Appendix 4.7

Hydrology and Water Quality

PRELIMINARY DRAINAGE REPORT

The Homestead
Northwest and Southwest corners of Archibald Ave. and Limonite Ave.
Eastvale, California

June 2019

PREPARED FOR:

The Homestead, LLC
280 Newport Center Drive, Suite 240
Newport Beach, CA 92660

PREPARED BY:

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765 The City Drive, Suite 200
Orange, CA 92868

PRELIMINARY DRAINAGE REPORT

FOR

THE HOMESTEAD

EASTVALE, CALIFORNIA

June 2019

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Project Description and Report Purpose

The proposed project is located on an approximately 56-acre site located on the northwest and southwest corners of Archibald Avenue and Limonite Avenue in the City of Eastvale, Riverside County, California. For reference, see ***Exhibit 1**, Location Map*.

The proposed project consists of an industrial development with a Limonite Avenue road extension running thru the middle of the site. The proposed development will include the construction of seven industrial buildings of varying sizes consisting of approximately 1,981,000 square feet. Improvements within the site will provide parking facilities, driveway entrances connecting to existing roads, site utilities, bio filtration units, storm drain system and underground detention.

There is an existing 54 in. storm drain pipe (Lateral F-3) that is part of Riverside County's Master Drainage Plan (MDP) that stubs into the site at the southwest corner and runs southwest, ultimately discharging into Cucamonga Creek. As part of the Limonite Avenue roadway extension project, this storm drain will be extended easterly within the new road right-of-way. Storm water from the developed site and new road would be discharged to this existing 54 in. storm drain pipe.

The existing 54-in storm drain was designed to accept 93 cfs in the 100-yr storm from the project site. To accommodate developed peak flows that exceed the storm drain design flow, the Project storm water management system incorporates on-site detention basins. These detention basins have been designed to attenuate the 100-year storm event peak flow difference between the developed flow from the project and allowable flow in the pipe.

The purpose of this report is to provide information about the design of the Storm Water Management System (SWMS) for the proposed project. This investigation was conducted to evaluate the hydrologic and hydraulic conditions of the project described above. The purpose is also to determine the impact that the proposed development has on the local drainage system and to confirm that the post development 100-yr peak flows will not increase beyond the level the existing 54" storm drain was designed for.

Calculation Methodology

The design criteria for the hydrologic and hydraulic calculations for this project have been conducted per requirements as outlined in the Riverside County Hydrology Manual, April 1978 (Hydrology Manual). See ***Appendix A**, Hydrologic / Hydraulic Reference Material*.

Runoff calculations were performed using the rational method computer program developed by Advanced Engineering Software (AES). This method calculates time of concentration and runoff rates using criteria as specified in the Hydrology Manual. Intensity values were obtained from National Oceanic and Atmospheric Administration (NOAA) Atlas 14. Loss rates were calculated using soil data obtained from the Natural Resources Conservation Service (NRCS) Web Soil Survey for Riverside County, California, Santa Ana River Area. Existing elevation data for travel flow paths were obtained from an ALTA/ACSM land title survey completed for the project site March 7, 2019. Results from these calculations are included with this report as ***Appendix B**, Rational Method Calculation Results*.

Hydrograph calculations were performed using a computer program developed by Advanced Engineering Software (AES). This method calculates a unit hydrograph using lag time, maximum watershed loss rates, low loss fraction, and an S-graph as specified in the Hydrology Manual. Lag was calculated using the time of concentration calculated from the rational method analysis. The maximum watershed loss rate was obtained directly from the rational method analysis. The low loss fraction was calculated using soil data obtained from the NRCS Web Soil Survey for Riverside County, California, Santa Ana River Area. The Valley: Developed S-graph was used to develop the unit hydrograph. Results from these calculations are included with this report as ***Appendix C****, Hydrograph Calculation Results*.

The computer program Pond Pack was used to design and model the proposed detention basin and outlet structure for this project. Pond Pack routes a hydrograph through a detention basin according to the requirements specified in the Hydrology Manual. The unit hydrograph was input directly along with proposed stage-storage-discharge information. See **Appendix D**, *Detention Basin Calculation Results*.

Description of Site

Our site is located in the Federal Emergency Management Administration (FEMA), Flood Insurance Rate Map (FIRM) panel number 06065C0677G. The flood map for this area has a status of "Not Printed" for the panel where the project site is located. The "FIRMette" shows it as an "Area of Minimal Flood Hazard". Per conversations with Federal Emergency Management Administration (FEMA) Flood Insurance Rate Map (FIRM) technicians and considering adjacent panel 06065C0679G, it has been determined that the project site is located within Zone X Flood Zone Designation. Zone X is defined by FEMA as the area determined to be outside the 500-year flood and protected by levee from 100-year flood. No portion of the site is within the special flood hazard area inundated by the 100-year flood.

For an exhibit of the adjacent FIRM Panel 06065C0679G see ***Exhibit 2,*** *FEMA Flood Insurance Rate Maps.*

Pre-development Condition

The existing site is divided into two sub-basins. The majority of the pre-development runoff sheet-flows to the southwest corner of the property where there is an existing shallow pond. The pond discharges via spillway where it is then picked up by an existing CMP riser to a 24 inch lateral (F3-2). The lateral connects to the existing 54-inch storm line (F3) ultimately, discharging in to Cucamonga Creek channel. Approximately 2 acres sheet-flows to Archibald and surface drains south to a City catch basin on Schleisman Road.

For an exhibit of the existing conditions drainage, see ***Exhibit 3****, Pre-Development Drainage Condition*.

