APPENDIX E

STORMWATER TECHNICAL MEMORANDUM

Part 1 of 3

Michael Baker INTERNATIONAL

We Make a Difference

El Caballo Park CEQA Stormwater Technical Memorandum

TO:	City of Escondido	**DATE:**	8/9/2024
FROM:	Michael Baker International	**SUBJECT:**	El Caballo Park CEQA Stormwater

INTRODUCTION

This technical memorandum is intended to summarize the hydrologic and hydraulic analyses of El Caballo Park located within the City of Escondido, CA. The findings herein build off the proposed site plan documented in the City's 2014 Master Plan. The narrative & analyses address project site run-on and run-off, post-development water quality and hydromodification, construction Risk Level, Escondido Creek vegetation alternatives, and CEQA's thresholds of significance. A summary of the attachments is listed below:

- Attachment 1 – Project Information
- Attachment 2 – Hydrology
- Attachment 3 – Hydraulics
- Attachment 4 – Water Quality & Hydromodification
- Attachment 5 – Escondido Creek Improvements
- Attachment 6 – 2014 Master Plan Excerpts

PROJECT DESCRIPTION

The project site is located along the northeasterly limits of the City of Escondido, immediately west of Save a Life Way and south of the San Diego (Escondido) Humane Society. Proposed improvements encompass approximately 16.8 total acres including development within the park, Escondido Creek adjacent to the park, and a vacant dirt lot east of the Escondido Creek.

Proposed development within the existing park includes, in part, new: DG parking stalls, drive aisles and walkways, equestrian riding areas, picnic areas, a community hall building, and access roads. Minimal grading is anticipated; however, new and/or replaced impervious area is anticipated to trigger Priority Development Project (PDP) classification, as defined in the City of Escondido's BMP Manual (Oct. 2022). Escondido Creek is located immediately east of Save a Life Way and represents the receiving water for all project site runoff under existing and proposed conditions. The creek is listed as an environmentally sensitive area (ESA). As such, the threshold for PDP applicability is 2,500 SF of new and/or replaced impervious area.

Proposed development within Escondido Creek includes transitioning the creek from a concrete-lined channel to a vegetated channel along the El Caballo Park frontage – approximately 1,300 linear feet.

Proposed development at the existing vacant dirt lot includes a new overflow parking lot. The area is located east of

Escondido Creek and is bound by Wohlford Drive to the west, the Hidden Valley Obedience Club to the north, Valley Parkway to the east, and Beven Drive to the south. Decomposed granite (DG) is proposed as the parking lot surface (drive aisles and parking stalls) along the vegetated medians.

HYDROLOGY

Advanced Engineering Solutions (AES – HydroWIN 2016) has been used to quantify project site run-on and run-off for the 100-year storm event. The study areas include El Caballo Park run-on and runoff, as well as the existing vacant dirt lot located east of Escondido Creek. The AES software utilizes the Rational Method and conforms to the hydrologic methodologies outlined in the County of San Diego Hydrology Manual (June 2003). The rational method is a physically based model that calculates peak flow rates (Q) as a function of runoff coefficients (C), rainfall intensities (i), and drainage areas (A):

$$Q = C * I * A$$

Where:

- Runoff coefficient (C) is a function of the impervious and pervious areas, soil type, and landcover,
- Time of concentration and rainfall intensities (I) have been developed internally within the AES software and follow County of San Diego methodology (which the City of Escondido follows),
- Area (A) delineations were developed using project specific contour topography.

El Caballo Park is subjected to run-on from the west and north. At the westerly park boundary, approximate 54.2-acres drain easterly through the park towards Escondido Creek (not including the area tributary to the Dixon Reservoir). The off-site area is undeveloped open space consisting of steep slopes and heavy brush. Run-on from this westerly area is conveyed through the park in a channel that transitions from vegetated to concrete lined midway through the park, ultimately discharging to Escondido creek via 4 – 24" HDPE culverts beneath Save a Life Way. This channel is mapped by FEMA as a special flood hazard area (SFHA), Zone A (based flood elevations not determined). This Zone A mapping is associated with the Dixon Reservoir spillway and will require further analysis during final engineering, including the potential for a Conditional Letter of Map Revision (CLOMR) and a Letter of Map Revision (LOMR).

At the northerly park boundary, approximately 6.4-acres drain towards the park via Save a Life Way. The off-site area is comprised of undeveloped open space with steep slopes and heavy brush, and the San Diego (Escondido) Humane society. An existing culvert beneath Save a Life Way appears to divert runoff from smaller storms directly into Escondido Creek; however, it does not appear this culvert is designed for 100-year peak flow, likely resulting in some project-site run-on during larger storm events.

AES has not been used herein to study the total flow within Escondido Creek along the El Caballo Park frontage. The 100-year flow has been approximated as 6,300 cfs based on work performed in this area within the past five years by MBI. Refer to the Hydraulic section below for more information on peak flow used within Escondido Creek.

Existing On-site Condition

The table below summarizes the peak flow for the project site under existing conditions. Node 108 represents discharge from El Caballo Park into Escondido Creek. Node 203 represents off-site flow at the northerly project boundary (immediately south of the Humane Society) that discharges into Escondido Creek but has potential to run-on to the project site. Node 302 represents the vacant dirt lot that drains directly into Escondido Creek via existing public storm drain.

TABLE 1 - SUMMARY OF EXISTING PEAK FLOW RATES

Drainage Node	Tc	C	I	A	Q100	V100
	(min)	-	In/hr	ac	cfs	fps
105	16.87	0.37	4.45	42.3	70.42	5.13
106	19.72	0.36	4.02	50.8	76.01	4.11
107	21.54	0.35	3.80	54.2	76.26	4.47
108	**21.79**	**0.37**	**4.25**	**60.6**	**85.63**	**9.21**
203	**14.81**	**0.61**	**4.84**	**12.3**	**21.88**	**6.29**
302	**29.34**	**0.35**	**3.11**	**2.5**	**2.71**	**0.41**
Nodes 108, 203, and 302 represent discharge to Escondido Creek						

Proposed On-Site Condition

The table below summarizes the peak flow for the project site under proposed conditions.

TABLE 2 - SUMMARY OF PROPOSED PEAK FLOW RATES

Drainage Node	Tc	C	I	A	Q100	V100
	(min)	-	In/hr	ac	cfs	fps
105	16.29	0.37	4.55	38.8	66.25	5.25
106	17.84	0.36	5.24	45.7	72.88	6.10
107	18.23	0.39	4.23	46.9	73.80	11.38
108	**19.08**	**0.44**	**4.11**	**60.6**	**94.18**	**9.38**
203	**14.81**	**0.61**	**4.84**	**12.3**	**21.88**	**6.29**
302	**25.70**	**0.47**	**3.39**	**2.5**	**3.98**	**0.46**
Nodes 108, 203, and 302 represent discharge to Escondido Creek						

The results tabulated above indicate an increase in un-mitigated peak flow is anticipated based on proposed improvements. On-site improvements at El Caballo Park include new impervious area that results in an increase in un-mitigated peak flow at Node 108. The need for peak flow mitigation is anticipated prior to this discharge location and can be achieved on-site via small, spaced-out water quality basins, oversized storm drains with low-flow orifices, and/or above-ground cisterns for roof drainage to name a few. The ultimate post-development treatment control approach will impact the peak flow mitigation options.

The minor increase in anticipated peak flow at Node 302 (the vacant dirt lot converted to the overflow parking lot) is associated with the assumed compaction and installation of new DG surface. This minor increase can be mitigated back to existing conditions via a thickened gravel storge section beneath a portion of the new DG parking lot. Furthermore, tree wells and/or depressed drive aisle medians throughout the parking lot could be utilized for peak flow mitigation.

Refer to Attachment 2 for the hydrologic calculations and exhibits.

HYDRAULICS

Hydraflow Express extension by Autodesk Inc. has been used for hydraulic analyses. This software follows the methodology of the Federal Highway Administration (FHWA) Hydraulic Engineering Center (HEC-22) criteria for determining inlet capture capacity. Culvert and channel conveyance has also been developed using Hydraflow Express Extension for AutoCAD Civil 3D by Autodesk Inc., which uses manning's equations to calculate depth of flow given design flow rates and accounts for inlet and outlet control.

