

PRELIMINARY DRAINAGE REPORT
FOR
Tract 37305
Nichols South Specific Plan
City of Lake Elsinore

Prepared for:

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Prepared under supervision of:

A handwritten signature in blue ink, appearing to read 'Keith Osborn', written over a horizontal line.

Keith Osborn, RCE No. 36996

July 2018

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ATTACHMENTS

- **A:** Off-site Inflow Hydrographs - Drainage Area A (tributary to Stovepipe Canyon Creek)
 - Ultimate Condition: 100-year 1-, 3-, 6- and 24-hour storm
- **B:** On-site Inflow Hydrographs - Drainage Areas A and B
 - Proposed Condition: 100-year 1-, 3-, 6- and 24-hour storm and 2-year 24-hour storm
- **C:** On-site Inflow Hydrographs - Drainage Areas A and B
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- **E:** Rational Methods - Drainage Area off-site to new Nichols Road
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- **F:** As-built drawings for references only.

INTRODUCTION

PURPOSE

This drainage study has been prepared to support the drainage system of the proposed development of Tentative Tract No. 37305 in the City of Lake Elsinore. TTM 37305 is a 74 acre development consisting of 168 single family residential homes, a 14.5 acre commercial site along with a park and open space areas. TTM 37305 is located within the Nichols South Specific Plan which is being processed concurrently with TTM 37305. This report identifies the existing drainage patterns; the existing offsite flows tributary to this site and provides an evaluation of the runoff from the site under full development as shown on TTM 37305. The primary purpose of this analysis is to estimate offsite and onsite peak storm water discharge to facilitate the design of the storm drain system within the project. This analysis also provides hydraulic calculations for the proposed storm drain and detention basin facilities proposed for TTM 37305.

With the City of Lake Elsinore, Riverside Counties' MS4 permit, certain post development water quality features need to be designed into the project for water quality treatment of daily nuisance flows and first flush storm flows after the project is constructed and homes are occupied. The project will implement LID practices and also proposes BMPs treatment to mitigate for Hydromodification impact (HCOC). See Preliminary WQMP for TTM 37305 (Nichols South Specific Plan).

SETTING – EXISTING CONDITION

TTM 37305 (Nichols South Specific Plan) is located south of Nichols Road, east of and adjacent to interstate 15, west of El Toro Road, and north of Temescal Canyon High School in the City of Lake Elsinore.

Stovepipe Canyon Creek bisects the project site from the east enters the property via two 24" pipes and over the concrete spillway and exits the property along the westerly property line via existing Caltrans 6'x14' RCB culvert. For detail of existing structures please see as-built drawing Tract 18595-1 and Tract 18595 Grading Plans Drawing No. 77-29 GP-05 in Attachment F.

The project is located in APNs 389-200-037, 389-210-008, 389-210-034, and 389-210-036. **See figure 1a – Vicinity Map.**

Stovepipe Canyon Creek located in the Lake Elsinore community within the City of Lake Elsinore has been designated as a Special Flood Hazard Area (SFHA) on the FEMA Flood Insurance Rate Maps (FIRM) Map Number 06065C2028G Panel 2028 of 3805, dated August 28, 2008. It has been designated with a Zone A, No based flood elevations determined.

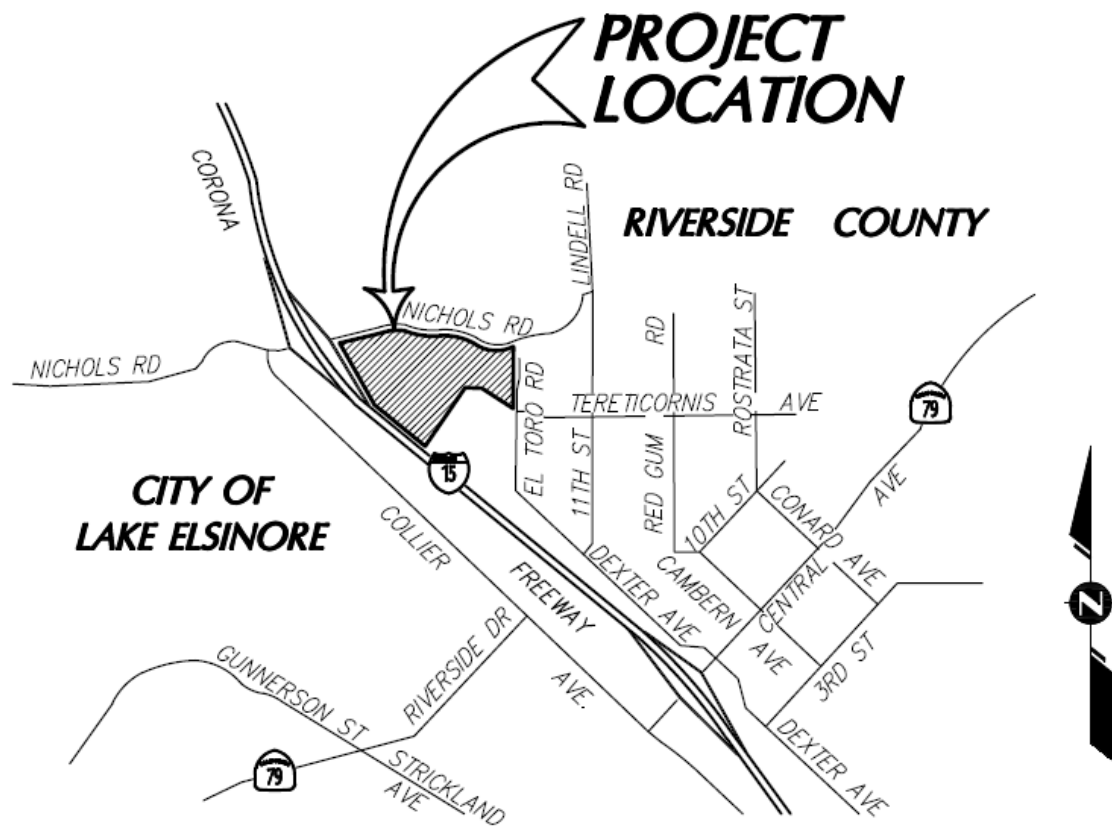


Figure 1a: Vicinity Map

Hydrology - Existing Condition:

The project site currently consists of vacant, undeveloped land. The subject property is bounded to the west by Interstate 15, to the north by Nichols Road, to the east by residential development, and to the south by Temescal Canyon High School. Stovepipe Canyon Creek bisects the project site from the east enters the property via two 24" pipes and over the concrete spillway and exits the property along the westerly property line via existing Caltrans 6'x14' RCB culvert.

See Aerial picture in the current condition below:



**Figure 1b: Aerial Picture
Project Site**

As shown on **Figure 2** there are four (4) drainage areas in the existing condition in this study, drainage Areas A, B, C and D:

Drainage Area A is approximately 837.7 acres and is tributary to the Stovepipe Canyon Creek at the existing 6'x14' RCB Caltrans Culvert. This area includes the off-site tributary drainage area that drains to project site through Stovepipe Canyon Creek which bisects the project. These flows from the east enter the property via two 24" pipes and over the existing concrete spillway at the east boundary, then traverse through the property and then these flows exit the property along the westerly property line via the existing Caltrans 6'x14' RCB culvert at the I-15 Freeway.

Drainage Area B is approximately 8.4 acres and this tributary area comprises the southeast portion of the project site and drains to existing El Toro Road.

Drainage Area C is approximately 47.8 acres and this tributary area drains into the two existing 24" Caltrans culverts located along the northbound I-15 Freeway off-ramp at Nichols Road.

Drainage Area D is approximately 25.9 acres and this tributary area drains to Nichols Road.

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 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 tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables 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 NAD 83, GRS80 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, NINGS12
National Geodetic Survey
SSMC-3, #9202
1515 East-West Highway
Silver Spring, Maryland 20910-3282
(201) 712-3212

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 (201) 712-3242, or visit its website at <http://www.ngs.noaa.gov>.

Base map information shown on this FIRM was derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography taken 1984 or later.

