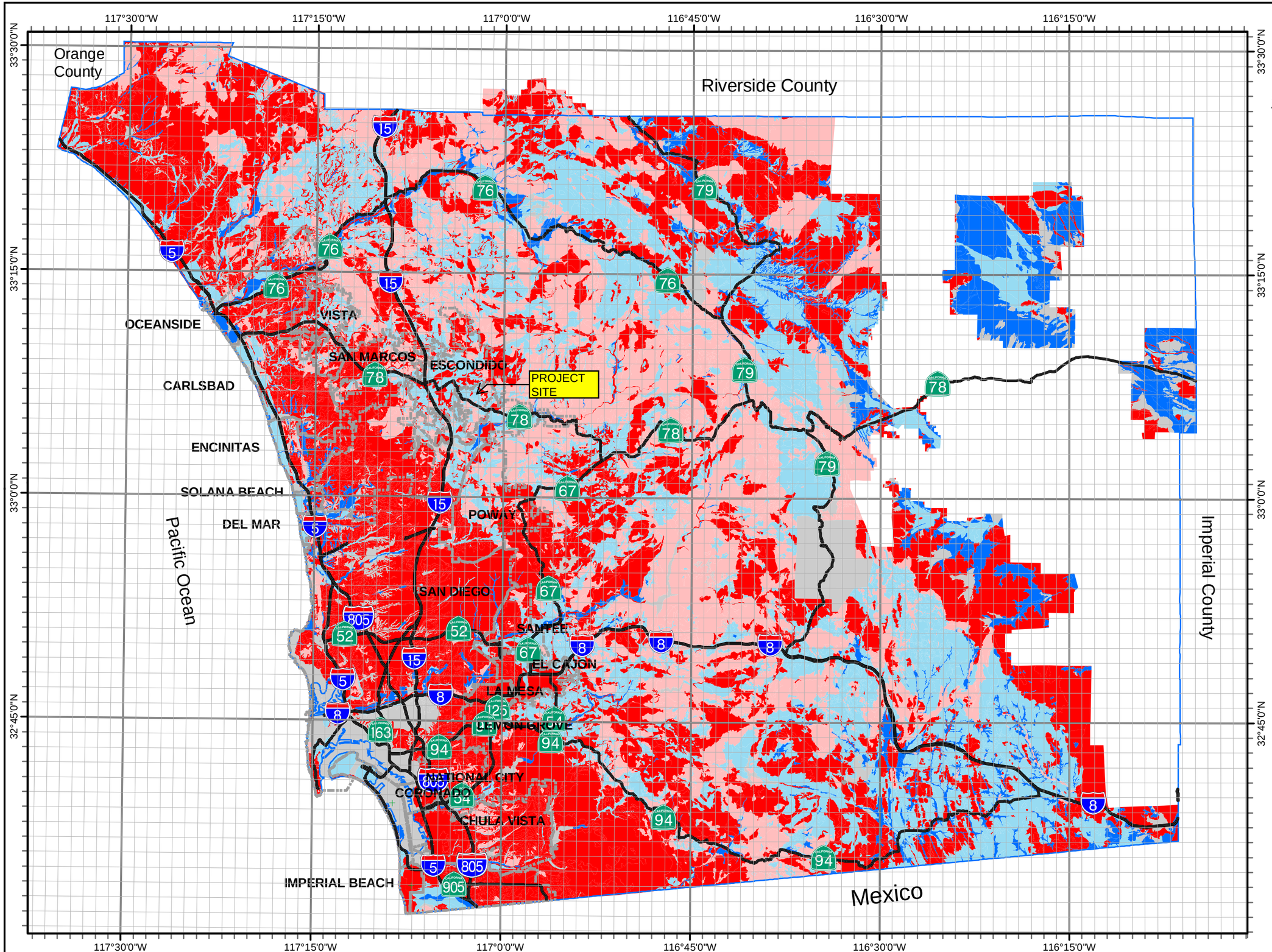
$$T = \frac{1.8\,(1.1-C)\sqrt{D}}{\sqrt[3]{s}}$$

SOURCE: Airport Drainage, Federal Aviation Administration, 1965

Rational Formula - Overland Time of Flow Nomograph

FIGURE 3-3

County of San Diego Hydrology Manual Soil Hydrologic Group



Legend

- Major Roads
- Incorporated City Bdy

HYDROLOGIC SOIL GROUP

- Hydrologic Group Undefined
- Hydrologic Group A
- Hydrologic Group B
- Hydrologic Group C
- Hydrologic Group D
- No Soil Data