On-site storm water infrastructure is limited under existing and proposed conditions. In most cases, runoff sheet flows into an on-site channel conveying through the park towards Escondido Creek. A new culvert crossing is proposed on-site to allow for fire truck access. This culvert has been designed to convey Q100 without overtopping. On the east side of Escondido Creek, the existing dirt lot that will be converted to an overflow DG parking lot currently drains westerly via sheet flow and shallow concentrated flow towards a curb inlet that discharges into Escondido Creek. There are no significant hydrologic or hydraulic changes proposed for this area. New storm drain and area drains are anticipated within the DG parking lot to facilitate drainage during intense storms and reduce future maintenance.

WATER QUALITY

On-site improvements and El Caballo Park will be classified as a Priority Development Project based on exceeding 2,500 square feet of new and/or replaced impervious area. The 2,500 threshold is due to Escondido Creek being classified as an Environmentally Sensitive Area (ESA) per Section 1.4.1(d) of the City of Escondido BMP Design Manual (October 2022).

A Drainage Management Area (DMA) exhibit is included in Attachment 4 and provides a preliminary layout of anticipated treatment areas and DMA's that qualify as self-mitigating. In most cases, new surface improvements are comprised of DG and do not required treatment control BMPs. Where treatment control BMPs are required, a variety of sizing has been documented herein to support final engineering. Dispersion with amended soil is likely a viable treatment control BMP given the new impervious areas are spread out and, in all cases, immediately adjacent to pervious area. Bioretention, Biofiltration, and Biofiltration with Partial Infiltration basins have also been preliminarily designed as treatment control options.

Capture and Re-Use is considered feasible at this site given the low amount of impervious area and potential opportunities for re-use on-site. Capture and Re-Use is often economically infeasible on typical development projects where large volumes of captured runoff must be used within a short amount of time within limit re-use opportunities. Pre-treatment of captured runoff is dependent upon re-use mechanism and an important consideration.

Runoff from project area directly discharges to Escondido Creek via hard-lined conveyance. Escondido Creek is currently concrete lined and classified as a Hydromodification Mitigation exempt receiving water (San Diego County Regional Watershed Management Area Analysis, Oct. 2015). As such, on-site improvements at El Caballo Park are not subjected to HMP design. However, converting Escondido Creek from concrete to vegetated along the park frontage is expected to negate the HMP exemption (only where the channel is no longer concrete lined). As such, the El Caballo Park improvements are expected to comply with Hydromodification mitigation, along with any other development that might drain directly to the newly vegetated portion of Escondido Creek.

On-going maintenance will be required and will ultimately depend on the final BMP selection for post-development treatment control. Typical maintenance associated with basins include removing weeds, overgrowth, trash and debris, and ensure the outlet riser is not clogged. Typical inspection frequency is on par with on-site landscape maintenance, but should include a minimum of two (2) inspections per year and after large, intense storms.

CONSTRUCTION RISK LEVEL

The disturbed area associated with the proposed improvements will exceed one (1) acre. As such, a Storm Water Pollution Prevention Plan (SWPPP) is anticipated in conformance with Order WQ 2022-0057-DWQ NPDES No. CA000002. Risk Level during construction is a function of project location, construction duration, and receiving water. The table below summarizes the anticipated Risk Level based on construction duration.

TABLE 3 – CONSTRUCTION RISK LEVEL

Construction Duration	R Factor	K Factor	LS Factor	Receiving Water	Risk Level
0 – 10 months	0-32	0.02	2.31	Escondido Creek & San Elijo Lagoon Sediment Impairment – NO SPAWN/COLD/MIG – NO	1
10-48 months	32-162				2
48+ months	162+				3
-	-				-

ESCONDIDO CREEK

Escondido Creek is characterized as a concrete trapezoidal flood control channel, approximately 12 feet deep with a 10-foot base width and 2:1 side-slopes. The creek is located east of El Caballo Park, separated by Save a Life Way (a paved, two-lane road).

Proposed improvements intend to convert the concrete lined creek to a natural, vegetated creek with a low-flow concrete channel. An increase to the cross-sectional area of the channel is proposed to off-set the increase in roughness coefficient associated with the proposed vegetation. The creek has been hydraulically studied under existing and proposed conditions with a variety of flow rates and roughness coefficients. The tables below summarize the results, refer to Attachment 5 for supporting calculations and a cross-section excerpt from the 2014 Master Plan.

TABLE 4 – ESCONDIDO CREEK FLOW CAPACITY

Flow Capacity	Escondido Creek Peak Flow Capacity (cfs)					
	EX. Concrete	PR. Vegetated	PR. Vegetated	PR. Vegetated	PR. Vegetated	PR. Vegetated
	n = 0.014	n = 0.035	n = 0.04	n = 0.05	n = 0.06	n = 0.15
25% Full	2,441	2,068	1,809	1,447	1,206	482
50% Full	4,881	4,135	3,618	2,894	2,412	964
75% Full	7,322	6,203	5,427	4,341	3,617	1,446
1' of FB	8,004	7,073	6,188	4,950	4,125	1,649
100 Full	9,762	8,270	7,236	5,788	4,823	1,928

The results tabulated above show how flow capacity within Escondido Creek varies with changes to the channel cross section and roughness coefficient. Two (2) cross section areas where studied: the existing concrete lined creek and the vegetative-lined cross section shown in the 2014 Master Drainage Plan. This table highlights the importance of maintenance, as indicated by the significant reduction in flow capacity associated with a total lack of channel maintenance (i.e. n = 0.15). Refer to Attachment 5 for supporting calculations.

TABLE 5 – ESCONDIDO CREEK FLOW CAPACITY

Creek ID	Q2 (cfs)	Q2 % Capacity	Q50 (cfs)	Q50 % Capacity	Q100 (cfs)	Q100 % Capacity
EX Creek (n=0.014)	2,697	28%	5,650	58%	6,300	65%
PR Creek (n=0.035)		33%		68%		76%
PR Creek (n=0.04)		37%		78%		87%
PR Creek (n=0.05)		47%		98%		109%
PR Creek (n=0.06)		56%		117%		131%
PR Creek (n=0.15)		140%		293%		327%

The results tabulated above show how flow capacity (expressed as a percentage of full flow capacity under existing conditions) of each channel configuration (based on roughness coefficient) correlates with anticipated storm events. As previously mentioned herein, the peak flow rates tabulated above have not been studied herein, rather build off a separate project develop by MBI from 2018. This table is included for order of magnitude and will require confirmation of peak flows within Escondido Creek during final engineering. As an example, the table above indicates during existing conditions, the approximate 100-year storm event only takes up 65% of the total creek capacity along the El Caballo Park frontage. Under proposed conditions, the channel roughness coefficient will need to be maintained as 0.04 to ensure 100-year storm capacity is still contained within Escondido Creek.

TABLE 6 – ESCONDIDO CREEK FLOW CAPACITY

Creek ID	Q2	V2	Q50	V50	Q100	V100
EX Creek (n=0.014)	2,697	16.7	5,650	20.2	6,300	20.8
PR Creek (n=0.035)		7.8		9.7		10.0
PR Creek (n=0.04)		7.1		8.8		9.1
PR Creek (n=0.05)		6.1		7.5		n/a
PR Creek (n=0.06)		5.3		n/a		n/a
PR Creek (n=0.15)		n/a		n/a		n/a
"n/a" correlates with flows that exceed channel capacity						

The results tabulated above show how velocity within the channel changes based on roughness and flow capacity. The results indicate flow velocities are erosive (over 5 feet per second) during smaller storm events (2-year) even with a high roughness coefficient – which correlates with heavy vegetation. The Escondido Creek bottom will require rock, grouted riprap, or a low-flow concrete section to mitigate the potential for erosion during small, less intense storms. Additional applications include modular concrete cells that allow for vegetation growth and also provide erosion protection.

The figures below are taken from the County of San Diego Hydraulic Design Manual (Sept. 2014) and provide insight on roughness coefficients and associated vegetative cover:

FIGURE 1 – CHANNEL ROUGHNESS

Table A-4

Table A-4 Average Manning Roughness Coefficients for Larger Open Channels

Unlined Channels	
Clay Loam	0.023
Sand	0.020
Lined Channels	
Grass Lined (Well-Maintained)	0.035
Grass Lined (Not Maintained)	0.045
Wetland-Bottom Channels (New Channel)	0.023
Wetland-Bottom Channels (Mature Channel)	See Table A-5
Riprap-Lined Channels	See Section 5.7.2
Concrete (Poured)	0.014
Air Blown Mortar (Gunite or Shotcrete)[5]	0.016
Asphaltic Concrete or Bituminous Plant Mix	0.018

For channels with revetments or multiple lining types, use composite Manning roughness coefficient based on component lining materials.