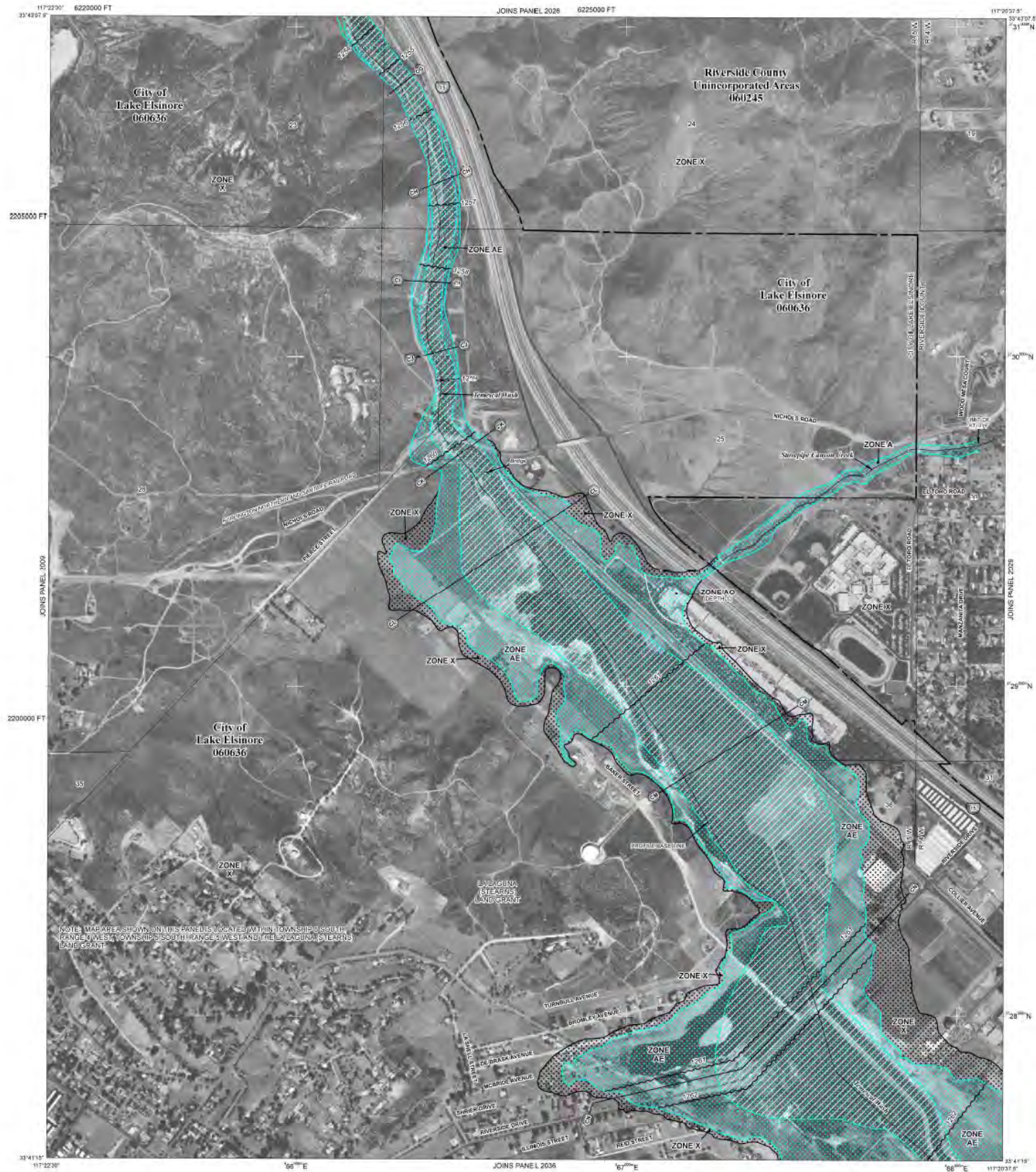
This map may reflect more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the Flood Profiles and Floodway Data 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 rates for each community as well as a listing of the panels on which each community is located.

Contact the **FEMA Map Service Center** at 1-800-358-9616 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://www.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>.



LEGEND

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

The 1% annual 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 flood. Areas of Special Flood Hazard include Zone A, AE, AH, AO, 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 ponds); 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 unusual fan flooding, velocities also determined.
- ZONE AH** Open flood hazard areas formerly contained within the 1% annual chance flood by a flood control system that was subsequently destroyed. Zone AH 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 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 boundaries dividing Special Flood Hazard Areas of different base flood elevations, flood depths or flood velocities.
- Base Flood Elevation line and values; elevation in feet*
- Base Flood Elevation value where uniform within zone; elevation in feet

- * Referenced to the North American Vertical Datum of 1988
- CBRS and OPA line
- Traverse line
- Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
- 200-meter Universal Transverse Mercator grid values, zone 12N
- 5000-foot grid ticks: California State Plane coordinate system, zone VI (FIPS/ZONE 42N), Lambert Conformal Conic projection
- Bench mark (see explanation in Notes to Users section of this FIRM issue)
- 1:1.5
- River mile

MAP repository
Refer to listing of Map Repositories on Map Index
EFFECTIVE DATE OF COUNTERMAPPING
FLOOD INSURANCE RATE MAP
August 28, 2008
EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countermap 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 1-800-638-6622.



NFIP
PANEL 2028G
FIRM
FLOOD INSURANCE RATE MAP
RIVERSIDE COUNTY, CALIFORNIA AND INCORPORATED AREAS
PANEL 2028 OF 3805
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
LAKE EL SINORE CITY OF	060245	2028	G

Notes 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
06065C2028G
EFFECTIVE DATE
AUGUST 28, 2008
Federal Emergency Management Agency

PROPOSED CONDITIONS

The development of Tract 37305 will provide for grading for the proposed 168 single family lots, a Commercial Site, a park site, open space areas and the construction of a storm drain system that will:

- Safely intercept offsite flows and convey through the site without co-mingling these flows with untreated onsite developed flows.
- Generally maintain the drainage patterns and discharge locations.
- In complying with Santa Ana Region NPDES-MS4 Permit requirements, safely intercept Design Capture Volume and convey onsite developed storm flows to onsite Water Quality Treatment Control Basins.
- Provide emergency by-pass for 100-year storm event without damage the BMPs.
- Control outlet velocities such that downstream erosion potential is minimized and outlet flows are released in a safe manner.

Hydrology – Proposed Condition:

As shown on **Figure 3** there are four (4) drainage areas in the existing condition in this study, drainage Areas A, B, C and D. All originating from the same tributary drainage areas; drainage patterns will generally remain as in the existing condition.

Drainage Area A will be divided into several drainage sub-areas:

Drainage Area A (off-site) is approximately 837.7 acres, tributary to the Stovepipe Canyon Creek at the existing 6'x14' RCB Caltrans Culvert. This area is a project off-site drainage area drain to project site through Stovepipe Canyon Creek which bisects the project site from the east enters the property via two 24" pipes and over the concrete spillway and exits the property along the westerly property line via existing Caltrans 6'x14' RCB culvert. No change from existing condition.

Drainage Area A-1 is approximately 27.03 acres and tributary to the proposed residential area drain into Extended Detention Basin A1 to mitigate the post water quality and outlet into Detention Basin A.

Drainage Area A-2 is approximately 24.37 acres and tributary to the proposed commercial site and proposed Nichols Road area drain into Sand Filter Basin A2 to mitigate the post water quality and outlet into Detention Basin A to mitigate the increase peak flow of the proposed project prior drain into Stovepipe Canyon Creek.

Drainage Area B is approximately total of 8.4 acres and tributary to the proposed residential at southeast portion of the project site. Drainage Area B will drains into Enhanced Sand Filter/Detention Basin B then outlet through parkway drain to El Toro Road.

Drainage Area C-1 is approximately total of 9.2 acres. Approximately 5.5 acres (Area C-1a) is tributary to the proposed commercial site and the remaining 3.7 acres (Area C-1b) existing areas which originally tributary to off-site existing 24" Caltrans culvert.

Drainage Area C-2 is approximately 8.0 acres. Approximately 5.8 acres (Area C-2a) is tributary to the proposed commercial site and the remaining 2.2 acres (Area C-2b) existing areas which originally tributary to off-site existing 24" Caltrans culvert.

Drainage Area D is approximately 25.9 acres and tributary to the areas drain to proposed Nichols Road.

UNIT HYDROGRAPH ANALYSIS

The unit hydrograph analysis was conducted using the CivilDesign Corporation Unit Hydrograph software and the Riverside County Hydrology Manual. In this study analysis, the goal was to estimate the quantity of storm water to be detained onsite to mitigate the increase in storm water peak discharge and volume resulting from this development. The 100-year 1-hour, 3-hour, 6-hour and 24-hour storms hydrographs were computed to evaluate that the project peak runoff discharge originating from the site for ultimate/proposed conditions. And 2-year 24-hour storm for HCOC mitigation.

The ultimate condition-project hydrographs will be used as inflow hydrograph in detention basin routing with restricted outlet structure works.

Summary of Precipitation (Elsinore – Wildomar) – Intensity Pattern per Hydrology Manual (NOAA Atlas 2):

<i>Storm Event</i>	<i>1-hour</i>	<i>3-hour</i>	<i>6-hour</i>	<i>24-hour</i>
2-year	0.6	1.00	1.40	2.50
100-year	1.5 rat	2.50	3.50	6.00
	1.45 hyd			

Summary of Precipitation – Intensity Pattern per Hydrology Manual (NOAA Atlas 14):

<i>Storm Event</i>	<i>1-hour</i>	<i>3-hour</i>	<i>6-hour</i>	<i>24-hour</i>
2-year	0.491	0.882	1.26	2.38
100-year	1.38	2.22	3.12	6.35

NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES: CA

Data description

Data type: Precipitation depth ▾ Units: English ▾ Time series type: Partial duration ▾