Post-Development Condition

The existing storm sewer system at the connection point for the project was designed and constructed for a 100-yr peak site discharge of 93 cfs. However, a higher peak un-detained flow of 167 cfs has been estimated. Detention basins will be implemented into the site design in order to maintain the peak discharge of 93 cfs

167 cfs has been estimated. Detention basins will be implemented into the site design in order to maintain the peak discharge of 93 cfs

The proposed conditions drainage area is comprised of six (6) sub-areas. Each sub-area has multiple corresponding biofiltration systems that it drains to. The biofiltration systems are connected to an underground storm sewer system and the flow is conveyed to one of three underground detention systems. The site detention basins have been designed to have a combined maximum outflow, including street flow, of 93 cfs discharging into Lateral F3, which is being extended in Limonite Rd.

For an exhibit of the post-development drainage condition, see ***Exhibit 4***, *Post-Development Drainage Condition*. ***Table 1*** contains a summary of the post-development condition runoff.

Table 1 - Post-Development Condition Runoff Summary

Location	Storm Frequency/Duration (cfs)	
	100-year 24-hour	
	In-Flow	Out-Flow
Detention Basin A	38.22 cfs	19 cfs
Detention Basin B	79.86 cfs	38 cfs
Detention Basin C	26.02 cfs	13 cfs
Total Onsite	**144 cfs**	**70**
Limonite Ave (un-detained)	22.61 cfs	23 cfs
Total Offsite	**23 cfs**	**23 cfs**
TOTAL PROJECT	**167 cfs**	**93 cfs**

Detention Basins

Three on-site below-ground detention basin are located through-out the site. See proposed hydrology map. The detention basin outflow will be controlled by an orifice to restrict the flow entering the storm drain running in Limonite Avenue.

Table 2 - Detention Basin Calculation Summary

Detention Basin	Pipe Diameter	Volume	Pipe Length
	(inches)	(CF)	(feet)
Detention Basin A	72	18,458	660
Detention Basin B	72	36,185	1,280
Detention Basin C	72	11,122	400

Results Summary and Discussion

The proposed site will have an underground storm sewer system that will collect stormwater runoff via strategically dispersed biofiltration systems and will covey the runoff to three underground detention systems. The detention basins has been designed to mitigate the impacts of peak runoff, which is higher than the County's design hydrology for its downstream system. More specifically, the detention basin shall be able to receive a combined inflow discharge exceeding 144 cfs, while still maintaining a maximum 100-yr outflow discharge of 70 cfs, which is the County storm sewer design peak discharge minus the proposed 23 cfs street flow. See ***Table 3***, *Allowable- vs. Post-Development Condition Runoff Summary (Undetained), and* ***Table 4***, *Allowable- vs. Post-Development Condition Runoff Summary (Detained).*

Table 3 - Allowable- vs. Post-Development Condition Runoff Summary (Undetained)

Condition	Storm Frequency/Duration (cfs)
	100-year 24-hour
Allowable Discharge	93
Post-Development (undetained)	167
Difference:	**74**

Table 4 - Allowable- vs. Post-Development Condition Runoff Summary (Detained)

Condition	Storm Frequency/Duration (cfs)
	100-year 24-hour
Allowable Discharge	93
Post-Development (detained)	93
Difference:	**0.00**

REFERENCES

1) Riverside County Hydrology Manual, April 1978.

2) Riverside Hydrology Manual Addendum for Arid Regions, April 2010.

3) National Oceanic and Atmospheric Administration Atlas 14, volume 6, version 2, 2015.