[1] Based on materials and workmanship required by standard specifications.
[5] For air-blown concrete, use n–0.012 (if troweled) and n–0.025 if purposely roughened.

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FIGURE 2 – CHANNEL ROUGHNESS

Table A-5

Table A-5 Average Manning Roughness Coefficients for Natural Channels

Minor Streams (Surface Width at Flood Stage < 100 ft)	
Fairly Regular Section	
(A) Some Grass and Weeds, Little or No Brush	0.030
(B) Dense Growth of Weeds, Depth of Flow Materially Greater Than Weed Height	0.040
(C) Some Weeds, Light Brush on Banks	0.040
(D) Some Weeds, Heavy Brush on Banks	0.060
(E) For Trees within Channel with Branches Submerged at High Stage, Increase All Above Values By	0.015
Irregular Section, with Pools, Slight Channel Meander	
Chennels (A) to (E) Above, Increase All Values By	0.015
Mountain Streams; No Vegetation in Channel, Banks Usually Steep, Trees and Brush along Banks Submerged at High Stage	
(A) Bottom, Gravel, Cobbles and Few Boulders	0.050
(B) Bottom, Cobbles with Large Boulders	0.060
Flood Plains (Adjacent To Natural Streams)	
Pasture, No Brush	
(A) Short Grass	0.030
(B) High Grass	0.040
Cultivated Areas	
(A) No Crop	0.040
(B) Mature Row Crops	0.040
(C) Mature Field Crops	0.050
Heavy Weeds, Scattered Brush	0.050
Light Brush and Trees	0.060
Medium To Dense Brush	0.090
Dense Willows	0.170
Cleared Land with Tree Stumps, 100-150 Per Acre	0.060
Heavy Stand of Timber, Little Undergrowth	
(A) Flood Depth below Branches	0.110
(B) Flood Depth Reaches Branches	0.140

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CEQA THRESHOLDS

A. Would the project violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?

No, the project will include post-construction site design, source control, and treatment control Best Management Practices (BMPs) consistent with all local, state, and federal requirements for Priority Development Projects as defined the City of Escondido's Storm Water Design Manual (BMP Manual) dated Oct. 2022.

B. Would the project substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

No, the project is not anticipated to have any measurable impact on groundwater nor interfere with groundwater recharge. The site is located immediately adjacent to Escondido Creek, a concrete lined flood control channel. Project site runoff is conveyed directly to Escondido Creek under existing and proposed conditions.

C.i. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or through the addition of impervious surfaces, in a manner which would result in substantial erosion or siltation on-or off-site?

No, the project will not alter existing drainage patterns nor divert flow, as compared to existing conditions. An existing channel conveys off-site run-on through El Caballo Park towards Escondido Creek. The Dixon Reservoir emergency spillway is located west and upstream of the on-site channel. The proposed Park improvements do not change or alter the existing channel conveying flow easterly towards Escondido Creek. The on-site channel is partially vegetated, partially concrete lined, and partially rock lined. Flow velocity and runoff within the channel will not be impacted by the proposed improvements. A new culvert crossing is proposed for vehicular access and will include upstream and downstream riprap. A second pedestrian crossing is proposed on-site, upstream from the vehicular crossing and is anticipated as a clear-span walkway deck that does not impact flow within the channel.

The project includes converting a portion of Escondido Creek (concrete) along the El Caballo Park frontage to a vegetative-lined channel. As a vegetative-lined channel would result in reduced flow capacity within the channel, due to an increased roughness coefficient, the anticipated improvements include expanding the cross-sectional area of the creek to create additional flow capacity.

C.ii Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or through the addition of impervious surfaces, in a manner which would substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site?

No, the project includes post-construction BMPs that will be designed, in part, to mitigate 100-year peak flow back to existing conditions. Proposed grading will direct runoff away from all proposed structures and no structures will be placed

Improvements within Escondido Creek to convert a portion of the channel from concrete lined to vegetated can be achieved while still maintaining 100-year flow capacity.

C.iii Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or through the addition of impervious surfaces, in a manner which would create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

No, the project includes post-construction BMPs that will be designed, in part, to mitigate 100-year peak flow back to existing conditions and provide post-development treatment in accordance with Priority Development Projects. There are no downstream drainage systems that will be impacted by post-construction runoff from the El Caballo Park. All runoff from new and/or replaced impervious surfaces will undergo on-site treatment prior to discharge to Escondido Creek.

C.iv Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or through the addition of impervious surfaces, in a manner which would create or contribute runoff water which would impede or redirect flood flows?

No, the project will not alter existing drainage patterns nor divert flow, as compared to existing conditions. On-site improvement within El Caballo Park will not impact the existing channel. Improvements within Escondido Creek to convert a portion of the creek from concrete to vegetated can be achieved without substantially impeding flow. The introduction of vegetation within Escondido Creek, as compared to existing concrete, will cause a minor impediment as compared to existing conditions. However, the Creek still has capacity for 100-year conveyance when vegetation is introduced and maintained.

D In flood hazard, tsunami, or seiche zones, would the project risk release of pollutants due to project inundation?

No, the limits of inundation on-site are contained within the existing on-site channel and are associated with the Dixon Reservoir Emergency spillway. Under normal 100-year conditions, off-site area contributes run-on that is conveyed through the on-site channel directly to Escondido Creek. This will not be impacted by proposed improvements.

E Would the project conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

No, the project will include post-construction BMP's consistent with Priority Development Projects. The project is not anticipated to have a measurable impact on groundwater given the direct discharge of surface water to Escondido Creek. There are no existing or proposed dry-wells or other on-site BMPs that might direct surface pollutants into the groundwater.

ADDITIONAL PROJECT INFORMATION

The follow Q&A is typical of planning-level projects within the greater San Diego County region and included for reference.

1. **Will the project 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 which would result in substantial erosion or siltation on- or off-site?**

   The project will not alter the existing drainage pattern across the site. An existing channel conveying run-on through the middle of the park will remain, as will the ultimate discharge receiving water (Escondido Creek). The on-site channel is partially vegetated, partially concrete, and partially rock lined. Flow velocity and runoff within the channel will not be impacted by the proposed improvements. A new culvert crossing is proposed for emergency access and will include upstream and downstream riprap. A second pedestrian crossing is proposed on-site, upstream from the vehicular crossing and is anticipated as a clear-span walkway deck that does not impact flow within the channel.

2. **Will the project increase water surface elevation in a watercourse within a watershed equal to or greater than 1 square mile, by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more?**

   The proposed improvements will not increase water surface elevations (WSEs) within the on-site channel nor the receiving channel (Escondido Creek). The conversion of Escondido Creek from a concrete lined channel to a vegetated channel along the El Caballo Park frontage is not anticipated to impact the 100-year WSE within Escondido Creek by more than 1.0 feet. Additionally, improvements within the Creek are anticipated to still maintain capacity during the 100-year event.

3. **Will the project result in increased velocities and peak flow rates exiting the project site that could cause flooding downstream or exceed the storm water drainage system capacity serving the site?**

   The proposed improvements will not increase velocities nor peak flow rates within the on-site channel nor within the receiving channel (Escondido Creek). The on-site channel will not be impacted by proposed improvements. The conversion of Escondido Creek from a concrete lined channel to a vegetated channel along the El Caballo Park frontage will decrease velocity as compared to existing conditions. Containment within the channel during 100-year peak flow will be maintained, though WSE's are anticipated to increase slightly (less than 1.0 feet) due to a change in the channel roughness coefficient.

4. **Will the project result in placing housing, habitable structures, or unanchored impediments to flow in a 100-year floodplain area or other special flood hazard area, as shown on a FIRM, a County Flood Plain Map or County Alluvial Fan Map, which would subsequently endanger health, safety, and property due to flooding?**

   There are no proposed structures or unanchored impediments within a 100-year floodplain or other SFHA. Escondido Creek is not mapped as a SFHA along the project frontage. The on-site channel conveying southerly through the Park towards Escondido Creek is mapped as Zone A on the FIRM and associated with the Dixon Reservoir spillway.