Select location

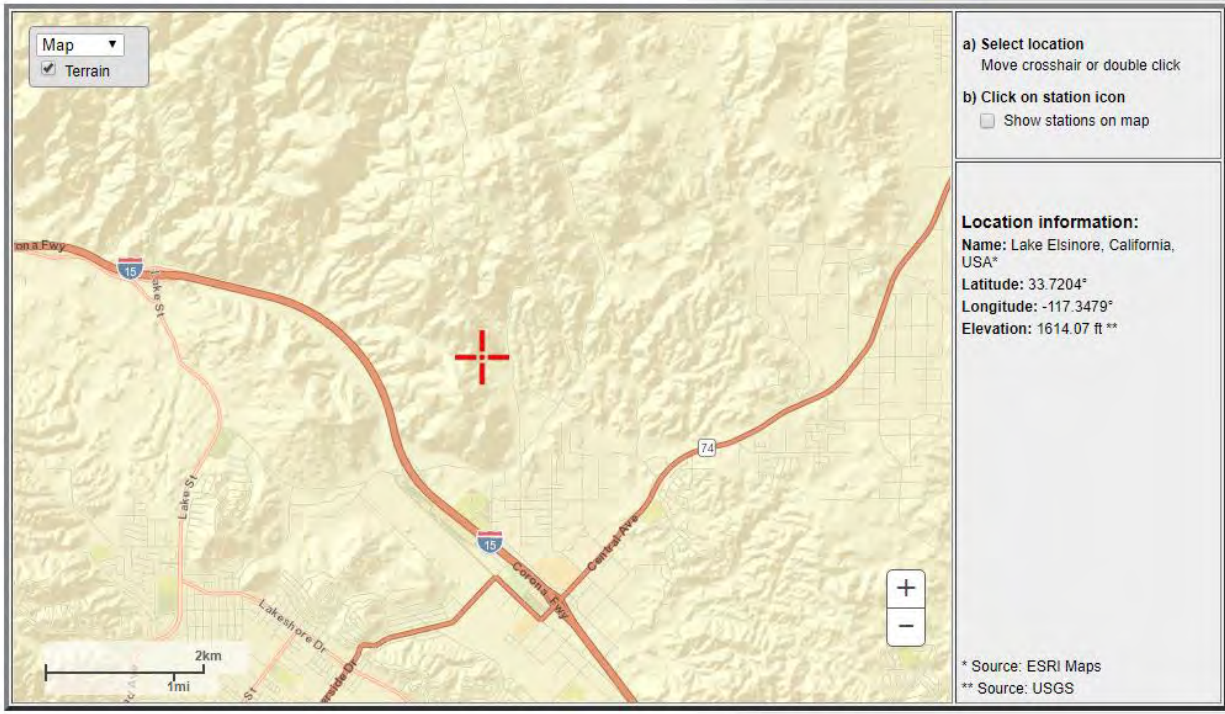
1) Manually:

a) By location (decimal degrees, use "-" for S and W): Latitude: Longitude: Submit

b) By station ([list of CA stations](#)): Select station ▾

c) By address Search

2) Use map (if ESRI interactive map is not loading, try adding the host: <https://js.arcgis.com/> to the firewall, or contact us at hdsc.questions@noaa.gov):



POINT PRECIPITATION FREQUENCY (PF) ESTIMATES

WITH 90% CONFIDENCE INTERVALS AND SUPPLEMENTARY INFORMATION
NOAA Atlas 14, Volume 6, Version 2

PF tabular

PF graphical

Supplementary information

 Print page

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

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.088 (0.074-0.106)	0.120 (0.101-0.145)	0.165 (0.137-0.199)	0.201 (0.167-0.246)	0.253 (0.202-0.320)	0.294 (0.230-0.381)	0.338 (0.257-0.448)	0.383 (0.283-0.524)	0.447 (0.316-0.638)	0.498 (0.340-0.738)
10-min	0.126 (0.106-0.152)	0.173 (0.145-0.208)	0.236 (0.197-0.286)	0.289 (0.239-0.353)	0.363 (0.290-0.459)	0.422 (0.330-0.546)	0.484 (0.368-0.642)	0.549 (0.406-0.751)	0.641 (0.453-0.915)	0.714 (0.487-1.06)
15-min	0.152 (0.128-0.184)	0.209 (0.175-0.252)	0.285 (0.238-0.345)	0.349 (0.289-0.427)	0.439 (0.351-0.556)	0.510 (0.399-0.660)	0.585 (0.445-0.777)	0.664 (0.491-0.908)	0.775 (0.548-1.11)	0.864 (0.589-1.28)
30-min	0.234 (0.196-0.282)	0.321 (0.269-0.388)	0.439 (0.366-0.531)	0.537 (0.444-0.656)	0.675 (0.539-0.854)	0.785 (0.613-1.01)	0.900 (0.685-1.19)	1.02 (0.754-1.40)	1.19 (0.842-1.70)	1.33 (0.906-1.97)
60-min	0.358 (0.300-0.432)	0.491 (0.411-0.593)	0.671 (0.560-0.812)	0.821 (0.679-1.00)	1.03 (0.824-1.31)	1.20 (0.937-1.55)	1.38 (1.05-1.83)	1.56 (1.15-2.13)	1.82 (1.29-2.60)	2.03 (1.38-3.01)
2-hr	0.546 (0.458-0.658)	0.715 (0.598-0.863)	0.945 (0.788-1.14)	1.14 (0.941-1.39)	1.41 (1.13-1.78)	1.63 (1.27-2.10)	1.85 (1.41-2.46)	2.09 (1.55-2.86)	2.43 (1.72-3.47)	2.70 (1.84-4.00)
3-hr	0.682 (0.571-0.822)	0.882 (0.738-1.06)	1.15 (0.962-1.40)	1.38 (1.14-1.69)	1.70 (1.36-2.15)	1.96 (1.53-2.53)	2.22 (1.69-2.95)	2.51 (1.85-3.43)	2.90 (2.05-4.14)	3.22 (2.19-4.77)
6-hr	0.978 (0.819-1.18)	1.26 (1.06-1.52)	1.64 (1.37-1.99)	1.96 (1.62-2.40)	2.41 (1.92-3.05)	2.76 (2.15-3.57)	3.12 (2.38-4.14)	3.50 (2.59-4.79)	4.04 (2.86-5.77)	4.46 (3.04-6.61)
12-hr	1.28 (1.07-1.54)	1.71 (1.43-2.07)	2.28 (1.90-2.76)	2.74 (2.27-3.35)	3.37 (2.69-4.26)	3.85 (3.01-4.98)	4.34 (3.30-5.76)	4.85 (3.58-6.63)	5.54 (3.92-7.91)	6.07 (4.14-8.99)
24-hr	1.68 (1.49-1.94)	2.38 (2.10-2.75)	3.26 (2.87-3.78)	3.97 (3.47-4.64)	4.92 (4.16-5.93)	5.64 (4.67-6.93)	6.35 (5.15-8.00)	7.08 (5.58-9.16)	8.05 (6.10-10.9)	8.80 (6.45-12.3)
2-day	2.01 (1.78-2.32)	2.93 (2.59-3.38)	4.11 (3.62-4.76)	5.06 (4.42-5.91)	6.33 (5.36-7.64)	7.30 (6.05-8.98)	8.27 (6.70-10.4)	9.26 (7.30-12.0)	10.6 (8.02-14.3)	11.6 (8.51-16.2)
3-day	2.17 (1.92-2.51)	3.21 (2.83-3.71)	4.56 (4.01-5.28)	5.65 (4.94-6.60)	7.12 (6.03-8.59)	8.25 (6.84-10.1)	9.39 (7.60-11.8)	10.6 (8.33-13.7)	12.1 (9.20-16.4)	13.4 (9.80-18.6)
4-day	2.34 (2.07-2.70)	3.49 (3.08-4.03)	4.99 (4.39-5.78)	6.21 (5.43-7.25)	7.87 (6.66-9.49)	9.15 (7.59-11.3)	10.5 (8.47-13.2)	11.8 (9.31-15.3)	13.6 (10.3-18.4)	15.1 (11.0-21.0)
7-day	2.66 (2.35-3.07)	3.96 (3.50-4.58)	5.71 (5.03-6.61)	7.16 (6.25-8.36)	9.16 (7.75-11.0)	10.7 (8.91-13.2)	12.4 (10.0-15.6)	14.1 (11.1-18.2)	16.5 (12.5-22.2)	18.4 (13.5-25.6)
10-day	2.82 (2.50-3.26)	4.20 (3.71-4.86)	6.07 (5.35-7.04)	7.64 (6.68-8.93)	9.85 (8.34-11.9)	11.6 (9.63-14.3)	13.5 (10.9-16.9)	15.4 (12.2-19.9)	18.2 (13.8-24.5)	20.4 (14.9-28.4)
20-day	3.37 (2.98-3.89)	5.02 (4.43-5.80)	7.30 (6.43-8.46)	9.26 (8.09-10.8)	12.1 (10.2-14.6)	14.4 (11.9-17.7)	16.8 (13.6-21.2)	19.5 (15.4-25.3)	23.3 (17.7-31.4)	26.5 (19.4-36.9)
30-day	3.98 (3.52-4.59)	5.86 (5.18-6.77)	8.52 (7.50-9.87)	10.8 (9.46-12.6)	14.2 (12.0-17.1)	17.0 (14.1-20.9)	20.0 (16.2-25.2)	23.3 (18.4-30.2)	28.1 (21.3-37.9)	32.1 (23.5-44.7)
45-day	4.69 (4.15-5.42)	6.80 (6.00-7.86)	9.81 (8.64-11.4)	12.5 (10.9-14.6)	16.4 (13.9-19.8)	19.7 (16.3-24.2)	23.3 (18.9-29.3)	27.2 (21.5-35.3)	33.1 (25.1-44.6)	38.1 (27.9-53.0)
60-day	5.44 (4.81-6.27)	7.72 (6.82-8.92)	11.0 (9.71-12.8)	14.0 (12.2-16.3)	18.3 (15.5-22.1)	22.0 (18.3-27.1)	26.1 (21.2-32.9)	30.7 (24.2-39.7)	37.5 (28.4-50.5)	43.3 (31.7-60.3)

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

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

Please refer to NOAA Atlas 14 document for more information.