Note: Soil Data Source
USDA/NRCS
SSURGO Soils 2007

N

31.5 0 3 Miles

DPW GIS

SanGIS

Existing Condition Analysis

```
_____
___

**************************************************************************
***

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2006 Advanced Engineering Software (aes)
              Ver. 2.0 Release Date: 06/01/2005  License ID 1553

                              Analysis prepared by:



                                     LUNDSTROM




  ************************** DESCRIPTION OF STUDY
**************************
 * EXISTING 100 YEAR STORM EVENT
*
 *
*
 *
*

**************************************************************************
*

   FILE NAME: C:\321EX01.DAT
   TIME/DATE OF STUDY: 10:23 12/27/2019
 ------------------------------------------------------------------------
----
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ------------------------------------------------------------------------
----
   2003 SAN DIEGO MANUAL CRITERIA

   USER SPECIFIED STORM EVENT(YEAR) = 100.00
   6-HOUR DURATION PRECIPITATION (INCHES) =   3.400
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE =
0.01
   SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
   NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
```

```
   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW
MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:
MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE
FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)
(n)
 ===  =====  =========  =================  ======  ===== ====== =====
=======
   1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167
0.0150

   GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
     1. Relative Flow-Depth =  0.00 FEET
        as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
     2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
   *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
    OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*


****************************************************************************
***
   FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
 ----------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

============================================================================
===
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
   UPSTREAM ELEVATION(FEET) =   1015.00
   DOWNSTREAM ELEVATION(FEET) =   1014.00
   ELEVATION DIFFERENCE(FEET) =      1.00
   SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.391
   WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
            THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
            (Reference: Table 3-1B of Hydrology Manual)
            THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.589
   SUBAREA RUNOFF(CFS) =      0.23
   TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.23


****************************************************************************
***
   FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<
```

```
================================================================================
   ELEVATION DATA: UPSTREAM(FEET) =   1014.00  DOWNSTREAM(FEET) =
845.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =  1265.00   CHANNEL SLOPE =  0.1336
   NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       0.23
   FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   4.44   Tc(MIN.) =  14.84
   LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =    1365.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

================================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.442
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =   17.00   SUBAREA RUNOFF(CFS) =   30.96
   TOTAL AREA(ACRES) =       17.1   TOTAL RUNOFF(CFS) =      31.14
   TC(MIN.) =  14.84


****************************************************************************
***
   FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

================================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    845.00  DOWNSTREAM(FEET) =
725.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =  2660.00   CHANNEL SLOPE =  0.0451
   CHANNEL FLOW THRU SUBAREA(CFS) =      31.14
   FLOW VELOCITY(FEET/SEC) =   7.19 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   6.17   Tc(MIN.) =  21.00
   LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    4025.00
FEET.
```

```
****************************************************************************
***
   FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.549
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =  113.00   SUBAREA RUNOFF(CFS) =  164.45