5. Will the project place structure within a 100-year flood hazard or alter the floodway in a manner that would redirect or impede flow resulting in any of the following:

a) Alter the line of inundation resulting in the placement of other housing in a 100-year flood hazard.

b) Increase water surface elevation in a watercourse with a watershed equal to or greater than 1 square mile by 1 foot or more in height and in the case of the San Luis Rey River, San Dieguito River, San Diego River, Sweetwater River and Otay River, 2/10 of a foot or more?

The project will not locate any structures within a 100-year flood hazard. There are no on-site improvements that would redirect or impede flow. There are no proposed improvements to the alignment of Escondido Creek, nor will flow be impeded by the proposed improvements.

a) The project will not alter the line of inundation nor will the project place housing (or any habitable structure) within a 100-year flood hazard.

b) The project will not increase water surface elevations across the site nor within Escondido Creek by more than one (1.0) foot. Proposed improvements will not alter the existing hydrologic and hydraulic properties of the site. No increase in peak flow discharge, as compared to pre-development conditions, is anticipated as a result of the proposed improvements.

CONCLUSIONS

The re-development of El Caballo Park is anticipated as a Priority Development Project and will require treatment control BMPs for new and/or replaced impervious area. Peak flow increase during the 100-year storm event is anticipated based new impervious area and will require mitigation back to pre-development conditions, presumably within the same BMPs used for WQ and Hydromodification.

Although Escondido Creek is the project site receiving water and currently documented as exempt from hydromodification, project improvements include converting a portion of the creek from concrete to vegetated, which is expected to negate the hydromodification exemption classification. As such, on-site BMPs at El Caballo Park are anticipated to be designed as conjunctive use for water quality, hydromodification, and 100-year peak flow mitigation.

Channel maintenance within Escondido Creek will be critical to ensure 100-year flow capacity is maintained. The overgrowth of vegetation will quickly result in reduced capacities and loss flow containment, resulting in off-site flooding. Under proposed conditions, flow velocities within the Creek are erosive during smaller, less intense storms. As such, a soft bottom is not recommended. Rock, concrete, or modular cells are recommended to protect against erosion where vegetation is not established within Escondido Creek.

Processing of a CLOMR/LOMR with FEMA for the on-site channel currently mapped as SFHA Zone A will be at the discretion of the City of Escondido.