Place Name

lake elsinore Find

Add the country code for better results. Ex: London, UK

Latitude Longitude

33.705976 -117.351590

Facebook Google+ Twitter

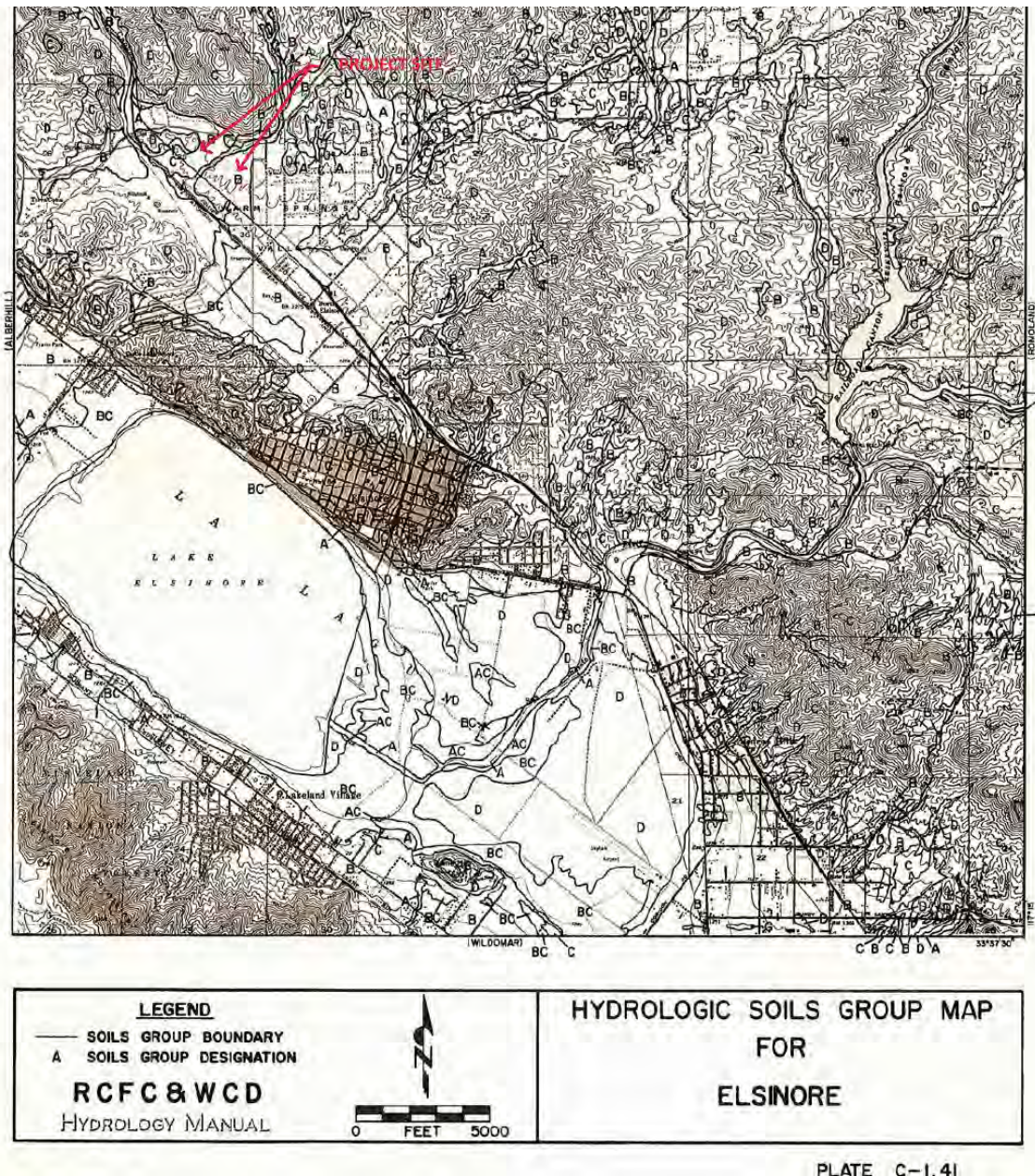


Lat Long	GPS Coordinates	Map Mouse Over Location
(33.705976, -117.351590)	33° 42' 21.5136" N 117° 21' 5.724" W	(33.702531, -117.349488)

Rational Method

The hydrology calculations for determining the on-site and offsite flows have been conducted using the Rational Method as incorporated into the CivilCADD Rational Method Hydrology software. The rational method relates rainfall intensity, the ratio of runoff to rainfall, and the drainage area size to the peak storm runoff and is expressed by the equation: $Q = CIA$. Where Q = runoff (in cubic feet per second), C = runoff coefficient relating the ratio of runoff to rainfall, I = rainfall intensity (in inches per hour), A = drainage area (in acres). The soil type used in the analysis is a combination Type B, C, and D, yielding a relatively high soil runoff potential is Type D.

See below soil map:



Information from TTM 37305 – General Note:

6. PROPOSED ZONING: SPECIFIC PLAN (SP) – NICHOLS SOUTH

7. TOTAL LOTS:

SINGLE FAMILY	LOTS 1–168	22.74 AC
COMMERCIAL	LOT 169	14.43 AC
SEWER LIFT STATION	LOT 170	0.13 AC
PARK SITE	LOT 171	6.49 AC
PUBLIC STREETS (A–J)	10 LOTS	12.28 AC
LETTERED LOTS (SEE TABLE ON SHEET 2)	16 LOTS	16.43 AC

8. RESIDENTIAL LOT SIZE DATA

AVERAGE LOT SIZE = 5,896 SF

MINIMUM LOT SIZE = 4,549 SF

MAXIMUM LOT SIZE = 9,468 SF

9. PROPOSED GROSS DENSITY RESIDENTIAL: 168 DU / 36.20 AC = 4.64 DU/AC

Based upon the above Proposed Development Type we have converted each use to show the impervious percentage using Table D-5.6 per Hydrology Manual (copy below):

“Single Family” → use Land Use “**Residential < ¼ Ac**” with impervious percent = 0.65 (conservative assumption).

“Commercial” → use Land Use “**Commercial**” with impervious percent = 0.9

“Sewer Lift Station” → use Land Use “**Commercial**” with impervious percent = 0.9

“Park Site” → use Land Use “**Natural Cover**”.

“Public Street” → use Land Use “**Commercial**” with impervious percent = 0.9

Proposed impervious cover for Nichols Road Project – Tract 37305 varies per the proposed landuse and per the table below (see below Plate D-5.6 from RCFC&WCD Hydrology Manual).

<u>ACTUAL IMPERVIOUS COVER</u>		
Land Use (1)	Range-Percent	Recommended Value For Average Conditions-Percent(2)
Natural or Agriculture	0 - 10	0
Single Family Residential: (3)		
40,000 S. F. (1 Acre) Lots	10 - 25	20
20,000 S. F. ($\frac{1}{2}$ Acre) Lots	30 - 45	40
7,200 - 10,000 S. F. Lots	45 - 55	50
Multiple Family Residential:		
Condominiums	45 - 70	65
Apartments	65 - 90	80
Mobile Home Park	60 - 85	75
Commercial, Downtown Business or Industrial	80 -100	90
Notes: 1. Land use should be based on ultimate development of the watershed. Long range master plans for the County and incorporated cities should be reviewed to insure reasonable land use assumptions. 2. Recommended values are based on average conditions which may not apply to a particular study area. The percentage impervious may vary greatly even on comparable sized lots due to differences in dwelling size, improvements, etc. Landscape practices should also be considered as it is common in some areas to use ornamental gravels underlain by impervious plastic materials in place of lawns and shrubs. A field investigation of a study area should always be made, and a review of aerial photos, where available may assist in estimating the percentage of impervious cover in developed areas. 3. For typical horse ranch subdivisions increase impervious area 5 percent over the values recommended in the table above.		
RCFC & WCD HYDROLOGY MANUAL		IMPERVIOUS COVER FOR DEVELOPED AREAS

PLATE D-5.6

RUNOFF INDEX NUMBERS OF HYDROLOGIC SOIL-COVER COMPLEXES FOR PERVIOUS AREAS-AMC II					
Cover Type (3)	Quality of Cover (2)	Soil Group			
		A	B	C	D
<u>NATURAL COVERS -</u>					
Barren (Rockland, eroded and graded land)		78	86	91	93
Chaparrel, Broadleaf (Manzonita, ceanothus and scrub oak)	Poor	53	70	80	85
	Fair	40	63	75	81
	Good	31	57	71	78
Chaparrel, Narrowleaf (Chamise and redshank)	Poor	71	82	88	91
	Fair	55	72	81	86
Grass, Annual or Perennial	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Meadows or Cienegas (Areas with seasonally high water table, principal vegetation is sod forming grass)	Poor	63	77	85	88
	Fair	51	70	80	84
	Good	30	58	72	78
Open Brush (Soft wood shrubs - buckwheat, sage, etc.)	Poor	62	76	84	88
	Fair	46	66	77	83
	Good	41	63	75	81
Woodland (Coniferous or broadleaf trees predominate. Canopy density is at least 50 percent)	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	28	55	70	77
Woodland, Grass (Coniferous or broadleaf trees with canopy density from 20 to 50 percent)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
<u>URBAN COVERS -</u>					
Residential or Commercial Landscaping (Lawn, shrubs, etc.)	Good	32	56	69	75
Turf (Irrigated and mowed grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
<u>AGRICULTURAL COVERS -</u>					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92
RCFC & WCD HYDROLOGY MANUAL		RUNOFF INDEX NUMBERS FOR PERVIOUS AREAS			

PLATE E-6.1 (1 of 2)

Figure 2 is the Stovepipe Canyon Creek Existing Condition Hydrograph Areas Map.

See **Attachment A** for Inflow Hydrographs calculations Ultimate Condition Drainage Area to Stovepipe Canyon Creek at 6'x14' Caltrans Culvert.