EXHIBITS

Exhibit 1: Location Map

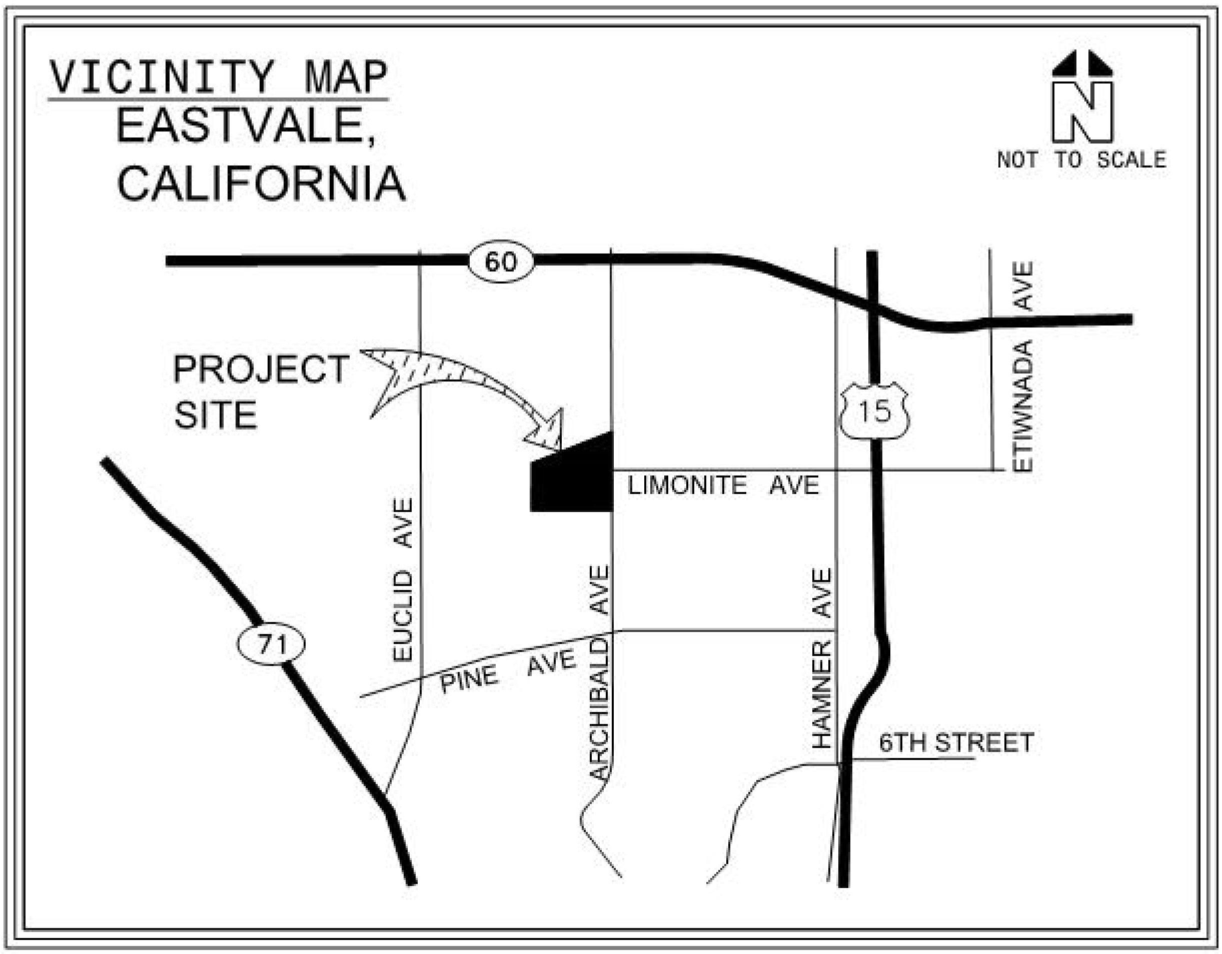


Exhibit 2: Federal Emergency Management Agency Flood Insurance Rate Maps (FEMA FIRM)

Attached in the following order:

- Panel 06065C0679G (South of Site)
- Panel 06065C0681G (East of Site)

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, 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 derived from U.S. Geological Survey Digital Orthophoto Quadrangles produced at a scale of 1:12,000 from photography dated 1994 or later.

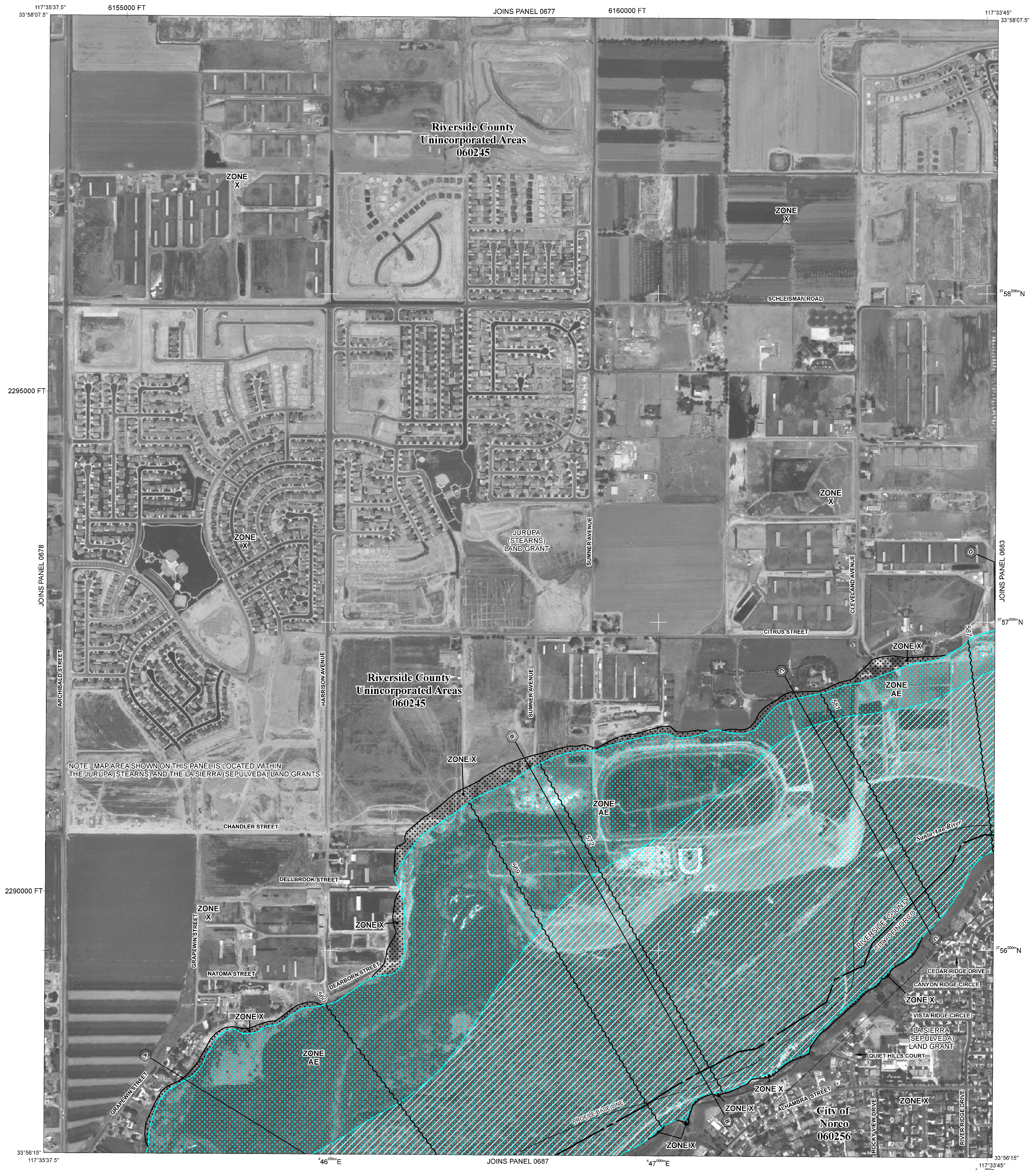
This map may reflect more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As 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 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 1-800-358-9616 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://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.