   TOTAL AREA(ACRES) =      130.1   TOTAL RUNOFF(CFS) =     189.33
   TC(MIN.) =  21.00


****************************************************************************
***
   FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    725.00  DOWNSTREAM(FEET) =
680.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =  1100.00   CHANNEL SLOPE =  0.0409
   CHANNEL FLOW THRU SUBAREA(CFS) =     189.33
   FLOW VELOCITY(FEET/SEC) =  11.66 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.57   Tc(MIN.) =  22.58
   LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =    5125.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.388
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =   52.20   SUBAREA RUNOFF(CFS) =   72.51
```

```
   TOTAL AREA(ACRES) =      182.3   TOTAL RUNOFF(CFS) =     253.23
   TC(MIN.) =  22.58


****************************************************************************
***
   FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    680.00  DOWNSTREAM(FEET) =
650.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =  1020.00   CHANNEL SLOPE =  0.0294
   CHANNEL FLOW THRU SUBAREA(CFS) =     253.23
   FLOW VELOCITY(FEET/SEC) =  10.83 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.57   Tc(MIN.) =  24.15
   LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =    6145.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.244
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =   33.10   SUBAREA RUNOFF(CFS) =   44.03
   TOTAL AREA(ACRES) =      215.4   TOTAL RUNOFF(CFS) =     286.51
   TC(MIN.) =  24.15


****************************************************************************
***
   FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  13
 ----------------------------------------------------------------------------
----
   >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<

============================================================================
===
```

```
****************************************************************************
***
   FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  21
 ----------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

============================================================================
===
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
   UPSTREAM ELEVATION(FEET) =    851.00
   DOWNSTREAM ELEVATION(FEET) =    850.00
   ELEVATION DIFFERENCE(FEET) =      1.00
   SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.971
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.230
   SUBAREA RUNOFF(CFS) =      1.19
   TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.19


****************************************************************************
***
   FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    850.00  DOWNSTREAM(FEET) =
750.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =  1760.00   CHANNEL SLOPE =  0.0568
   CHANNEL FLOW THRU SUBAREA(CFS) =       1.19
   FLOW VELOCITY(FEET/SEC) =   3.69 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   7.94   Tc(MIN.) =  14.91
   LONGEST FLOWPATH FROM NODE      7.00 TO NODE      9.00 =    1810.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE      9.00 TO NODE      9.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.427
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
```

```
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =   15.40   SUBAREA RUNOFF(CFS) =   27.95
   TOTAL AREA(ACRES) =       15.8   TOTAL RUNOFF(CFS) =      28.68
   TC(MIN.) =  14.91


****************************************************************************
***
   FLOW PROCESS FROM NODE      9.00 TO NODE     10.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    750.00  DOWNSTREAM(FEET) =
680.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   900.00   CHANNEL SLOPE =  0.0778
   CHANNEL FLOW THRU SUBAREA(CFS) =      28.68
   FLOW VELOCITY(FEET/SEC) =   9.22 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.63   Tc(MIN.) =  16.54
   LONGEST FLOWPATH FROM NODE      7.00 TO NODE     10.00 =    2710.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE     10.00 TO NODE     10.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.141
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =   11.50   SUBAREA RUNOFF(CFS) =   19.52
   TOTAL AREA(ACRES) =       27.3   TOTAL RUNOFF(CFS) =      46.35
   TC(MIN.) =  16.54

============================================================================
===
   END OF STUDY SUMMARY:
   TOTAL AREA(ACRES)     =       27.3  TC(MIN.) =     16.54
   PEAK FLOW RATE(CFS)   =      46.35

============================================================================
===
```