Figure 3 is the Stovepipe Canyon Creek Proposed Condition Hydrograph Areas Map.

See **Attachment B** for Inflow Hydrographs calculations On-site Proposed Condition Drainage Areas A and B.

Figure 4 is the Onsite Drainage Hydrology for the Proposed Condition.

See **Attachment C** for Inflow Hydrographs calculations On-site Existing Condition (for comparison) Drainage Areas A and B.

Figure 5 is the Offsite Drainage area to new Nichols Road. The calculation is based on the Rational Method peak flow hydrology for 10-year and 100-year 1-hour storm (Attachment E).

Figure 6 is the Onsite Drainage Hydrology for the Proposed Condition. Based on the peak flow inflow hydrograph for 100-year 1-hour storm (Attachment B), the sub-drainage areas are calculated by prorating from Drainage Area peak flow.

The design peak discharge in the various sub-drainage areas considered in this study are listed in the table below:

**Stovepipe Canyon Creek tributary to existing 6'x14' Caltrans Culvert
Summary of Unit Hydrograph Peak Discharge Area A (837.7 Ac):**

Storm Event	Peak Discharge (cfs)			
	1-hour	3-hour	6-hour	24-hour
100-year	1,135	918	843	478

See comparison Stovepipe Creek Hydrographs existing and proposed at the end of this section.

**Summary of Hydrographs, 1-hour, -3hour, -6, hour and -24 hour 100-year storm:
Drainage Area A – existing (40.1 Ac), proposed (40.1 Ac)**

Storm Frequency	Existing Q ₁₀₀ (cfs) [1]	Proposed Q ₁₀₀ (cfs)	Det. Basin Outlet Q ₁₀₀ (cfs) [2]	Different [2] – [1] (cfs)	Different [2] – [1] (%)
100-year 1-hour	94.27	120.95	13.20	-81.07	-86%
100-year 3-hour	67.65	76.06	20.49	-47.16	-70%
100-year 6-hour	62.58	67.99	32.45	-30.13	-48%
100-year 24-hour	29.03	31.62	23.08	-5.95	-20%

For existing hydrographs see Attachment C

For proposed hydrographs see Attachment B

For Detention Basin Routing see Attachment D

Drainage Area B – existing (8.4 Ac), proposed (8.4 Ac)

Storm Frequency	Existing Q ₁₀₀ (cfs) [1]	Proposed Q ₁₀₀ (cfs)	Det. Basin Outlet Q ₁₀₀ (cfs) [2]	Different [2] – [1] (cfs)	Different [2] – [1] (%)
100-year 1-hour	24.57	26.34	9.81	-14.76	-60%
100-year 3-hour	15.27	16.60	12.29	-2.98	-19.5%
100-year 6-hour	13.76	15.46	12.08	-1.68	-12.2%
100-year 24-hour	6.09	6.54	6.35	0.26	4.2%

Drainage Areas C-1 and C-2 to existing 24" Caltrans Culvert

Based on 1.4 cfs/Ac for 10-year storm and 2.26 cfs/Ac for 100-year storm in existing condition:

Area	Acre (Ac)	Peak discharge 10-year storm (cfs)	Peak Discharge 100- year storm (cfs)
C-1	18.6	26.04	42.04
C-2	29.2	40.88	65.99

Drainage Areas C-1 and C-2 to existing 24" Caltrans Culvert

Based on 1.4 cfs/Ac for 10-year storm and 2.26 cfs/Ac for 100-year storm in existing condition:

Based on 1.87 cfs/Ac for 10-year storm and 3.02 cfs/Ac for 100-year storm in proposed condition (commercial):

Area	Acre (Ac)	Peak discharge 10-year storm (cfs)	Total Peak discharge 10-year storm (cfs)	Peak Discharge 100-year storm (cfs)	Total Peak discharge 100-year storm (cfs)
C-1a	5.5 (commercial)	10.85		17.52	
C-1b	3.7 (existing)	5.18	16.03	8.36	25.88
C-2a	5.8 (commercial)	10.85		17.52	
C-2b	2.2 (existing)	3.08	13.93	4.97	22.49

Drainage Area C1 – existing (18.6 Ac), proposed (9.2 Ac)**Drainage Area C2 – existing (29.2 Ac), proposed (8 Ac)**

Area	Existing Q ₁₀ (cfs) [1]	Proposed Q ₁₀ (cfs) [2]	Different [2] – [1] (cfs)	Different [2] – [1] (%)
C-1	26.04	16.03	-10.01	-38%
C-2	40.88	13.93	-26.95	-66%

Summary Hydrology Drainage Area D, Proposed Condition – Rational Method 10-year storm:

Drainage Area	Area in Acre	Q ₁₀ sub-area in cfs	Q ₁₀ confluence in cfs
D-1	4.60	8.49	
D-2	2.10	3.78	12.27
D-3	15.00	25.70	37.97
D-4	4.20	6.73	44.69

Summary Hydrology Drainage Area D, Proposed Condition – Rational Method 100-year storm:

Drainage Area	Area in Acre	Q ₁₀₀ sub-area in cfs	Q ₁₀₀ confluence in cfs
D-1	4.60	13.41	
D-2	2.10	5.98	19.39
D-3	15.00	40.97	60.36
D-4	4.20	10.81	71.17

Comparison Stovepipe Creek Hydrographs existing and proposed conditions, For comparison use 100-year 3-hour storm:

Unit Hydrograph Analysis

Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2008, Version 8.1
Study date 01/15/18 File: nicholsex3100.out

+++++

Riverside County Synthetic Unit Hydrology Method
RCFC & WCD Manual date - April 1978

Program License Serial Number 4029

English (in-lb) Input Units Used
English Rainfall Data (Inches) Input Values Used

English Units used in output format

Nichols Road Project - Tract 37305
Drainage Area Stovepipe Canyon Creek = 837.7 Ac (1.3 sq. mi.)
Ultimate Condition (per County of Riverside General Plan Land Use)
100-year 3-hour storm

Drainage Area = 837.70(Ac.) = 1.309 Sq. Mi.
Duration of storm = 3 Hour(s)

Flood volume = Effective rainfall 1.50(In)
times area 837.7(Ac.)/[(In)/(Ft.)] = 104.6(Ac.Ft)
Total soil loss = 0.71(In)

```

Total soil loss =      49.824(Ac.Ft)
Total rainfall =       2.21(In)
Flood volume =      4555635.0 Cubic Feet
Total soil loss =      2170313.4 Cubic Feet
-----
Peak flow rate of this hydrograph =      918.435(CFS)
-----
+++++
      3 - H O U R      S T O R M
      R u n o f f      H y d r o g r a p h
-----
      Hydrograph in 5 Minute intervals ((CFS))
-----
Time(h+m) Volume Ac.Ft  Q(CFS) 0      250.0      500.0      750.0      1000.0
-----
2+30      38.8660      503.01 |      |      V      Q      |      |      |
2+35      42.8316      575.80 |      |      |      V      |      Q      |      |
2+40      47.4522      670.91 |      |      |      |      V      |      |      Q      |
2+45      52.5412      738.93 |      |      |      |      |      V      |      Q      |
2+50      57.9302      782.47 |      |      |      |      |      |      V      |      Q      |
2+55      64.0637      890.59 |      |      |      |      |      V      |      Q      |
3+ 0      70.3890      918.44 |      |      |      |      |      V      |      Q      |
3+ 5      76.4080      873.95 |      |      |      |      |      |      V      |      Q      |
3+10      81.3299      714.66 |      |      |      |      |      |      Q      |      V      |
3+15      84.9998      532.87 |      |      |      |      |      |      |      Q      |      V      |
3+20      88.0237      439.07 |      |      |      |      |      |      |      |      Q      |      V      |
3+25      90.5546      367.49 |      |      |      |      |      |      |      |      |      Q      |

```

The above 100-year 3-hour storm Runoff Hydrograph for Stovepipe Canyon Creek peak discharge pre-project:

at time (hour + minute) **2+55** (2.917 hour) Volume in Ac.Ft **64.0637** and peak discharge at **890.59** |

at time (hour + minute) **3+ 0** (3.00 hour) Volume in Ac.Ft **70.3890** and peak discharge at **918.44** |

FLOOD HYDROGRAPH ROUTING PROGRAM
 Copyright (c) CIVILCADD/CIVILDESIGN, 1989 - 2005
 Study date: 01/31/18

 Nichols Road Project - Tract 37305
 Drainage Area A = 40.1 Ac
 Tributary to Detention Basin A
 Detention Basin Routing
 100-year 3-hour storm

Program License Serial Number 4029

 ***** HYDROGRAPH INFORMATION *****

 From study/file name: nrareaaprx3100.rte
 *****HYDROGRAPH DATA*****
 Number of intervals = 41
 Time interval = 5.0 (Min.)
 Maximum/Peak flow rate = 76.056 (CFS)
 Total volume = 6.477 (Ac.Ft)
 Status of hydrographs being held in storage
 Stream 1 Stream 2 Stream 3 Stream 4 Stream 5
 Peak (CFS) 0.000 0.000 0.000 0.000 0.000
 Vol (Ac.Ft) 0.000 0.000 0.000 0.000 0.000

+++++

Process from Point/Station 10.000 to Point/Station 11.000
 **** RETARDING BASIN ROUTING ****