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 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 by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

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

OTHER FLOOD AREAS

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

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

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

1% annual chance floodplain boundary

0.2% annual chance floodplain boundary

Floodway boundary

Zone D boundary

CBRS and OPA boundary

Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

~~ 513 ~~~	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988

A —— A	Cross section line
23 - - - - 23	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
$^{24}76^{000m}$N	1000-meter Universal Transverse Mercator grid values, zone 11N
600000 FT	5000-foot grid ticks: California State Plane coordinate system, zone VI (FIPSZONE 0406), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
● M1.5	River Mile

MAP REPOSITORY
Refer to listing of Map Repositories on Map Index

EFFECTIVE DATE OF COUNTYWIDE
FLOOD INSURANCE RATE MAP
August 28, 2008

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

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

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

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0679G

FIRM
FLOOD INSURANCE RATE MAP

RIVERSIDE COUNTY, CALIFORNIA
AND INCORPORATED AREAS

PANEL 679 OF 3805
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORCO, CITY OF	060256	0679	G
RIVERSIDE COUNTY	060245	0679	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
06065C0679G

EFFECTIVE DATE
AUGUST 28, 2008

Federal Emergency Management Agency

National Flood Hazard Layer FIRMette

FEMA

33°58'35.57"N

117°36'7.73"W

117°35'30.27"W

33°58'5.73"N

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

1:6,000

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	B 20.2 17.5	Cross Sections with 1% Annual Chance Water Surface Elevation
	8	Coastal Transect
	513	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

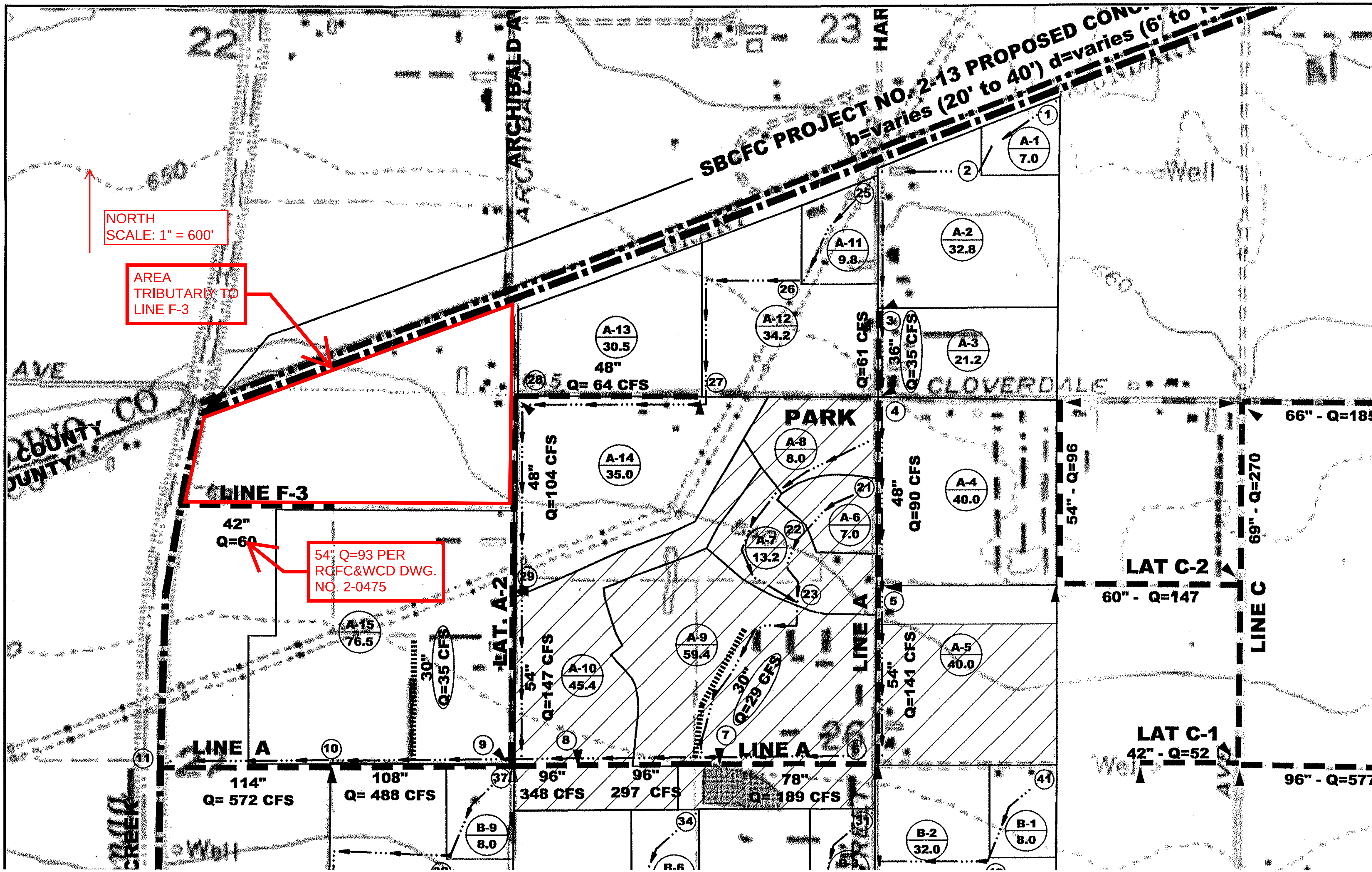
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