==========
END OF RATIONAL METHOD ANALYSIS

Proposed Condition Analysis

```
_____
___

**************************************************************************
***

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2006 Advanced Engineering Software (aes)
              Ver. 2.0 Release Date: 06/01/2005  License ID 1553

                              Analysis prepared by:



                                     LUNDSTROM




  ************************** DESCRIPTION OF STUDY
**************************
 * PROPOSED 100 YEAR STORM.
*
 *
*
 *
*

**************************************************************************
*

   FILE NAME: C:\321PR100.DAT
   TIME/DATE OF STUDY: 11:01 12/30/2019
 ------------------------------------------------------------------------
----
   USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
 ------------------------------------------------------------------------
----
   2003 SAN DIEGO MANUAL CRITERIA

   USER SPECIFIED STORM EVENT(YEAR) = 100.00
   6-HOUR DURATION PRECIPITATION (INCHES) =   3.400
   SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
   SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE =
0.01
   SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
   NOTE: USE MODIFIED RATIONAL METHOD PROCEDURES FOR CONFLUENCE ANALYSIS
```

```
   *USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW
MODEL*
      HALF-  CROWN TO   STREET-CROSSFALL:   CURB  GUTTER-GEOMETRIES:
MANNING
      WIDTH  CROSSFALL  IN-  / OUT-/PARK-  HEIGHT  WIDTH  LIP   HIKE
FACTOR
 NO.   (FT)     (FT)    SIDE / SIDE/ WAY    (FT)    (FT)  (FT)  (FT)
(n)
 ===  =====  =========  =================  ======  ===== ====== =====
=======
   1   30.0     20.0    0.018/0.018/0.020   0.67    2.00 0.0313 0.167
0.0150

   GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
     1. Relative Flow-Depth =  0.00 FEET
        as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
     2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
   *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
    OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*


****************************************************************************
***
   FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
 ----------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

============================================================================
===
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
   UPSTREAM ELEVATION(FEET) =   1015.00
   DOWNSTREAM ELEVATION(FEET) =   1014.00
   ELEVATION DIFFERENCE(FEET) =      1.00
   SUBAREA OVERLAND TIME OF FLOW(MIN.) =   10.391
   WARNING: INITIAL SUBAREA FLOW PATH LENGTH IS GREATER THAN
            THE MAXIMUM OVERLAND FLOW LENGTH =    70.00
            (Reference: Table 3-1B of Hydrology Manual)
            THE MAXIMUM OVERLAND FLOW LENGTH IS USED IN Tc CALCULATION!
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.589
   SUBAREA RUNOFF(CFS) =      0.23
   TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.23


****************************************************************************
***
   FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<
```

```
================================================================================
   ELEVATION DATA: UPSTREAM(FEET) =   1014.00  DOWNSTREAM(FEET) =
845.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =  1265.00   CHANNEL SLOPE =  0.1336
   NOTE: CHANNEL FLOW OF 1. CFS WAS ASSUMED IN VELOCITY ESTIMATION
   NOTE: CHANNEL SLOPE OF .1 WAS ASSUMED IN VELOCITY ESTIMATION
   CHANNEL FLOW THRU SUBAREA(CFS) =       0.23
   FLOW VELOCITY(FEET/SEC) =   4.74 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   4.44   Tc(MIN.) =  14.84
   LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =    1365.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE      3.00 TO NODE      3.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

================================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.442
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =   17.00   SUBAREA RUNOFF(CFS) =   30.96
   TOTAL AREA(ACRES) =       17.1   TOTAL RUNOFF(CFS) =      31.14
   TC(MIN.) =  14.84


****************************************************************************
***
   FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

================================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    845.00  DOWNSTREAM(FEET) =
725.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =  2660.00   CHANNEL SLOPE =  0.0451
   CHANNEL FLOW THRU SUBAREA(CFS) =      31.14
   FLOW VELOCITY(FEET/SEC) =   7.19 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   6.17   Tc(MIN.) =  21.00
   LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    4025.00
FEET.
```

```
****************************************************************************
***
   FLOW PROCESS FROM NODE      4.00 TO NODE      4.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.549
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =  113.00   SUBAREA RUNOFF(CFS) =  164.45
   TOTAL AREA(ACRES) =      130.1   TOTAL RUNOFF(CFS) =     189.33