Hydrograph Detention Basin Routing

Graph values: 'I'= unit inflow; 'O'=outflow at time shown

Time (Hours)	Inflow (CFS)	Outflow (CFS)	Storage (Ac.Ft)						Depth (Ft.)
				.0	19.0	38.03	57.04	76.06	
2.250	40.45	7.53	2.482	O		I			3.70
2.333	43.76	7.74	2.720	O		I			3.87
2.417	44.19	8.44	2.967	O		I			4.05
2.500	63.34	10.58	3.272	O			I		4.23
2.583	73.33	13.31	3.660	O				I	4.46
2.667	76.06	16.21	4.073	O				I	4.71
2.750	55.40	18.55	4.406	O			I		4.91
2.833	28.35	19.85	4.562	O I					5.01
2.917	19.48	20.49	4.588	O					5.02
3.000	14.30	19.92	4.565	I O					5.01
3.083	6.12	19.21	4.500	I O					4.97
3.167	1.75	18.49	4.398	O					4.91
3.250	0.52	17.67	4.281	O					4.84
3.333	0.17	16.85	4.164	O					4.77

The above 100-year 3-hour storm Runoff Hydrograph for Detention Basin outflow peak discharge post-project:

at time (hour + minute) **2.917** (2.917 hour) Inflow (CFS) **19.48** and peak discharge
 Outflow at **20.49** |

For conservative assumption in the preliminary study (will provide hydrograph confluence in final design):

Proposed Hydrograph for Stovepipe Canyon Creek: Existing hydrograph peak flow at 2+55 (2.917 hour) @ 890.50 cfs + Detention Basin A peak outflow at 2.917 hour @ 20.49 cfs = **(890.50 + 20.49) = 910.99 cfs < 918.44 cfs.....O.K.**

HYDRAULICS

Storm Drain System Calculations

Open Channel, Pipe and Inlet program Flow Master V8i by Bentley Inc., Reference 7 was used to determine the street capacity, ditch capacity and inlet sizing.

Main line system: the following assumptions and criteria were used to design the main line system:

1. $n = 0.013$ for reinforced concrete pipe, $n = 0.014$ for reinforced concrete box, and $n = 0.015$ for concrete V-ditch.
2. The minor losses considered in this study are as follows: friction loss, junction loss, transition loss, and manhole loss. In order to minimize junction structure losses, all junctions are inletting the main line at an angle of approximately 45 degrees.

WSPG hydraulic calculations will be used in the design for the principal off site and onsite storm drains to determine the hydraulic gradient elevation for proposed conduit sizes (in final design).

For proposed Storm Drain Pipe system in this stage, the size will be estimated by using peak discharges for 100-year storm event and using normal depth pipe flow capacity (Manning Formula, software program Flow Master V8i by Bentley Inc., Reference 7).

See below Rating Table for RCP:

Worksheet for Circular Pipe - 18" RCP with slope 1%

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.0100	ft/ft
Normal Depth	1.50	ft
Diameter	1.50	ft
Discharge	10.50	ft³/s

Results

Discharge	10.50	ft³/s
Normal Depth	1.50	ft
Flow Area	1.77	ft²
Wetted Perimeter	4.71	ft
Hydraulic Radius	0.38	ft
Top Width	0.00	ft
Critical Depth	1.25	ft
Percent Full	100.0	%
Critical Slope	0.00977	ft/ft
Velocity	5.94	ft/s
Velocity Head	0.55	ft
Specific Energy	2.05	ft
Froude Number	0.00	
Maximum Discharge	11.30	ft³/s
Discharge Full	10.5038	ft³/s
Slope Full	0.01000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%

GVF Output Data

Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.25	ft
Channel Slope	0.0100	ft/ft
Critical Slope	0.00977	ft/ft

Rating Table for Circular Pipe - 18" to 84" RCP, slope 0.5% to 6%

Project Description

Friction Method Manning Formula
Solve For Full Flow Capacity

Input Data

Roughness Coefficient 0.013
Channel Slope 0.0100 ft/ft
Normal Depth 1.50 ft
Diameter 1.50 ft
Discharge 10.50 ft³/s

Diameter (ft)	Channel Slope (ft/ft)	Normal Depth (ft)	Discharge (ft³/s)	Velocity (ft/s)	Flow Area (ft²)	Wetted Perimeter (ft)	Top Width (ft)
1.50	0.0050	1.50	7.43	4.20	1.77	4.71	0.00
1.50	0.0100	1.50	10.50	5.94	1.77	4.71	0.00
1.50	0.0150	1.50	12.86	7.28	1.77	4.71	0.00
1.50	0.0200	1.50	14.85	8.41	1.77	4.71	0.00
1.50	0.0250	1.50	16.61	9.40	1.77	4.71	0.00
1.50	0.0300	1.50	18.19	10.30	1.77	4.71	0.00
1.50	0.0350	1.50	19.65	11.12	1.77	4.71	0.00
1.50	0.0400	1.50	21.01	11.89	1.77	4.71	0.00
1.50	0.0450	1.50	22.28	12.61	1.77	4.71	0.00
1.50	0.0500	1.50	23.49	13.29	1.77	4.71	0.00
1.50	0.0550	1.50	24.63	13.94	1.77	4.71	0.00
1.50	0.0600	1.50	25.73	14.56	1.77	4.71	0.00
2.00	0.0050	2.00	16.00	5.09	3.14	6.28	0.00
2.00	0.0100	2.00	22.62	7.20	3.14	6.28	0.00
2.00	0.0150	2.00	27.71	8.82	3.14	6.28	0.00
2.00	0.0200	2.00	31.99	10.18	3.14	6.28	0.00
2.00	0.0250	2.00	35.77	11.39	3.14	6.28	0.00
2.00	0.0300	2.00	39.18	12.47	3.14	6.28	0.00
2.00	0.0350	2.00	42.32	13.47	3.14	6.28	0.00
2.00	0.0400	2.00	45.24	14.40	3.14	6.28	0.00
2.00	0.0450	2.00	47.99	15.27	3.14	6.28	0.00
2.00	0.0500	2.00	50.58	16.10	3.14	6.28	0.00
2.00	0.0550	2.00	53.05	16.89	3.14	6.28	0.00
2.00	0.0600	2.00	55.41	17.64	3.14	6.28	0.00
2.50	0.0050	2.50	29.00	5.91	4.91	7.85	0.00
2.50	0.0100	2.50	41.01	8.36	4.91	7.85	0.00
2.50	0.0150	2.50	50.23	10.23	4.91	7.85	0.00
2.50	0.0200	2.50	58.00	11.82	4.91	7.85	0.00
2.50	0.0250	2.50	64.85	13.21	4.91	7.85	0.00
2.50	0.0300	2.50	71.04	14.47	4.91	7.85	0.00
2.50	0.0350	2.50	76.73	15.63	4.91	7.85	0.00
2.50	0.0400	2.50	82.03	16.71	4.91	7.85	0.00
2.50	0.0450	2.50	87.01	17.72	4.91	7.85	0.00
2.50	0.0500	2.50	91.71	18.68	4.91	7.85	0.00

2.50	0.0550	2.50	96.19	19.60	4.91	7.85	0.00
2.50	0.0600	2.50	100.47	20.47	4.91	7.85	0.00
3.00	0.0050	3.00	47.16	6.67	7.07	9.42	0.00
3.00	0.0100	3.00	66.69	9.44	7.07	9.42	0.00
3.00	0.0150	3.00	81.68	11.56	7.07	9.42	0.00
3.00	0.0200	3.00	94.32	13.34	7.07	9.42	0.00
3.00	0.0250	3.00	105.45	14.92	7.07	9.42	0.00
3.00	0.0300	3.00	115.52	16.34	7.07	9.42	0.00
3.00	0.0350	3.00	124.77	17.65	7.07	9.42	0.00
3.00	0.0400	3.00	133.39	18.87	7.07	9.42	0.00
3.00	0.0450	3.00	141.48	20.02	7.07	9.42	0.00
3.00	0.0500	3.00	149.13	21.10	7.07	9.42	0.00
3.00	0.0550	3.00	156.41	22.13	7.07	9.42	0.00
3.00	0.0600	3.00	163.37	23.11	7.07	9.42	0.00
3.50	0.0050	3.50	71.14	7.39	9.62	11.00	0.00
3.50	0.0100	3.50	100.60	10.46	9.62	11.00	0.00
3.50	0.0150	3.50	123.21	12.81	9.62	11.00	0.00
3.50	0.0200	3.50	142.28	14.79	9.62	11.00	0.00
3.50	0.0250	3.50	159.07	16.53	9.62	11.00	0.00
3.50	0.0300	3.50	174.25	18.11	9.62	11.00	0.00
3.50	0.0350	3.50	188.21	19.56	9.62	11.00	0.00
3.50	0.0400	3.50	201.21	20.91	9.62	11.00	0.00
3.50	0.0450	3.50	213.41	22.18	9.62	11.00	0.00
3.50	0.0500	3.50	224.96	23.38	9.62	11.00	0.00
3.50	0.0550	3.50	235.94	24.52	9.62	11.00	0.00
3.50	0.0600	3.50	246.43	25.61	9.62	11.00	0.00
4.00	0.0050	4.00	101.57	8.08	12.57	12.57	0.00
4.00	0.0100	4.00	143.64	11.43	12.57	12.57	0.00
4.00	0.0150	4.00	175.92	14.00	12.57	12.57	0.00
4.00	0.0200	4.00	203.13	16.16	12.57	12.57	0.00
4.00	0.0250	4.00	227.11	18.07	12.57	12.57	0.00
4.00	0.0300	4.00	248.78	19.80	12.57	12.57	0.00
4.00	0.0350	4.00	268.72	21.38	12.57	12.57	0.00
4.00	0.0400	4.00	287.27	22.86	12.57	12.57	0.00
4.00	0.0450	4.00	304.70	24.25	12.57	12.57	0.00
4.00	0.0500	4.00	321.18	25.56	12.57	12.57	0.00
4.00	0.0550	4.00	336.85	26.81	12.57	12.57	0.00
4.00	0.0600	4.00	351.83	28.00	12.57	12.57	0.00
4.50	0.0050	4.50	139.04	8.74	15.90	14.14	0.00
4.50	0.0100	4.50	196.64	12.36	15.90	14.14	0.00
4.50	0.0150	4.50	240.83	15.14	15.90	14.14	0.00
4.50	0.0200	4.50	278.09	17.49	15.90	14.14	0.00
4.50	0.0250	4.50	310.91	19.55	15.90	14.14	0.00
4.50	0.0300	4.50	340.59	21.41	15.90	14.14	0.00
4.50	0.0350	4.50	367.88	23.13	15.90	14.14	0.00
4.50	0.0400	4.50	393.28	24.73	15.90	14.14	0.00
4.50	0.0450	4.50	417.13	26.23	15.90	14.14	0.00
4.50	0.0500	4.50	439.70	27.65	15.90	14.14	0.00
4.50	0.0550	4.50	461.16	29.00	15.90	14.14	0.00
4.50	0.0600	4.50	481.66	30.29	15.90	14.14	0.00
5.00	0.0050	5.00	184.15	9.38	19.63	15.71	0.00
5.00	0.0100	5.00	260.43	13.26	19.63	15.71	0.00
5.00	0.0150	5.00	318.96	16.24	19.63	15.71	0.00