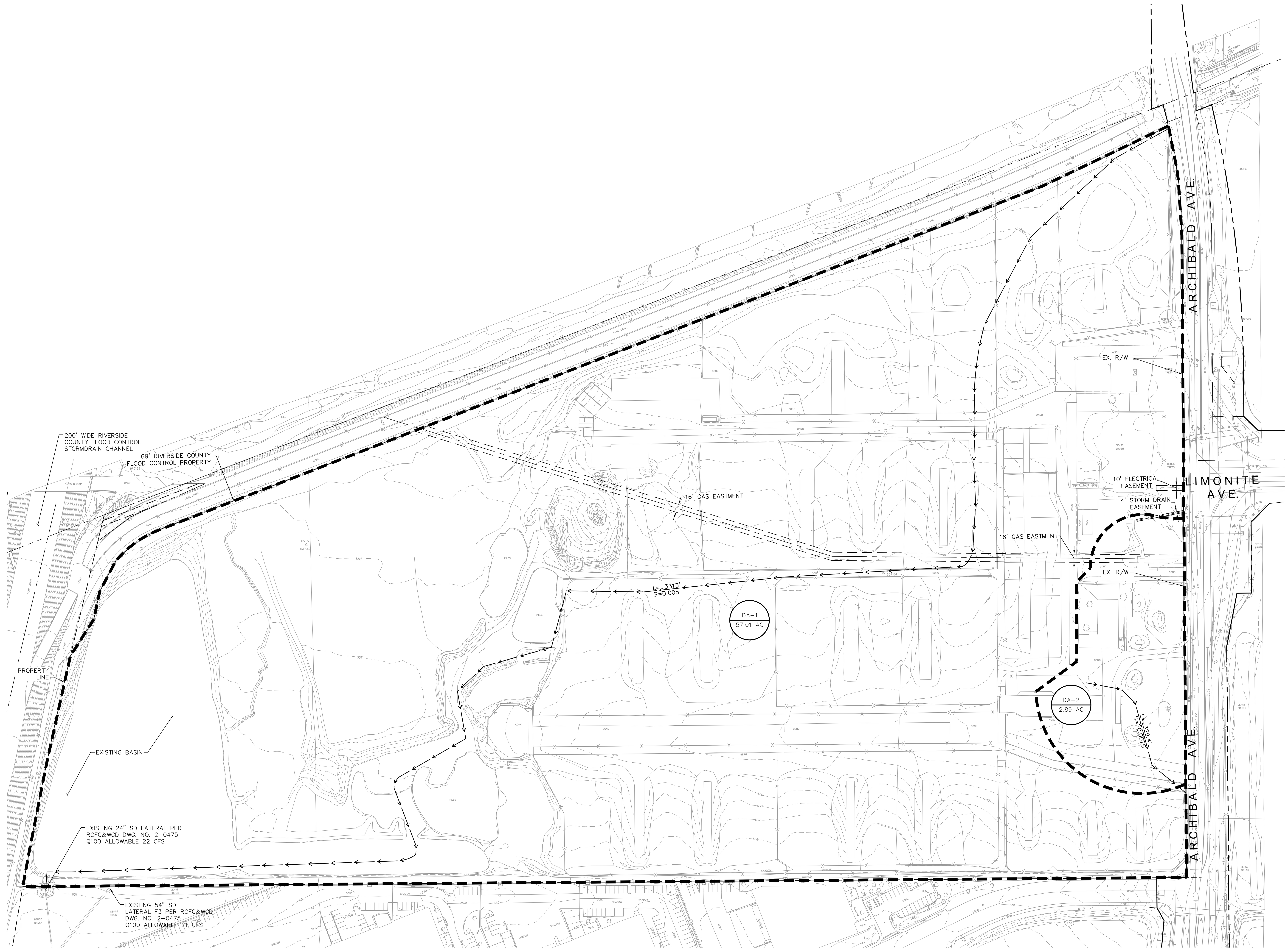
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/26/2019 at 6:47:55 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.

Exhibit 3: Pre-Development Drainage Conditions


NORTH
SCALE: 1" = 600'
AREA TRIBUTARY TO LINE F-3
54" Q=93 PER RCFC&WCD DWG. NO. 2-0475
SBCFC PROJECT NO. 2-13 PROPOSED CONC
b=varies (20' to 40') d=varies (6' to
22
23
26
650
ARCHIBALD AVE
AVE
COUNTY
CLOVERDALE
PARK
Well
CREEK
LINE F-3
42" Q=60
LINE A
LINE C
LAT. A-2
LAT C-2
LAT C-1
114" Q= 572 CFS
108" Q= 488 CFS
96" 348 CFS
96" 297 CFS
78" Q= 189 CFS
48" Q= 64 CFS
48" Q=104 CFS
54" Q=147 CFS
48" Q=90 CFS
54" Q=141 CFS
Q=61 CFS
36" Q=35 CFS
30" Q=35 CFS
30" Q=29 CFS
54" - Q=96
69" - Q=270
66" - Q=185
60" - Q=147
42" - Q=52
96" - Q=577
A-1 7.0
A-2 32.8
A-3 21.2
A-4 40.0
A-5 40.0
A-6 7.0
A-7 13.2
A-8 8.0
A-9 59.4
A-10 45.4
A-11 9.8
A-12 34.2
A-13 30.5
A-14 35.0
A-15 76.5
B-1 8.0
B-2 32.0
B-9 8.0



LEGEND

- FLOW LINE
- DRAINAGE AREA BOUNDARY
- ONSITE DRAINAGE AREA NAME
- TOTAL ACREAGE

NORTH

GRAPHIC SCALE IN FEET
0 40 80 160

Know what's below. Call 811 before you dig.