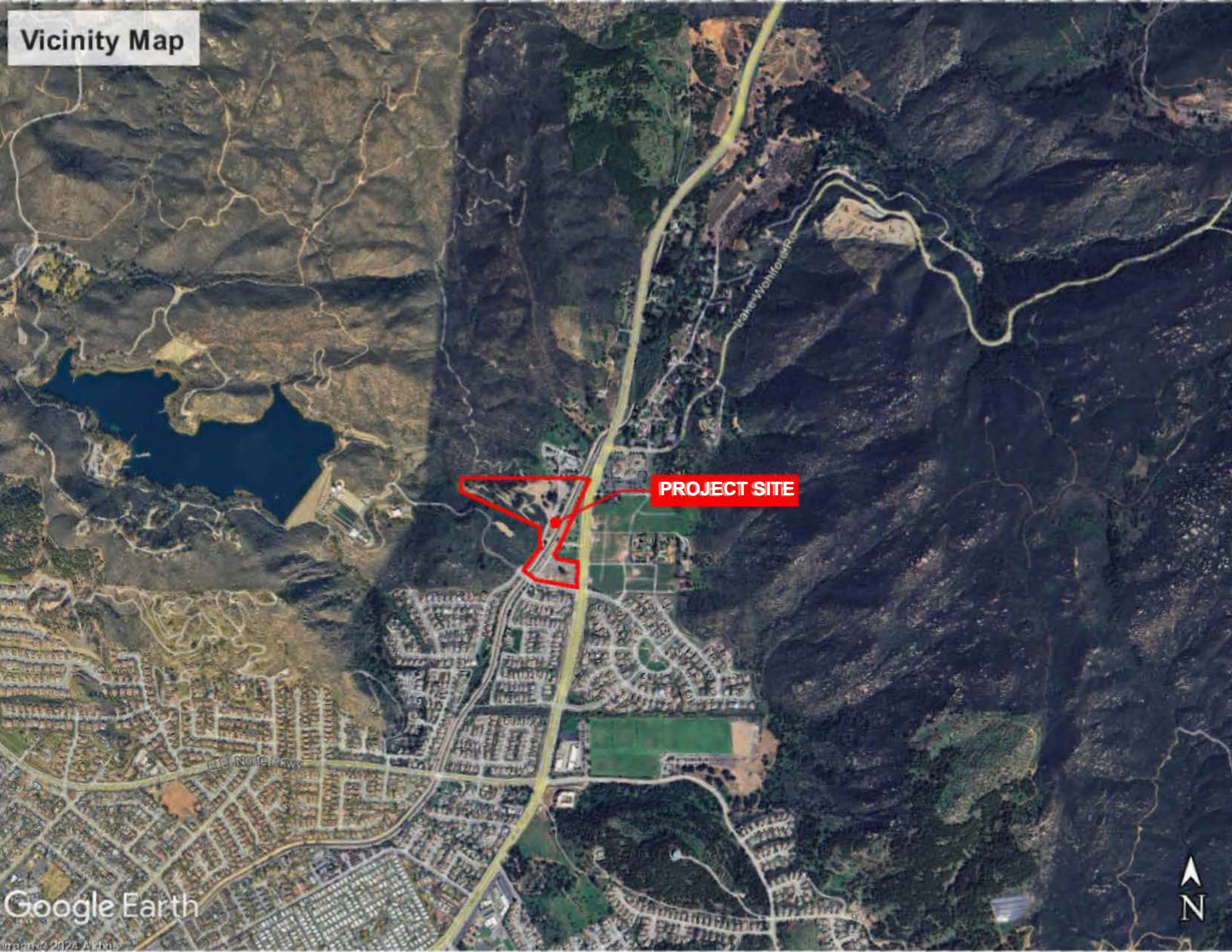


Jay Sullivan, PE, CFM, QSD
RCE #77445

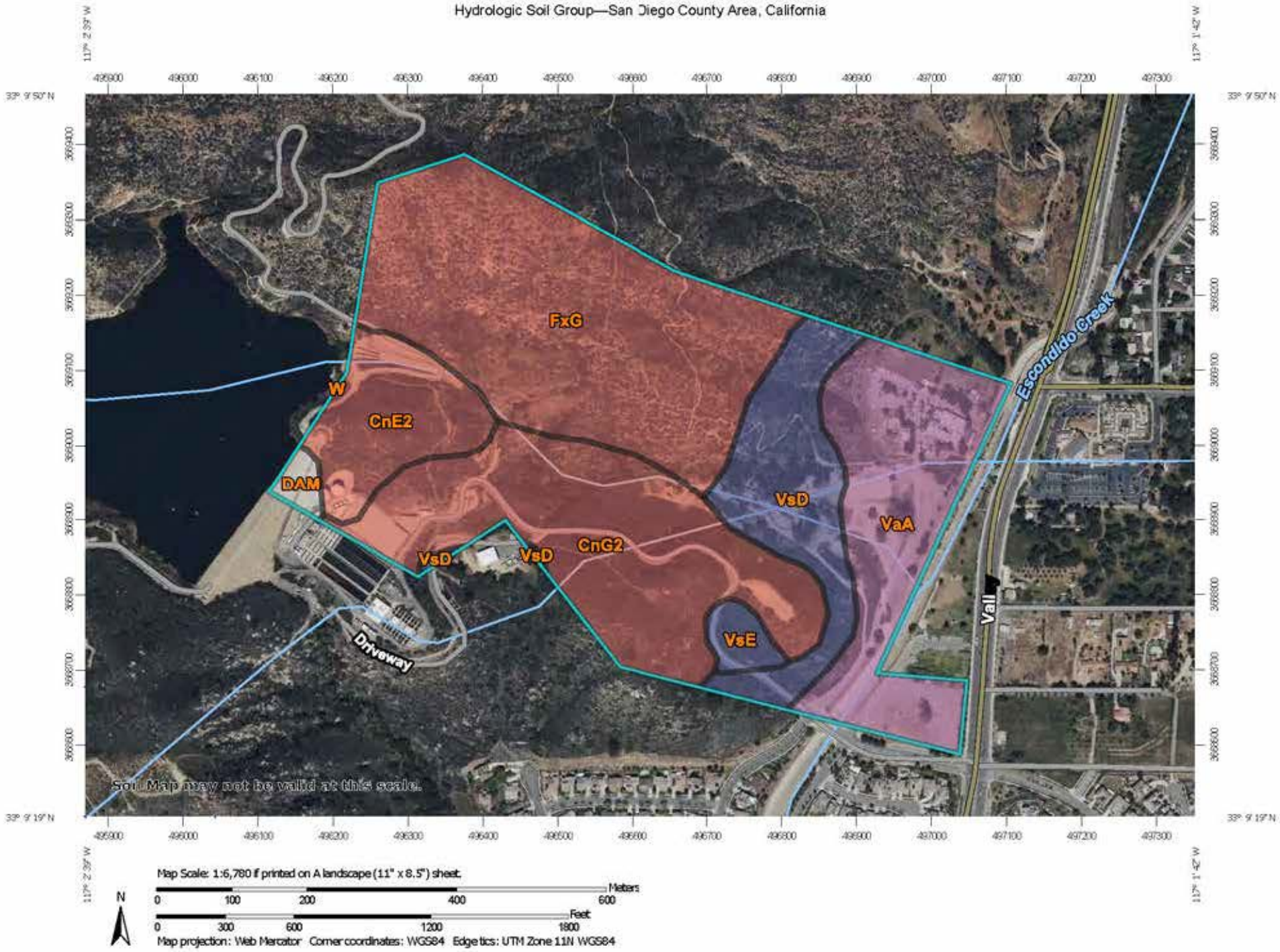
Attachment 1

Vicinity Map
Aerial Image
Web-Soil Survey
FEMA FIRM
Isopluvial Maps

Vicinity Map




Site Aerial Map
PROJECT SITE
Smith Pl
Norman Ln
Valle Lindo Rd
Shuel Pl
Beven Dr
Murcott Way
Burnett Dr
Google Earth
N



Map Scale: 1:6,780 if printed on A landscape (11" x 8.5") sheet.

Meters: 0, 100, 200, 400, 600

Feet: 0, 300, 600, 1200, 1800

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Diego County Area, California
Survey Area Data: Version 19, Aug 30, 2023

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 14, 2022—Mar 17, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
CnE2	Cieneba-Fallbrook rocky sandy loams, 9 to 30 percent slopes, eroded	D	9.2	8.6%
CnG2	Cieneba-Fallbrook rocky sandy loams, 30 to 65 percent slopes, eroded	D	26.2	24.6%
DAM	Dams		1.0	1.0%
FxG	Friant rocky fine sandy loam, 30 to 70 percent slopes	D	35.9	33.7%
VaA	Visalia sandy loam, 0 to 2 percent slopes	A	19.4	18.2%
VsD	Vista coarse sandy loam, 9 to 15 percent slopes, MLRA 20	B	13.0	12.3%
VsE	Vista coarse sandy loam, 15 to 30 percent slopes, MLRA 20	B	1.8	1.7%
W	Water		0.0	0.0%
Totals for Area of Interest			**106.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

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, N/NGS12
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.

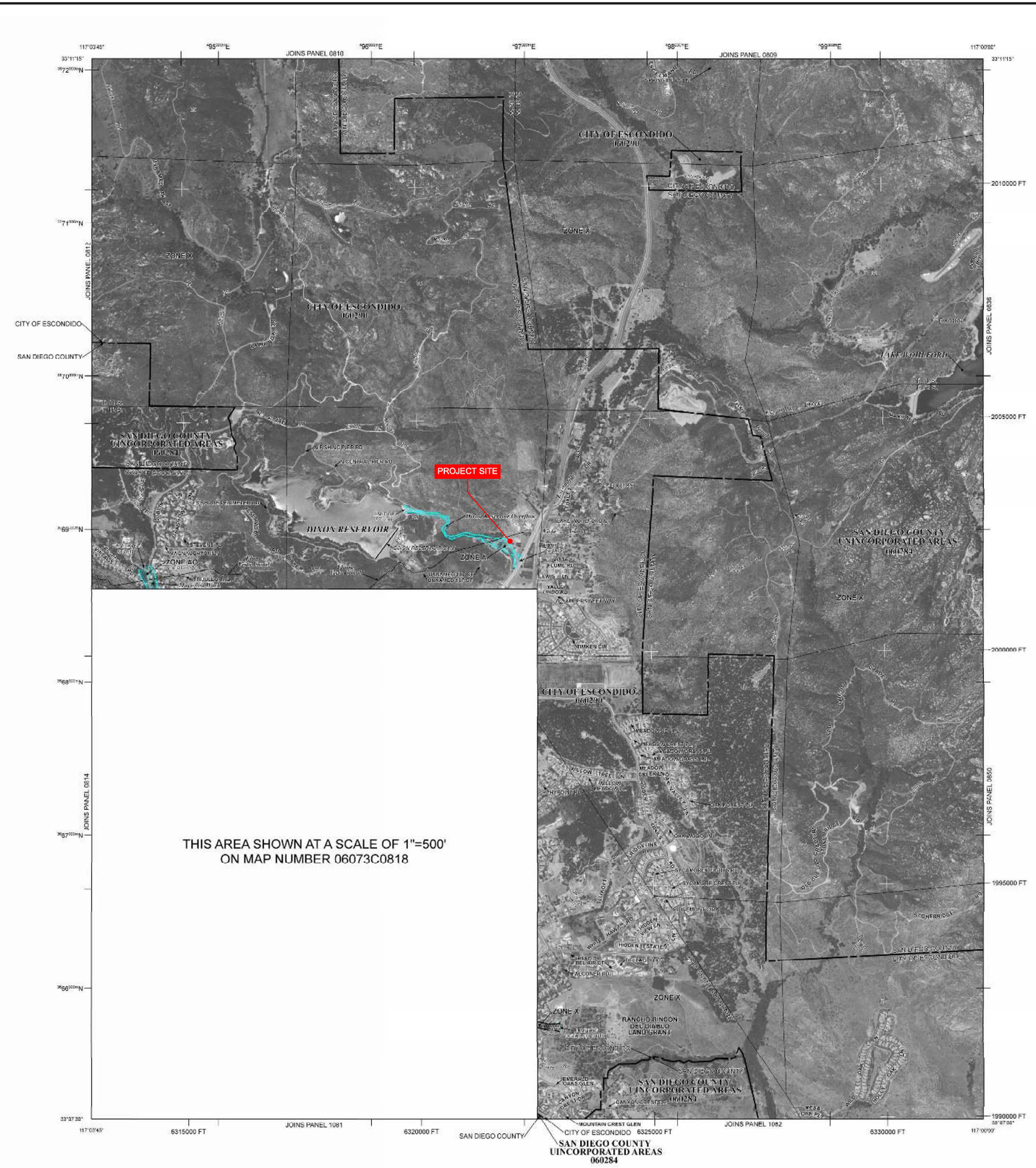
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

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** — Area 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 Elevation, flood depths, or flood velocities
- 513 (EL 987) — Base Flood Elevation line and value; elevation in feet*
- 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
- 23 — 23 — Transect line
- 97°07'30", 32°22'30" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 4275000 FT — 1000-meter Universal Transverse Mercator grid ticks, zone 11
- 6000000 FT — 5000-foot grid values: California State Plane coordinate system, Zone VI (FIPSZONE = 406), Lambert projection
- DX5510 — 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" = 1000'

500 0 500 1,000 1,500 2,000 FEET
150 0 300 600 METERS

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0820G

FIRM

FLOOD INSURANCE RATE MAP
SAN DIEGO COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 820 OF 2375
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
ESCONDIDO, CITY OF	060290	0820	G
SAN DIEGO COUNTY	060284	0820	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
06073C0820G