   TC(MIN.) =  21.00


****************************************************************************
***
   FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    725.00  DOWNSTREAM(FEET) =
680.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =  1100.00   CHANNEL SLOPE =  0.0409
   CHANNEL FLOW THRU SUBAREA(CFS) =     189.33
   FLOW VELOCITY(FEET/SEC) =  11.66 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.57   Tc(MIN.) =  22.58
   LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =    5125.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE      5.00 TO NODE      5.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.388
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =   52.20   SUBAREA RUNOFF(CFS) =   72.51
```

```
   TOTAL AREA(ACRES) =      182.3   TOTAL RUNOFF(CFS) =     253.23
   TC(MIN.) =  22.58


****************************************************************************
***
   FLOW PROCESS FROM NODE      5.00 TO NODE      6.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    680.00  DOWNSTREAM(FEET) =
650.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =  1020.00   CHANNEL SLOPE =  0.0294
   CHANNEL FLOW THRU SUBAREA(CFS) =     253.23
   FLOW VELOCITY(FEET/SEC) =  10.83 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.57   Tc(MIN.) =  24.15
   LONGEST FLOWPATH FROM NODE      1.00 TO NODE      6.00 =    6145.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.244
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =   19.60   SUBAREA RUNOFF(CFS) =   26.07
   TOTAL AREA(ACRES) =      201.9   TOTAL RUNOFF(CFS) =     268.55
   TC(MIN.) =  24.15


****************************************************************************
***
   FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.244
   USER-SPECIFIED RUNOFF COEFFICIENT = .4600
```

```
   S.C.S. CURVE NUMBER (AMC II) =  84
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4131
   SUBAREA AREA(ACRES) =   13.50   SUBAREA RUNOFF(CFS) =   20.15
   TOTAL AREA(ACRES) =      215.4   TOTAL RUNOFF(CFS) =     288.70
   TC(MIN.) =  24.15


****************************************************************************
***
   FLOW PROCESS FROM NODE      6.00 TO NODE      6.00 IS CODE =  13
 ----------------------------------------------------------------------------
----
   >>>>>CLEAR THE MAIN-STREAM MEMORY<<<<<

============================================================================
===


****************************************************************************
***
   FLOW PROCESS FROM NODE      7.00 TO NODE      8.00 IS CODE =  21
 ----------------------------------------------------------------------------
----
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

============================================================================
===
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
   UPSTREAM ELEVATION(FEET) =    851.00
   DOWNSTREAM ELEVATION(FEET) =    850.00
   ELEVATION DIFFERENCE(FEET) =      1.00
   SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.971
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  7.230
   SUBAREA RUNOFF(CFS) =      1.19
   TOTAL AREA(ACRES) =      0.40   TOTAL RUNOFF(CFS) =      1.19


****************************************************************************
***
   FLOW PROCESS FROM NODE      8.00 TO NODE      9.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    850.00  DOWNSTREAM(FEET) =
750.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =  1760.00   CHANNEL SLOPE =  0.0568
   CHANNEL FLOW THRU SUBAREA(CFS) =       1.19
```

```
   FLOW VELOCITY(FEET/SEC) =   3.69 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   7.94   Tc(MIN.) =  14.91
   LONGEST FLOWPATH FROM NODE      7.00 TO NODE      9.00 =    1810.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE      9.00 TO NODE      9.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

============================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.427
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =   15.40   SUBAREA RUNOFF(CFS) =   27.95
   TOTAL AREA(ACRES) =       15.8   TOTAL RUNOFF(CFS) =      28.68
   TC(MIN.) =  14.91


****************************************************************************
***
   FLOW PROCESS FROM NODE      9.00 TO NODE     10.00 IS CODE =  52
 ----------------------------------------------------------------------------
----
   >>>>>COMPUTE NATURAL VALLEY CHANNEL FLOW<<<<<
   >>>>>TRAVELTIME THRU SUBAREA<<<<<

============================================================================
===
   ELEVATION DATA: UPSTREAM(FEET) =    750.00  DOWNSTREAM(FEET) =
680.00
   CHANNEL LENGTH THRU SUBAREA(FEET) =   900.00   CHANNEL SLOPE =  0.0778
   CHANNEL FLOW THRU SUBAREA(CFS) =      28.68
   FLOW VELOCITY(FEET/SEC) =   9.22 (PER LACFCD/RCFC&WCD HYDROLOGY
MANUAL)
   TRAVEL TIME(MIN.) =   1.63   Tc(MIN.) =  16.54
   LONGEST FLOWPATH FROM NODE      7.00 TO NODE     10.00 =    2710.00
FEET.


****************************************************************************
***
   FLOW PROCESS FROM NODE     10.00 TO NODE     10.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
```