No.	REVISIONS	DATE	BY

Kimley»Horn

765 THE CITY DRIVE, SUITE 200, ORANGE, CA 92868
PHONE: 714-939-1030 FAX: 714-938-9488
WWW.KIMLEY-HORN.COM

LICENSED PROFESSIONAL
BRIAN GILLIS
CA LICENSE NUMBER 63021
EXP. DATE 6/30/20

KHA PROJECT 194121001
DATE 6.04.2019
SCALE AS SHOWN
DESIGNED BY ML
DRAWN BY OG
CHECKED BY CK

EXISTING HYDROLOGY MAP

THE HOMESTEAD

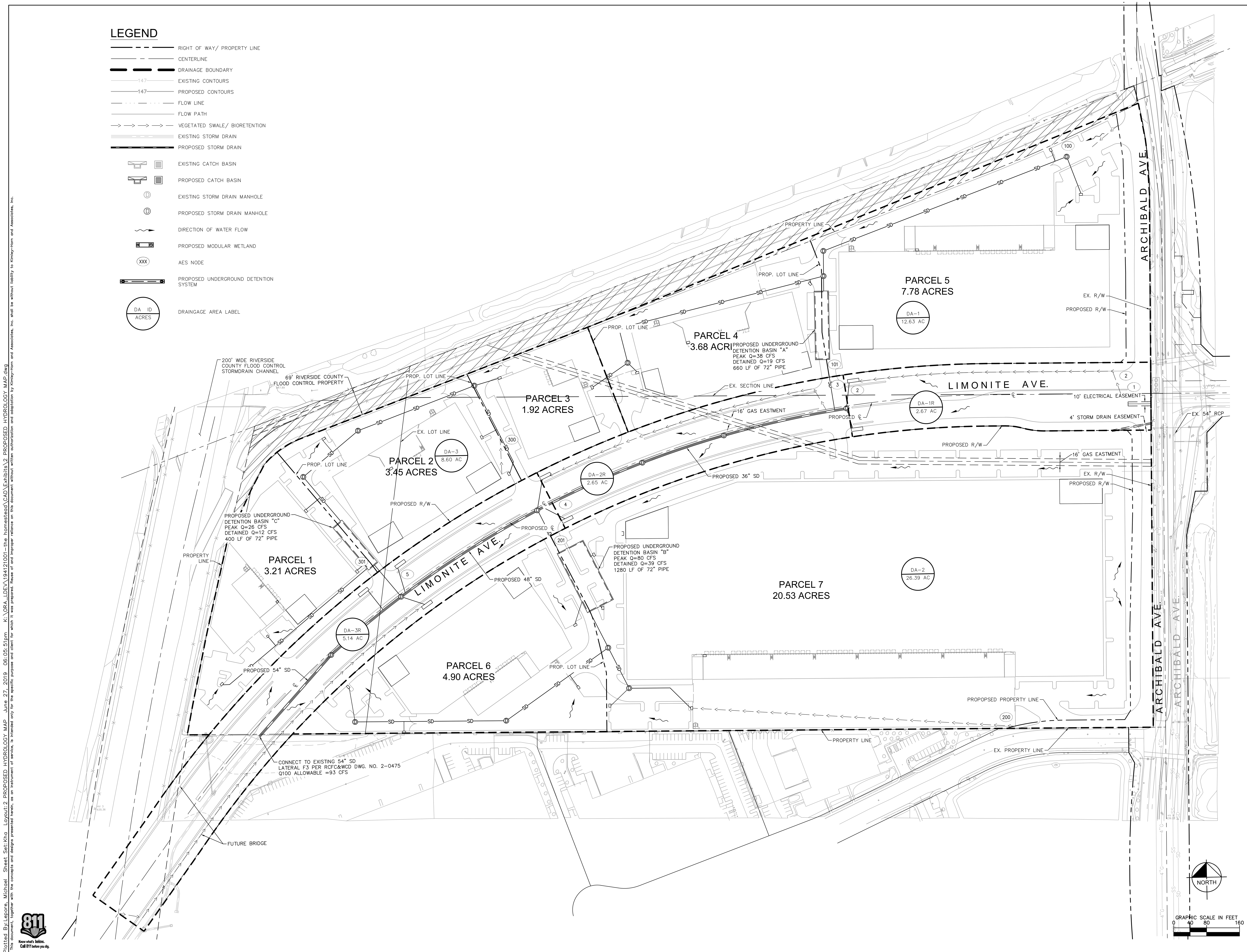
PREPARED FOR

ORBIS REAL ESTATE PARTNERS

EASTVALE CA

SHEET NUMBER
1

Exhibit 4: Post-Development Drainage Conditions



Plotted By:Lepore, Michael Sheet Set:Kha Layout:2 PROPOSED HYDROLOGY MAP June 27, 2019 06:05:51pm K:\ORA_LDEV\194121001-the homestead\CAD\Exhibits\2 PROPOSED HYDROLOGY MAP.dwg