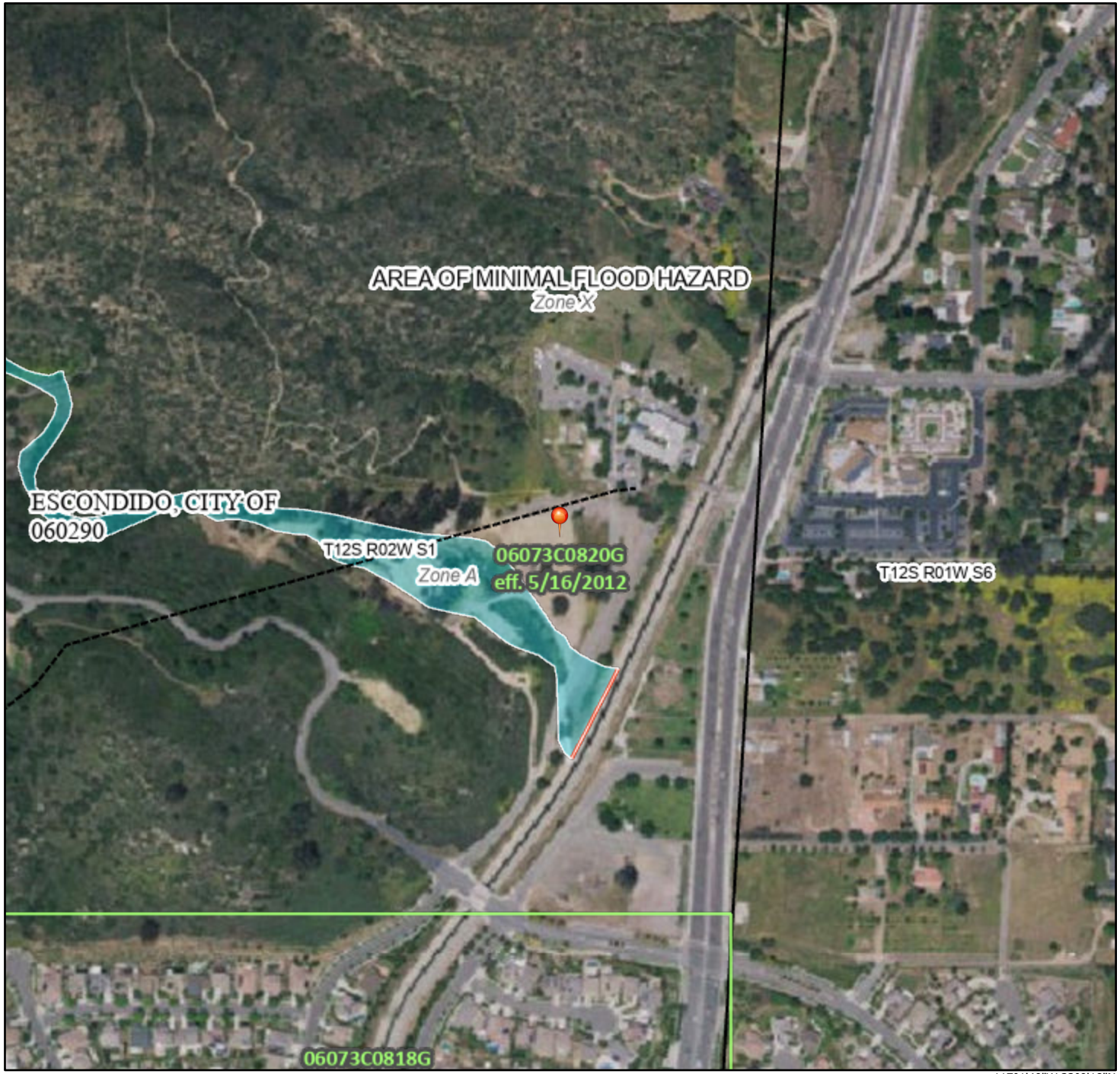
MAP REVISED
MAY 16, 2012

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

117°2'17"W 33°9'48"N



117°1'40"W 33°9'18"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap Imagery Source: USGS National Map 2023

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 Cross Sections with 1% Annual Chance
- 17.5 Water Surface Elevation
- Coastal Transect
- Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 8/7/2024 at 12:41 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 6 Hours

Isopluvial (inches)

Project Location
100-Yr, P6=3.7

Orange County
Riverside County
Imperial County
Pacific Ocean
Mexico

OCEANSIDE
VISTA
CARLSBAD
ESCONDIDO
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
SD

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

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N W E S

3 0 3 Miles

County of San Diego Hydrology Manual

Rainfall Isopluvials

100 Year Rainfall Event - 24 Hours

Isopluvial (inches)

Project Location
100-Yr, P24=8.5

Orange County

Riverside County

Imperial County

Mexico

Pacific Ocean

OCEANSIDE
VISTA
ESCONDIDO
CARLSBAD
ENCINITAS
SOLANA BEACH
DEL MAR
POWAY
S.D. COUNTY
SANTEE
SAN DIEGO
EL CAJON
LA MESA
LEMON GROVE
CORONADO
CHULA VISTA
IMPERIAL BEACH
SD

117°30' 117°15' 117°00' 116°45' 116°30' 116°15'
33°30' 33°15' 33°00' 32°45' 32°30'

DPW GIS
Department of Public Works
Geographic Information Services

SanGIS
We Have San Diego Covered!

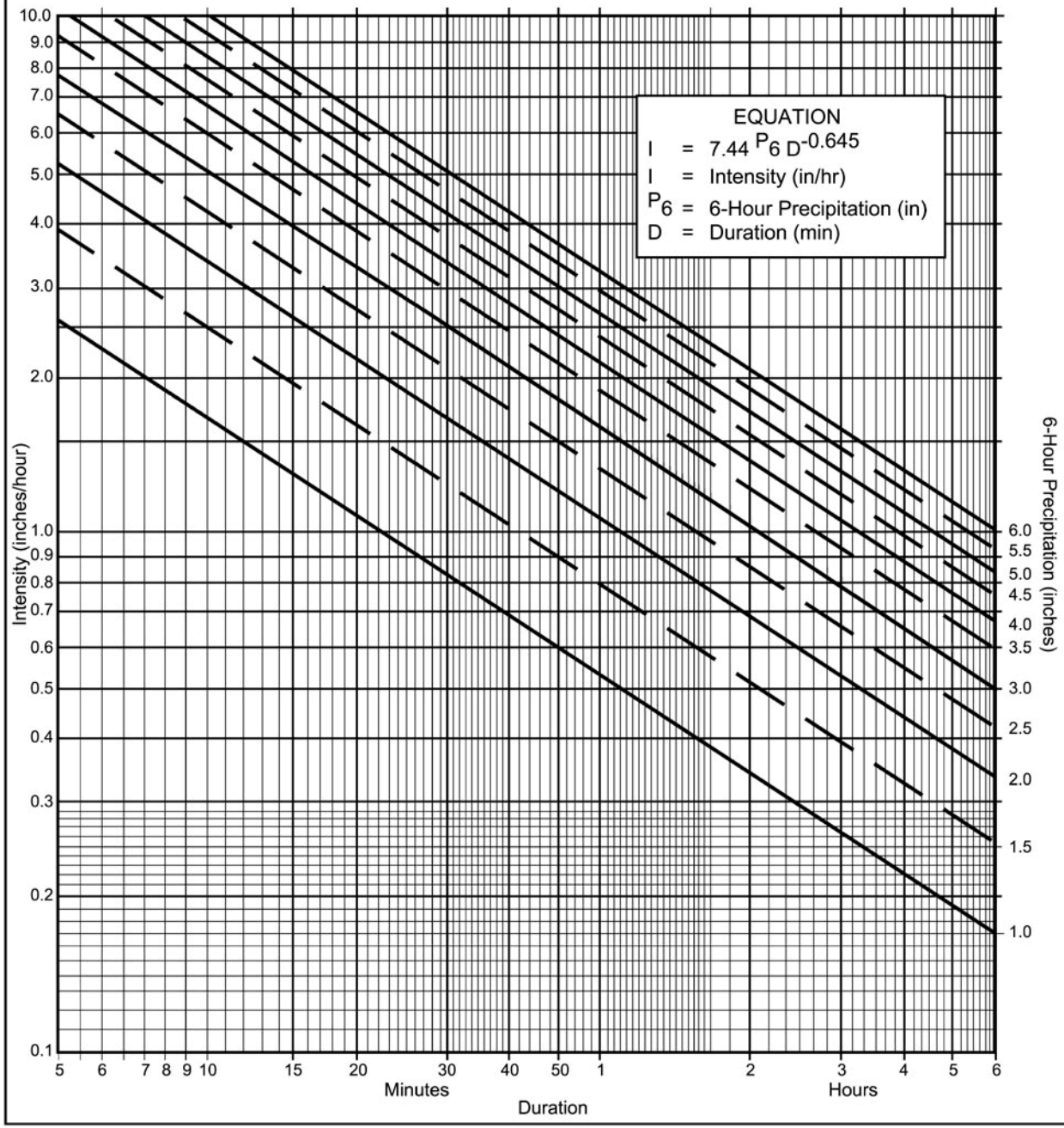
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N W E S

3 0 3 Miles



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 100 year

(b) P_6 = 3.7 in., P_{24} = 8.5, $\frac{P_6}{P_{24}}$ = 44 %(2)

(c) Adjusted P_6(2) = 3.7 in.