5.00	0.0200	5.00	368.30	18.76	19.63	15.71	0.00
5.00	0.0250	5.00	411.77	20.97	19.63	15.71	0.00
5.00	0.0300	5.00	451.08	22.97	19.63	15.71	0.00
5.00	0.0350	5.00	487.22	24.81	19.63	15.71	0.00
5.00	0.0400	5.00	520.86	26.53	19.63	15.71	0.00
5.00	0.0450	5.00	552.45	28.14	19.63	15.71	0.00
5.00	0.0500	5.00	582.34	29.66	19.63	15.71	0.00
5.00	0.0550	5.00	610.76	31.11	19.63	15.71	0.00
5.00	0.0600	5.00	637.92	32.49	19.63	15.71	0.00
5.50	0.0050	5.50	237.44	9.99	23.76	17.28	0.00
5.50	0.0100	5.50	335.79	14.13	23.76	17.28	0.00
5.50	0.0150	5.50	411.26	17.31	23.76	17.28	0.00
5.50	0.0200	5.50	474.88	19.99	23.76	17.28	0.00
5.50	0.0250	5.50	530.93	22.35	23.76	17.28	0.00
5.50	0.0300	5.50	581.61	24.48	23.76	17.28	0.00
5.50	0.0350	5.50	628.21	26.44	23.76	17.28	0.00
5.50	0.0400	5.50	671.58	28.27	23.76	17.28	0.00
5.50	0.0450	5.50	712.32	29.98	23.76	17.28	0.00
5.50	0.0500	5.50	750.85	31.60	23.76	17.28	0.00
5.50	0.0550	5.50	787.50	33.15	23.76	17.28	0.00
5.50	0.0600	5.50	822.52	34.62	23.76	17.28	0.00
6.00	0.0050	6.00	299.45	10.59	28.27	18.85	0.00
6.00	0.0100	6.00	423.49	14.98	28.27	18.85	0.00
6.00	0.0150	6.00	518.66	18.34	28.27	18.85	0.00
6.00	0.0200	6.00	598.90	21.18	28.27	18.85	0.00
6.00	0.0250	6.00	669.59	23.68	28.27	18.85	0.00
6.00	0.0300	6.00	733.50	25.94	28.27	18.85	0.00
6.00	0.0350	6.00	792.27	28.02	28.27	18.85	0.00
6.00	0.0400	6.00	846.97	29.96	28.27	18.85	0.00
6.00	0.0450	6.00	898.35	31.77	28.27	18.85	0.00
6.00	0.0500	6.00	946.94	33.49	28.27	18.85	0.00
6.00	0.0550	6.00	993.16	35.13	28.27	18.85	0.00
6.00	0.0600	6.00	1037.32	36.69	28.27	18.85	0.00
6.50	0.0050	6.50	370.70	11.17	33.18	20.42	0.00
6.50	0.0100	6.50	524.25	15.80	33.18	20.42	0.00
6.50	0.0150	6.50	642.07	19.35	33.18	20.42	0.00
6.50	0.0200	6.50	741.40	22.34	33.18	20.42	0.00
6.50	0.0250	6.50	828.91	24.98	33.18	20.42	0.00
6.50	0.0300	6.50	908.03	27.36	33.18	20.42	0.00
6.50	0.0350	6.50	980.78	29.56	33.18	20.42	0.00
6.50	0.0400	6.50	1048.50	31.60	33.18	20.42	0.00
6.50	0.0450	6.50	1112.10	33.51	33.18	20.42	0.00
6.50	0.0500	6.50	1172.26	35.33	33.18	20.42	0.00
6.50	0.0550	6.50	1229.47	37.05	33.18	20.42	0.00
6.50	0.0600	6.50	1284.14	38.70	33.18	20.42	0.00
7.00	0.0050	7.00	451.70	11.74	38.48	21.99	0.00
7.00	0.0100	7.00	638.80	16.60	38.48	21.99	0.00
7.00	0.0150	7.00	782.36	20.33	38.48	21.99	0.00
7.00	0.0200	7.00	903.40	23.47	38.48	21.99	0.00
7.00	0.0250	7.00	1010.03	26.25	38.48	21.99	0.00
7.00	0.0300	7.00	1106.43	28.75	38.48	21.99	0.00
7.00	0.0350	7.00	1195.08	31.05	38.48	21.99	0.00
7.00	0.0400	7.00	1277.59	33.20	38.48	21.99	0.00

7.00	0.0450	7.00	1355.09	35.21	38.48	21.99	0.00
7.00	0.0500	7.00	1428.39	37.12	38.48	21.99	0.00
7.00	0.0550	7.00	1498.11	38.93	38.48	21.99	0.00
7.00	0.0600	7.00	1564.73	40.66	38.48	21.99	0.00

The on-site drainage hydrology for the proposed condition is based on the peak flow inflow hydrograph for 100-year 1-hour storm (Attachment B), the sub-drainage areas are calculated by prorating from the Drainage Area peak flow.

On-site Drainage Areas A and C

ONSITE HYDROLOGY					
Nichols Road - Tract 37305					
AREA	ACRE (Ac)	Q100 = cfs/Ac *)	Q100 (cfs)	Main Line Q100 (cfs)	Main Line Pipe Size (slope 1%)
A-1	2.85	3.02	8.61		
A-2	1.87	3.02	5.65	14.25	24"
A-3	5.19	3.02	15.67	29.93	30"
A-4	0.89	3.02	2.69	32.62	30"
A-5	0.69	3.02	2.08		
A-6	2.86	3.02	8.64	10.72	24"
A-7	2.81	3.02	8.49	19.21	24"
A-8	1.43	3.02	4.32	23.53	30"
A-9	1.55	3.02	4.68	28.21	30"
A-10	2.02	3.02	6.10	34.31	30"
A-11	2.05	3.02	6.19	40.50	36"
A-12	1.34	3.02	4.05	44.55	36"
A-13	1.47	3.02	4.44	48.98	36"
C-1a	5.5	3.02	16.61	**))	Ex. 24" Caltrans
C-2a	5.8	3.02	17.52	**))	Ex. 24" Caltrans
A-14	12.77	3.02	38.57	38.57	36"
*) Based on Area A (40.1 Ac) Hydrograph peak 100-year 1-hour = 120.95 cfs ==> 3.02 cfs/Ac					
**) Low flow from Areas C-1a and C-2a drain into Sand Filter Basin A					

Similar approach was used to determine on-site peak discharges for other Drainage Area (Area B).

See Figure 6 for results.

HYDROMODIFICATION - (HCOC)

The proposed project Water Quality/Detention Basins are capable of all of the following:

1. Releasing the post-development hydrograph for 2-year, 24-hour at flow rates no greater than 110% of pre-development 2-year flow, 24-hour peak flow rates.
2. By-passing the 100-year storm event without damage to the BMP.
3. Control outlet velocities such that downstream erosion potential is minimized and outlet flows are released in a safe manner.

Detention Basin Routing Calculations

The Detention Basin Routing Calculations were conducted using the CivilCADD/Design software and the Riverside County Hydrology Manual. In this analysis, the goal was to estimate the quantity of storm water to be detained onsite to mitigate the increase in storm water peak discharge and volume resulting from this development for the 100-year 1-hour, 3-hour, 6-hour, 24-hour storms and 2-year 24-hour for HCOC mitigation.

HCOC criteria is **considered mitigated** by mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

Based on the information provided above, **this project meets the requirements of Condition C** and will not create a hydrologic condition of concern in the proximate or downstream receiving waters.

Project development and other improvements include local storm drain systems which convey developed flows and street areas runoff to proposed Enhanced Sand Filter Basins and Enhanced Extended Detention Basins. For Hydromodification, the proposed Detention Basins include sufficient volume above the proposed water quality volume that will satisfy the requirement of post-development peak discharge, volume and time of concentration for the 2-year 24-hour storm that DOES NOT exceed the pre-development peak runoff by more than 10 percent.