No.	REVISIONS	DATE	BY

Kimley»Horn

765 THE CITY DRIVE, SUITE 200, ORANGE, CA 92868
PHONE: 714-939-1030 FAX: 714-938-9488
WWW.KIMLEY-HORN.COM

LICENSED PROFESSIONAL
BRIAN GILLIS
CA LICENSE NUMBER 63021
EXP. DATE 6/30/20

KHA PROJECT 194121001
DATE 6.27.2019
SCALE AS SHOWN
DESIGNED BY ML
DRAWN BY GG
CHECKED BY CK

PROPOSED HYDROLOGY MAP

THE HOMESTEAD
PREPARED FOR
ORBIS REAL ESTATE PARTNERS

EASTVALE CA

SHEET NUMBER
2

Exhibit 5: Riverside County Flood Control Master Drainage Plan (MDP) Map


ONTARIO FREEWAY
SAN BERNARDINO COUNTY
RIVERSIDE COUNTY
LINE E DETENTION BASIN
LINE E-1
BELLEGRAVE AVE
EDISON AVE
MILLIKEN AVE
CLEVELAND AVE
SUMNER AVE
HARRISON AVE
ARCHIBALD AVE
HAMNER AVE
COUNTY LINE CHANNEL (RECTANGULAR AND RCB)
SWAN LAKE TRAILER PARK
CLOVERDALE ROAD
LINE F-3
LAT A-2
LAT C-2
LINE C
LINE D-3
LAT D-5
LINE E
LIMONITE AVE
LINE A
LAT D-4
CHERRY ST
CLEVELAND AVE. DETENTION BASIN
LINE D-2
LINE D
68TH ST
CUCAMONGA CREEK
LINE B
LAT D-6.4
LAT D-1
SCHLEISMAN ROAD
LAT D-7
ORANGE ST
WALNUT ST
LINE E-3
LINE D-6
HELLMAN AVE
LINE F-1
LINE A-1
LINE B-2
LAT B-3
LAT D-B
CITRUS ST
DAYLIGHT CHANNEL
HALL AVE
SELBY AVE
CHANDLER STREET CHANNEL
EXISTING EARTHEN CHANNEL
CHANDLER ST
LEGEND
DRAINAGE BOUNDARY
PROPOSED STORM DRAIN
EXISTING BASIN
PROPOSED BASIN
PROPOSED OPEN CHANNEL
EXISTING FACILITY
Q=385 100 YEAR FLOW IN CFS
Q=285 10 YEAR FLOW IN CFS
Q=185* DESIGN FLOW IN CFS SEE MDP BOOK
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
EASTVALE
MASTER DRAINAGE PLAN
REVISED - APRIL 2002
ORIGINAL ADOPTION DATE - 05/91
Copyright 2002 AirPhotoUSA™, LLC, All Rights Reserved

Appendix

Appendix A - Hydrologic / Hydraulic Reference Material

- USDA Soils Map and Descriptions
- Pages C-2, C-3, PLATE C-1.14, D-5.3, D-5.5, and E-6.2 from the Riverside County Hydrology Manual, dated 1978

Summary by Map Unit — San Bernardino County Southwestern Part, California (CA677)
Summary by Map Unit — Western Riverside Area, California (CA679)

Summary by Map Unit — San Bernardino County Southwestern Part, California (CA677)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
Hr	Hilmar loamy fine sand	B	0.0	0.1%
Subtotals for Soil Survey Area			**0.0**	**0.1%**

Summary by Map Unit — Western Riverside Area, California (CA679)

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
GoB	Grangeville loamy fine sand, drained, 0 to 5 percent slopes	A/D	7.1	12.2%
HhA2	Hilmar loamy sand, 0 to 2 percent slopes, eroded	C	1.5	2.6%
HlA	Hilmar loamy very fine sand, 0 to 2 percent slopes	A	26.4	45.2%
Hr	Hilmar loamy fine sand	C	20.1	34.4%
RsC	Riverwash		3.2	5.5%
Subtotals for Soil Survey Area			**58.3**	**99.9%**
Totals for Area of Interest			**58.3**	**100.0%**

Description — Hydrologic Soil Group

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 — Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: *None Specified*

Tie-break Rule: Higher

true where a reservoir or retention basin is planned, as the long duration storm may control due to the volume of runoff, even though the peak inflow may be lower than that for short duration storms.

It should be noted that in mountainous terrain, or for studies of large watersheds, the NOAA Atlas 2 data should be checked against District frequency analysis for all rain gauges in the study area, and adjustments made as necessary.

Precipitation Depth - Area Adjustment - Point rainfall values can be adjusted for areal effect according to the drainage area size using the curves on Plate E-5.8.

Precipitation-Intensity Pattern - Rainfall patterns used in development of 3 and 6-hour thunderstorm flood hydrographs are based on the Indio storm of September 24, 1939. The pattern used for development of 24-hour general storm flood hydrographs is based on the major flood producing storm of March 1938. Tabulations of these patterns are given on Plate E-5.9 for selected unit time periods. These patterns are considered to represent a reasonable distribution of rainfall which will cause critical runoff conditions during major storm events.

Loss Rates - Factors influencing loss rates are discussed in detail in Section C of this report. Where sufficient data is available loss rates for unit hydrograph hydrology can be estimated from a study of rainfall-runoff relationships of major storms. Where such data is not available loss rates for pervious areas can be estimated using Plates E-6.l and E-6.2. Loss rates for pervious areas estimated in this manner are generally consistent with previous District studies, and with loss rates developed by the Los Angeles District USCE in numerous hydrology studies in the Southern California area.

Loss rates for pervious areas can be adjusted to account for developed area using the relationship:

$$F = F_p (1.00-0.9A_i)$$

where:

F = Adjusted loss rate - inches/hour

F_p = Loss rate for pervious areas - inches/hour (Plate E-6.2)

A_I = Impervious area (actual) - decimal percent (Plate E-6.3)

Adjusted loss rates for the Synthetic Unit Hydrograph method on typical watersheds in the District run generally from 0.10 to 0.40 inches per hour, with most falling between 0.20 and 0.25 inches per hour. For short storms with durations of 6-hours or less the adjusted loss rate may be taken as constant. For longer duration storms the loss rate should normally be varied to decrease with time to yield a mean equal to the adjusted loss rate. For the 24-hour storm the loss curve can be expressed as a function of time:

$$F_T = C(D-T)^{1.55} + F_m$$

where:

F_T = Adjusted loss rate at time "T" inches/hour

C = $(F-F_m)/54$

F = Adjusted loss rate - inches/hour (as previously defined)

D = Storm duration - hours = 24-hours

T = Time from beginning of storm – hours

F_m = Minimum value on loss curve inches/hour (occurs at end of storm where D=T)

In the early and late stages of a design storm the adjusted loss rate (constant or variable) will generally exceed the rainfall intensity on a unit time basis, indicating a zero runoff condition which is considered unrealistic. To account for runoff occurring during such periods, a low loss rate is used. The low loss rate is usually taken to be 80 to 90-percent of the rainfall for any unit time period where loss would otherwise exceed rainfall. This is equivalent to an effective rain of from 10 to 20-percent of the storm rainfall for a particular time period.