(d) t_x = _____ min.

(e) I = _____ 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 - Template

FIGURE 3-1

Attachment 2

Existing Hydrologic Work Map
Existing AES
Proposed Hydrologic Work Map
Proposed AES

El Caballo Park
Existing Hydrologic Work Map

LEGEND
DRAINAGE BOUNDARY
FLOW PATH
STORM DRAIN
FLOW ARROWS
IMPERVIOUS AREA
PROJECT BOUNDARY

100 INITIAL A = 0.10 AC L = 95 FT Elevation = 1,260 FT C = 0.35
101 Elevation: 1,226 FT
SUB-AREA A = 3.78 AC L = 446 FT C = 0.35
102 Elevation: 1,048 FT
SUB-AREA A = 12.85 AC L = 861 FT C = 0.35
Elevation: 967 FT
103
SUB-AREA A = 13.00 AC L = 580 FT C = 0.41
104 Elevation: 838 FT
SUB-AREA A = 12.55 AC L = 698 FT C = 0.37
Elevation: 768 FT
105
SUB-AREA A = 8.51 AC L = 691 FT C = 0.36
200 INITIAL A = 0.10 AC L = 100 FT Elevation = 1,122 FT C = 0.35
201 Elevation: 1,096 FT
SUB-AREA A = 11.30 AC L = 1,658 FT C = 0.35
110 INITIAL A = 0.10 AC L = 100 FT Elevation = 856 FT C = 0.35
111 Elevation: 844 FT
SUB-AREA A = 1.37 AC L = 436 FT C = 0.35
Elevation: 736 FT
202
SUB-AREA A = 0.87 AC L = 192 FT C = 0.61
203 Elevation: 734 FT Area = 12.27 AC Q100 = 21.88 CFS V100 = 6.29 FPS
112 Elevation: 742 FT
SUB-AREA A = 4.92 AC L = 866 FT C = 0.40
Elevation: 736 FT
106
SUB-AREA A = 3.36 AC L = 328 FT C = 0.35
107 Elevation: 730 FT
Existing Culvert Crossing (4) - 24" L = 139 FT
108 Elevation: 724 FT Area = 60.55 AC Q100 = 85.63 CFS V100 = 9.21 FPS
Elevation: 726 FT Area = 2.49 AC Q100 = 2.71 CFS V100 = 0.41 FPS
302
Type B Curb Inlet 723.20' TC 18" RCP 717.66' IE 36.86' to junction
Dual 42" RCP 714.85' IE
42" RCP 716.05' IE
SUB-AREA A = 2.39 AC L = 453 FT C = 0.35
300 INITIAL A = 0.10 AC L = 50 FT Elevation = 727 FT C = 0.35
301 Elevation: 726.3 FT

Escondido Creek
Valley Pkwy
Sara A Lee Way
Beven Dr
Burnet Dr

N
0 160 320 Feet

```
**************************************************************************

            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
            Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT
                         2003,1985,1981 HYDROLOGY MANUAL
          (c) Copyright 1982-2016 Advanced Engineering Software (aes)
              Ver. 23.0 Release Date: 07/01/2016  License ID 1264

                             Analysis prepared by:
```

```
 ************************* DESCRIPTION OF STUDY *************************
* EL CABALLO PARK                                                      *
* EXISTING CONDITIONS                                                  *
* 100 YEAR STORM                                                       *
 ************************************************************************

  FILE NAME: EXQ100.DAT
  TIME/DATE OF STUDY: 10:15 08/07/2024
------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
------------------------------------------------------------------------
  2003 SAN DIEGO MANUAL CRITERIA

  USER SPECIFIED STORM EVENT(YEAR) = 100.00
  6-HOUR DURATION PRECIPITATION (INCHES) =   3.700
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  18.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.90
  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    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    95.00
  UPSTREAM ELEVATION(FEET) =   1260.00
  DOWNSTREAM ELEVATION(FEET) =   1226.00
  ELEVATION DIFFERENCE(FEET) =     34.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.108
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.568
  SUBAREA RUNOFF(CFS) =      0.30
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.30

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1226.00  DOWNSTREAM(FEET) =   1048.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   446.00   CHANNEL SLOPE =  0.3991
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.813
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       4.92
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.85
  AVERAGE FLOW DEPTH(FEET) =   0.03   TRAVEL TIME(MIN.) =   2.61
  Tc(MIN.) =    8.71
  SUBAREA AREA(ACRES) =     3.78       SUBAREA RUNOFF(CFS) =    9.01
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        3.9         PEAK FLOW RATE(CFS) =       9.25

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.04   FLOW VELOCITY(FEET/SEC.) =   4.13
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     541.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1048.00  DOWNSTREAM(FEET) =    967.00
```

```
  CHANNEL LENGTH THRU SUBAREA(FEET) =   861.00   CHANNEL SLOPE =  0.0941
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  5.287
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      21.20
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.42
  AVERAGE FLOW DEPTH(FEET) =   0.11   TRAVEL TIME(MIN.) =   4.20
  Tc(MIN.) =   12.91
  SUBAREA AREA(ACRES) =    12.85       SUBAREA RUNOFF(CFS) =   23.78
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =       16.7         PEAK FLOW RATE(CFS) =      30.96

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.14   FLOW VELOCITY(FEET/SEC.) =   3.82
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =    1402.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    967.00  DOWNSTREAM(FEET) =    838.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   580.00   CHANNEL SLOPE =  0.2224
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.886
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4100
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      43.96
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.76
  AVERAGE FLOW DEPTH(FEET) =   0.13   TRAVEL TIME(MIN.) =   1.68
  Tc(MIN.) =   14.59
  SUBAREA AREA(ACRES) =    13.00       SUBAREA RUNOFF(CFS) =   26.04
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.376
  TOTAL AREA(ACRES) =       29.7         PEAK FLOW RATE(CFS) =      54.66

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.16   FLOW VELOCITY(FEET/SEC.) =   6.09
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    1982.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
```

```
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    838.00  DOWNSTREAM(FEET) =    768.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   698.00   CHANNEL SLOPE =  0.1003
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.449
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3700
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      64.97
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.09
  AVERAGE FLOW DEPTH(FEET) =   0.21   TRAVEL TIME(MIN.) =   2.28
  Tc(MIN.) =   16.87
  SUBAREA AREA(ACRES) =    12.55       SUBAREA RUNOFF(CFS) =   20.66
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.374
  TOTAL AREA(ACRES) =       42.3         PEAK FLOW RATE(CFS) =      70.42

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.22   FLOW VELOCITY(FEET/SEC.) =   5.13
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    2680.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    768.00  DOWNSTREAM(FEET) =    736.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   691.00   CHANNEL SLOPE =  0.0463
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.023
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3600
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      76.59
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   4.05
  AVERAGE FLOW DEPTH(FEET) =   0.29   TRAVEL TIME(MIN.) =   2.85
  Tc(MIN.) =   19.72
  SUBAREA AREA(ACRES) =     8.51       SUBAREA RUNOFF(CFS) =   12.33
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.372
  TOTAL AREA(ACRES) =       50.8         PEAK FLOW RATE(CFS) =      76.01

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.29   FLOW VELOCITY(FEET/SEC.) =   4.11
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    3371.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.00 TO NODE    107.00 IS CODE =  51
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    736.00  DOWNSTREAM(FEET) =    730.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   328.00   CHANNEL SLOPE =  0.0183
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.800
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      78.24
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.00
  AVERAGE FLOW DEPTH(FEET) =   0.38   TRAVEL TIME(MIN.) =   1.82
  Tc(MIN.) =   21.54
  SUBAREA AREA(ACRES) =     3.36       SUBAREA RUNOFF(CFS) =    4.47
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.371
  TOTAL AREA(ACRES) =       54.2         PEAK FLOW RATE(CFS) =      76.26

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.38   FLOW VELOCITY(FEET/SEC.) =   2.94
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    107.00 =    3699.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    107.00 TO NODE    108.00 IS CODE =  41
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
==========================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   730.00  DOWNSTREAM(FEET) =   724.00
  FLOW LENGTH(FEET) =   139.00   MANNING'S N =  0.024
  DEPTH OF FLOW IN  28.0 INCH PIPE IS  17.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   9.21
  GIVEN PIPE DIAMETER(INCH) =  28.00    NUMBER OF PIPES =   3
  PIPE-FLOW(CFS) =      76.26
  PIPE TRAVEL TIME(MIN.) =   0.25    Tc(MIN.) =   21.79
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =    3838.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
==========================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   21.79
  RAINFALL INTENSITY(INCH/HR) =   3.77
  TOTAL STREAM AREA(ACRES) =    54.15
  PEAK FLOW RATE(CFS) AT CONFLUENCE =     76.26
```