Detention Basin Routing Calculations

The Detention Basin Routing Calculations were conducted using the CivilCADD/Design software and the Riverside County Hydrology Manual. In this analysis, the goal was to estimate the quantity of storm water to be detained onsite to mitigate the increase in storm water peak discharge and volume resulting from this development for 100-year 24-hour storms by proposing two (2) Detention Basins A and B.

The results of these calculations are displayed in the table below and show no increase over 10% in discharge due to development:

Summary of Hydrographs, 24-hour 2-year storm:

Drainage Area A – existing (51.4 Ac), proposed (51.4 Ac)

Storm Frequency	Existing Q_2 (cfs) [1]	Proposed Q_2 (cfs)	Det. Basin Outlet Q_2 (cfs) [2]	Different [2] – [1] (cfs)	Different [2] – [1] (%)
2-year 24-hour	9.37	13.12	6.75	-2.62	-28%

Drainage Area B – existing (8.4 Ac), proposed (8.4 Ac)

Storm Frequency	Existing Q_2 (cfs) [1]	Proposed Q_2 (cfs)	Det. Basin Outlet Q_2 (cfs) [2]	Different [2] – [1] (cfs)	Different [2] – [1] (%)
2-year 24-hour	1.52	1.97	0.95	-0.57	-37.5%

CONCLUSIONS

The proposed TTM 37305 project grading areas and proposed drainage systems are in conformance with General Plan, and proposed Land Use. The proposed grading and the proposed storm drain system will connect to existing facilities where it is reasonably feasible, and/or outlet to existing drainage facilities. Potential project impacts related to drainage runoff and water quality will be mitigated according to County/City requirements.

The development of Tract 37305 will provide for grading for the proposed 168 single family lots, a Commercial Site, a park site, open space areas and the construction of a storm drain system that will:

- Safely intercept offsite flows and convey through the site without co-mingling these flows with untreated onsite developed flows.
- Generally maintain the drainage patterns and discharge locations.
- In complying with Santa Ana Region NPDES-MS4 Permit requirements, safely intercept Design Capture Volume and convey onsite developed storm flows to onsite Water Quality Treatment Control Basins.
- Provide emergency by-pass for 100-year storm event without damage the BMPs.
- Control outlet velocities such that downstream erosion potential is minimized and outlet flows are released in a safe manner.

Per the current MS4 Permit:

HCOG criteria is **considered mitigated** by mimicking the pre-development hydrograph with the post-development hydrograph, for a 2-year return frequency storm. Generally, the hydrologic conditions of concern are not significant, if the post-development hydrograph is no more than 10% greater than pre-development hydrograph. In cases where excess volume cannot be infiltrated or captured and reused, discharge from the site must be limited to a flow rate no greater than 110% of the pre-development 2-year peak flow.

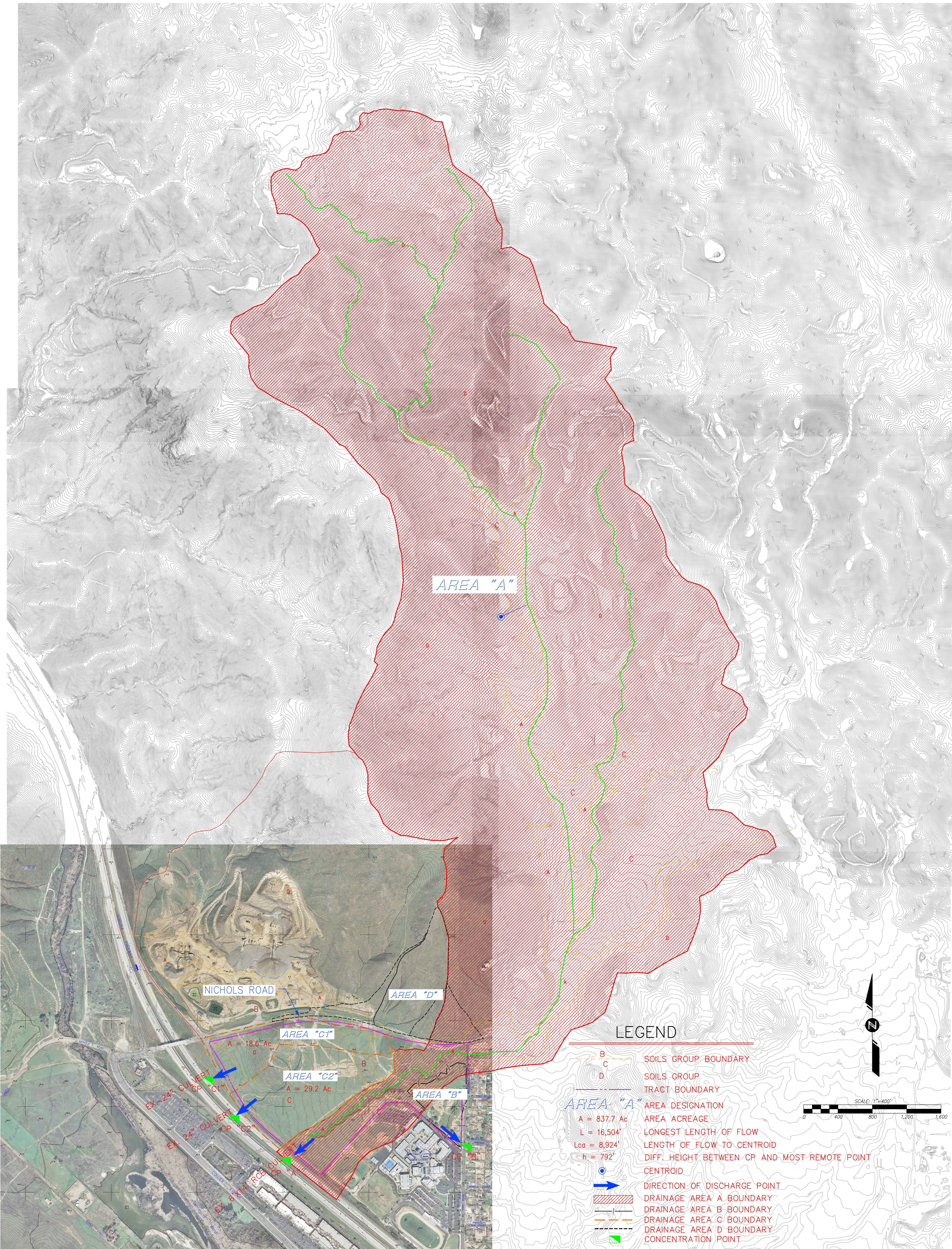
Based on the information provided within this Drainage Report, **this project meets the requirements of HCOG Condition C** and will not create a hydrologic condition of concern in the proximate or downstream receiving waters.

The proposed backbone storm drain systems are designed for the ultimate / proposed condition to convey the 100-year storm event. All necessary drainage easements will be provided as required. A final report will be prepared to accurately document the sizing of proposed channels, detention basins, catch basins, and will include storm drain water surface profile calculations to make sure that the system is capable of conveying the 100-year storm event. The storm drain system design will include water quality BMPs, the various water quality BMPs will provide mitigation as currently proposed and as processed through the City's review and approval process. Potential project impacts related to drainage runoff and water quality will be mitigated in accordance with the City of Lake Elsinore's and Riverside County's MS4 Permit requirements.

REFERENCES

1. County of Riverside Hydrology Manual, 1978, as incorporated in the CivilDesign Rational Method Hydrology Software.
2. CivilCADD/Design Engineering Software, version 7.1.
3. Aerial Topography by Inland Aerial Surveys, Inc.
4. County of Riverside Topographic Maps
5. Nichols Road Project – Tract 37305 Tentative Tract Map
6. WSPG, Los Angeles County Public Works Water Surface Profile software - Storm Drain Analysis Plus by CivilSoft.
7. Hydraulic Calculations software by Bentley, Inc., Flow Master V8i
8. Tract 37305

FIGURE 2
Stovepipe Creek Hydrograph Area Map – Existing Conditions



Stovepipe Canyon Creek tributary to existing 6"x14" Caltrans Culvert
Summary of Unit Hydrograph Peak Discharge Area A (837.7 Ac):

Storm Event	Peak Discharge (cfs)		
	1-hour	3-hour	24-hour
100-year	1,135	918	843

Drainage Areas C-1 and C-2 to existing 24" Caltrans Culvert
Based on 1.4 cfs/Ac for 10-year storm and 2.26 cfs/Ac for 100-year storm in existing condition:

Area	Acre (Ac)	Peak discharge 10-year storm (cfs)	Peak Discharge 100-year storm (cfs)
C-1	18.6	26.04	42.04
C-2	29.2	40.88	65.99

Drainage Area B - existing (8.4 Ac).
Storm Frequency

	Existing Q ₁₀₀ (cfs)
100-year 1-hour	24.57
100-year 3-hour	15.27
100-year 6-hour	13.76
100-year 24-hour	6.09

See Figure 6 for On-site Hydrology Map
Summary Hydrology Drainage Area D, Proposed Condition - Rational Method 100-year storm:

Drainage Area	Area in Acres	Q ₁₀₀ sub-area in cfs	Q ₁₀₀ confluence in cfs
D-1	4.60	13.41	
D-2	2.10	5.96	19.39
D-3	15.00	40.97	60.38
D-4	4.20	10.81	71.17

See Figure 5 for Hydrology Map Area D

NICHOLS ROAD PROJECT

HYDROGRAPH AREAS MAP

EXISTING CONDITION

FIGURE 2