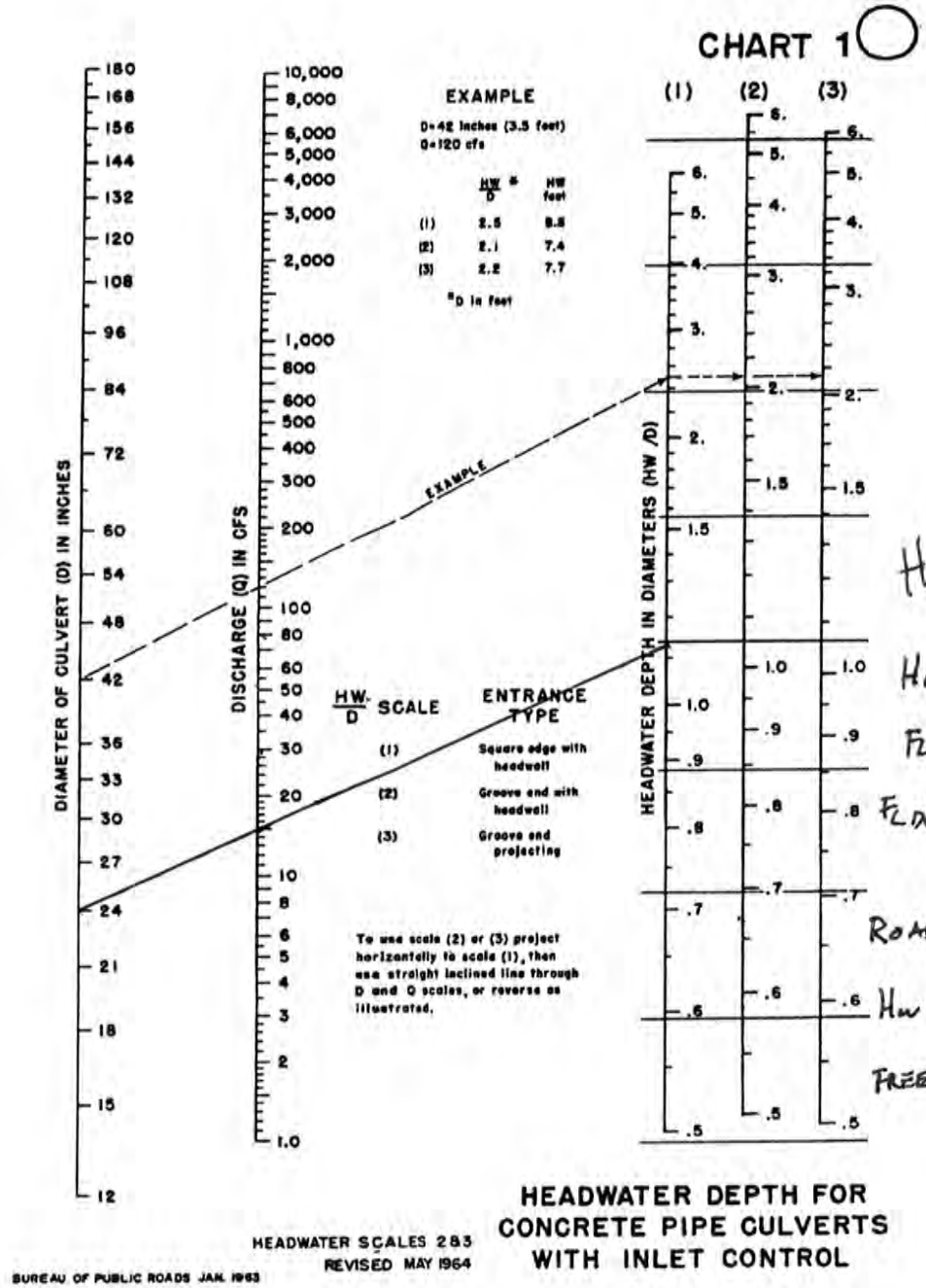
```
================================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.141
   USER-SPECIFIED RUNOFF COEFFICIENT = .4100
   S.C.S. CURVE NUMBER (AMC II) =  82
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4100
   SUBAREA AREA(ACRES) =    6.70   SUBAREA RUNOFF(CFS) =   11.38
   TOTAL AREA(ACRES) =       22.5   TOTAL RUNOFF(CFS) =      38.20
   TC(MIN.) =  16.54


****************************************************************************
***
   FLOW PROCESS FROM NODE     10.00 TO NODE     10.00 IS CODE =  81
 ----------------------------------------------------------------------------
----
   >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

================================================================================
===
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.141
   USER-SPECIFIED RUNOFF COEFFICIENT = .4600
   S.C.S. CURVE NUMBER (AMC II) =  84
   AREA-AVERAGE RUNOFF COEFFICIENT = 0.4188
   SUBAREA AREA(ACRES) =    4.80   SUBAREA RUNOFF(CFS) =    9.14
   TOTAL AREA(ACRES) =       27.3   TOTAL RUNOFF(CFS) =      47.34
   TC(MIN.) =  16.54

================================================================================
===
   END OF STUDY SUMMARY:
   TOTAL AREA(ACRES)     =       27.3  TC(MIN.) =     16.54
   PEAK FLOW RATE(CFS)   =      47.34

================================================================================
===

================================================================================
===
   END OF RATIONAL METHOD ANALYSIS
```

DUAL 24" RCP CULVERT

@ NODE 8, NE EMERGENCY ACCESS ROAD

Q_{100} = 30 cfs

15 cfs per 24" RCP



$H_W/D = 1.15$

$H_W = 2.3'$

$FL_{UPSTREAM} = 735.0$

$FL_{DOWNSTREAM} = 734.0$

ROAD ELEV. = 739.0

H_W ELEV = 737.2

FREEBOARD = 1.8'