Existing conditions has four (4) - 24" pipes. Due to limitations in AES. Only three (3) - 28" pipes were modeled.

```
****************************************************************************
  FLOW PROCESS FROM NODE    110.00 TO NODE    111.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =    856.00
  DOWNSTREAM ELEVATION(FEET) =    844.00
  ELEVATION DIFFERENCE(FEET) =     12.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.427
  SUBAREA RUNOFF(CFS) =      0.29
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
  FLOW PROCESS FROM NODE    111.00 TO NODE    112.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    844.00  DOWNSTREAM(FEET) =    742.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   436.00   CHANNEL SLOPE =  0.2339
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.039
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.75
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.71
  AVERAGE FLOW DEPTH(FEET) =   0.02   TRAVEL TIME(MIN.) =   4.24
  Tc(MIN.) =   10.50
  SUBAREA AREA(ACRES) =     1.37       SUBAREA RUNOFF(CFS) =    2.90
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        1.5         PEAK FLOW RATE(CFS) =       3.11

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.03   FLOW VELOCITY(FEET/SEC.) =   2.19
  LONGEST FLOWPATH FROM NODE    110.00 TO NODE    112.00 =     536.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    112.00 TO NODE    108.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
 ELEVATION DATA: UPSTREAM(FEET) =    742.00  DOWNSTREAM(FEET) =    724.00
 CHANNEL LENGTH THRU SUBAREA(FEET) =   866.00   CHANNEL SLOPE =  0.0208
 CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  50.000
 MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   1.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.251
 *USER SPECIFIED(SUBAREA):
 NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .4000
 S.C.S. CURVE NUMBER (AMC II) =   0
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       7.31
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.90
 AVERAGE FLOW DEPTH(FEET) =   0.28   TRAVEL TIME(MIN.) =   7.60
 Tc(MIN.) =   18.11
 SUBAREA AREA(ACRES) =     4.92       SUBAREA RUNOFF(CFS) =    8.37
 AREA-AVERAGE RUNOFF COEFFICIENT =  0.388
 TOTAL AREA(ACRES) =        6.4         PEAK FLOW RATE(CFS) =      10.55

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.32   FLOW VELOCITY(FEET/SEC.) =   2.09
 LONGEST FLOWPATH FROM NODE    110.00 TO NODE    108.00 =    1402.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    108.00 TO NODE    108.00 IS CODE =   1
----------------------------------------------------------------------------
 >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
 >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
 TOTAL NUMBER OF STREAMS =  2
 CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
 TIME OF CONCENTRATION(MIN.) =   18.11
 RAINFALL INTENSITY(INCH/HR) =   4.25
 TOTAL STREAM AREA(ACRES) =     6.39
 PEAK FLOW RATE(CFS) AT CONFLUENCE =     10.55

 ** CONFLUENCE DATA **
 STREAM     RUNOFF       Tc      INTENSITY      AREA
 NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
     1       76.26    21.79        3.772         54.15
     2       10.55    18.11        4.251          6.39

 RAINFALL INTENSITY AND TIME OF CONCENTRATION RATIO
 CONFLUENCE FORMULA USED FOR  2 STREAMS.

 ** PEAK FLOW RATE TABLE **
 STREAM     RUNOFF      Tc      INTENSITY
 NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1       73.91    18.11       4.251
     2       85.63    21.79       3.772

 COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
 PEAK FLOW RATE(CFS) =      85.63   Tc(MIN.) =   21.79
```

```
  TOTAL AREA(ACRES) =       60.5
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    108.00 =    3838.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   100.00
  UPSTREAM ELEVATION(FEET) =   1122.00
  DOWNSTREAM ELEVATION(FEET) =   1096.00
  ELEVATION DIFFERENCE(FEET) =     26.00
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    6.267
  WARNING: THE MAXIMUM OVERLAND FLOW SLOPE, 10.%, IS USED IN Tc CALCULATION!
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  8.427
  SUBAREA RUNOFF(CFS) =      0.29
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.29

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   1096.00  DOWNSTREAM(FEET) =    736.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  1658.00   CHANNEL SLOPE =  0.2171
  CHANNEL BASE(FEET) =   50.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.950
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.59
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.44
  AVERAGE FLOW DEPTH(FEET) =   0.06   TRAVEL TIME(MIN.) =   8.03
  Tc(MIN.) =   14.30
  SUBAREA AREA(ACRES) =    11.30       SUBAREA RUNOFF(CFS) =   19.58
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =       11.4         PEAK FLOW RATE(CFS) =      19.75

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.09   FLOW VELOCITY(FEET/SEC.) =   4.19
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =    1758.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    203.00 IS CODE =  41
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING USER-SPECIFIED PIPESIZE (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =   736.00  DOWNSTREAM(FEET) =   734.00
  FLOW LENGTH(FEET) =   192.00   MANNING'S N =  0.024
  ASSUME FULL-FLOWING PIPELINE
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.29
  PIPE FLOW VELOCITY = (TOTAL FLOW)/(PIPE CROSS SECTION AREA)
  GIVEN PIPE DIAMETER(INCH) =  24.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      19.75
  PIPE TRAVEL TIME(MIN.) =   0.51    Tc(MIN.) =   14.81
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    203.00 =    1950.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    203.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.840
  *USER SPECIFIED(SUBAREA):
  GENERAL COMMERCIAL RUNOFF COEFFICIENT = .6100
  S.C.S. CURVE NUMBER (AMC II) =   0
  AREA-AVERAGE RUNOFF COEFFICIENT = 0.3684
  SUBAREA AREA(ACRES) =    0.87   SUBAREA RUNOFF(CFS) =    2.57
  TOTAL AREA(ACRES) =       12.3   TOTAL RUNOFF(CFS) =      21.88
  TC(MIN.) =   14.81

****************************************************************************
  FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    50.00
  UPSTREAM ELEVATION(FEET) =    727.00
  DOWNSTREAM ELEVATION(FEET) =    726.30
  ELEVATION DIFFERENCE(FEET) =      0.70
  SUBAREA OVERLAND TIME OF FLOW(MIN.) =    8.533
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  6.906
  SUBAREA RUNOFF(CFS) =      0.24
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.24

****************************************************************************
  FLOW PROCESS FROM NODE    301.00 TO NODE    302.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
```

```
  ELEVATION DATA: UPSTREAM(FEET) =    726.30  DOWNSTREAM(FEET) =    726.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =   453.00   CHANNEL SLOPE =  0.0007
  CHANNEL BASE(FEET) =    0.00   "Z" FACTOR =  50.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.114
  *USER SPECIFIED(SUBAREA):
  NATURAL DESERT LANDSCAPING RUNOFF COEFFICIENT = .3500
  S.C.S. CURVE NUMBER (AMC II) =   0
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       1.64
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   0.36
  AVERAGE FLOW DEPTH(FEET) =   0.30   TRAVEL TIME(MIN.) =  20.80
  Tc(MIN.) =   29.34
  SUBAREA AREA(ACRES) =     2.39       SUBAREA RUNOFF(CFS) =    2.60
  AREA-AVERAGE RUNOFF COEFFICIENT =  0.350
  TOTAL AREA(ACRES) =        2.5         PEAK FLOW RATE(CFS) =       2.71

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.36   FLOW VELOCITY(FEET/SEC.) =   0.41
  LONGEST FLOWPATH FROM NODE    300.00 TO NODE    302.00 =     503.00 FEET.
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.5  TC(MIN.) =     29.34
  PEAK FLOW RATE(CFS)   =       2.71
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```