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
NATURAL COVERS -					
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
URBAN COVERS -					
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
AGRICULTURAL COVERS -					
Fallow (Land plowed but not tilled or seeded)		76	85	90	92

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
AGRICULTURAL COVERS (cont.) -					
Legumes, Close Seeded (Alfalfa, sweetclover, timothy, etc.)	Poor	66	77	85	89
	Good	58	72	81	85
Orchards, Deciduous (Apples, apricots, pears, walnuts, etc.)		See Note 4			
Orchards, Evergreen (Citrus, avocados, etc.)	Poor	57	73	82	86
	Fair	44	65	77	82
	Good	33	58	72	79
Pasture, Dryland (Annual grasses)	Poor	67	78	86	89
	Fair	50	69	79	84
	Good	38	61	74	80
Pasture, Irrigated (Legumes and perennial grass)	Poor	58	74	83	87
	Fair	44	65	77	82
	Good	33	58	72	79
Row Crops (Field crops - tomatoes, sugar beets, etc.)	Poor	72	81	88	91
	Good	67	78	85	89
Small Grain (Wheat, oats, barley, etc.)	Poor	65	76	84	88
	Good	63	75	83	87
Vineyard		See Note 4			

Notes:

1. All runoff index (RI) numbers are for Antecedent Moisture Condition (AMC) II.

2. Quality of cover definitions:
   Poor-Heavily grazed or regularly burned areas. Less than 50 percent of the ground surface is protected by plant cover or brush and tree canopy.
   Fair-Moderate cover with 50 percent to 75 percent of the ground surface protected.
   Good-Heavy or dense cover with more than 75 percent of the ground surface protected.

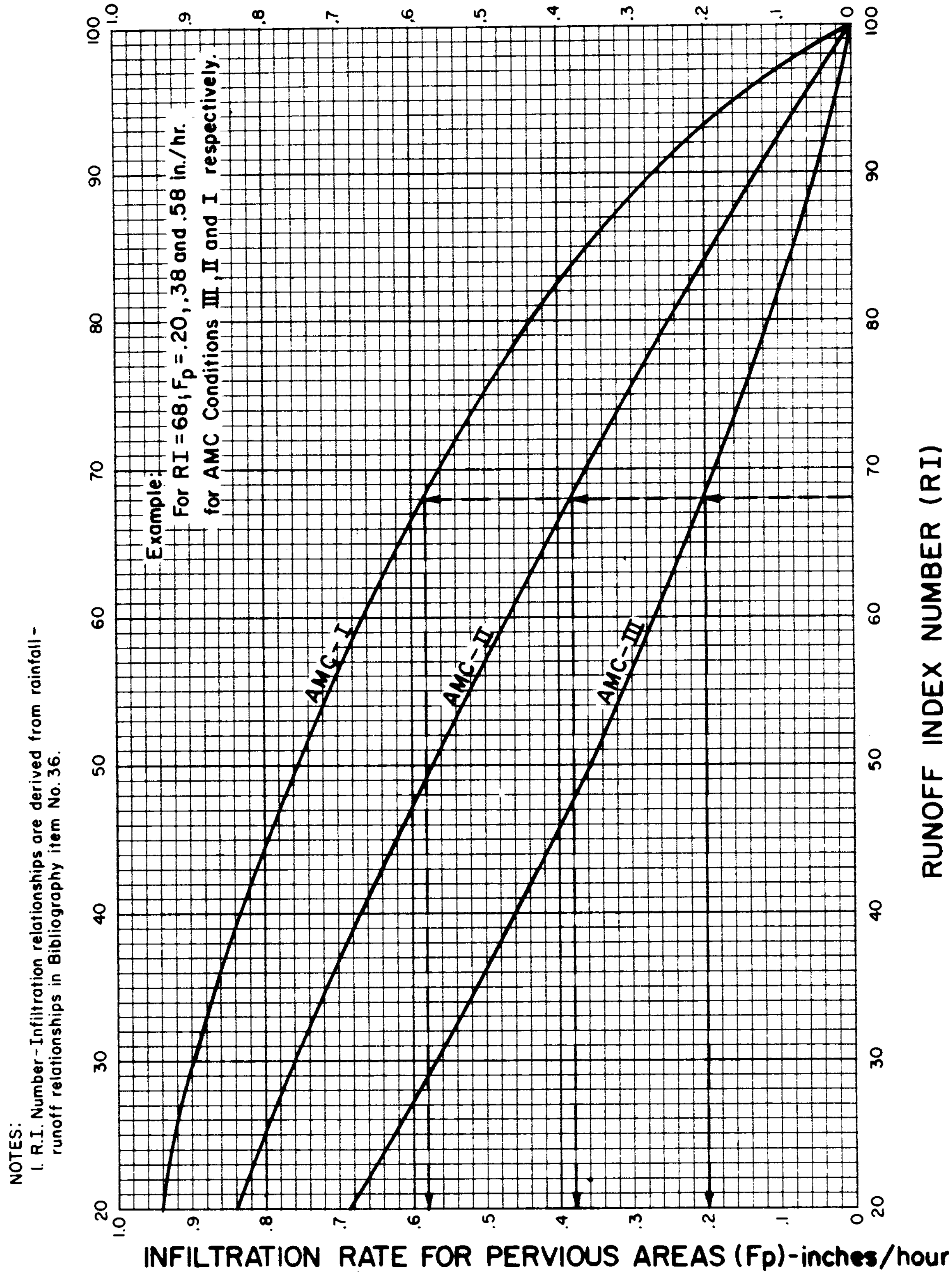
3. See Plate C-2 for a detailed description of cover types.

4. Use runoff index numbers based on ground cover type. See discussion under "Cover Type Descriptions" on Plate C-2.

5. Reference Bibliography item 17.

RCFC & WCD
HYDROLOGY MANUAL

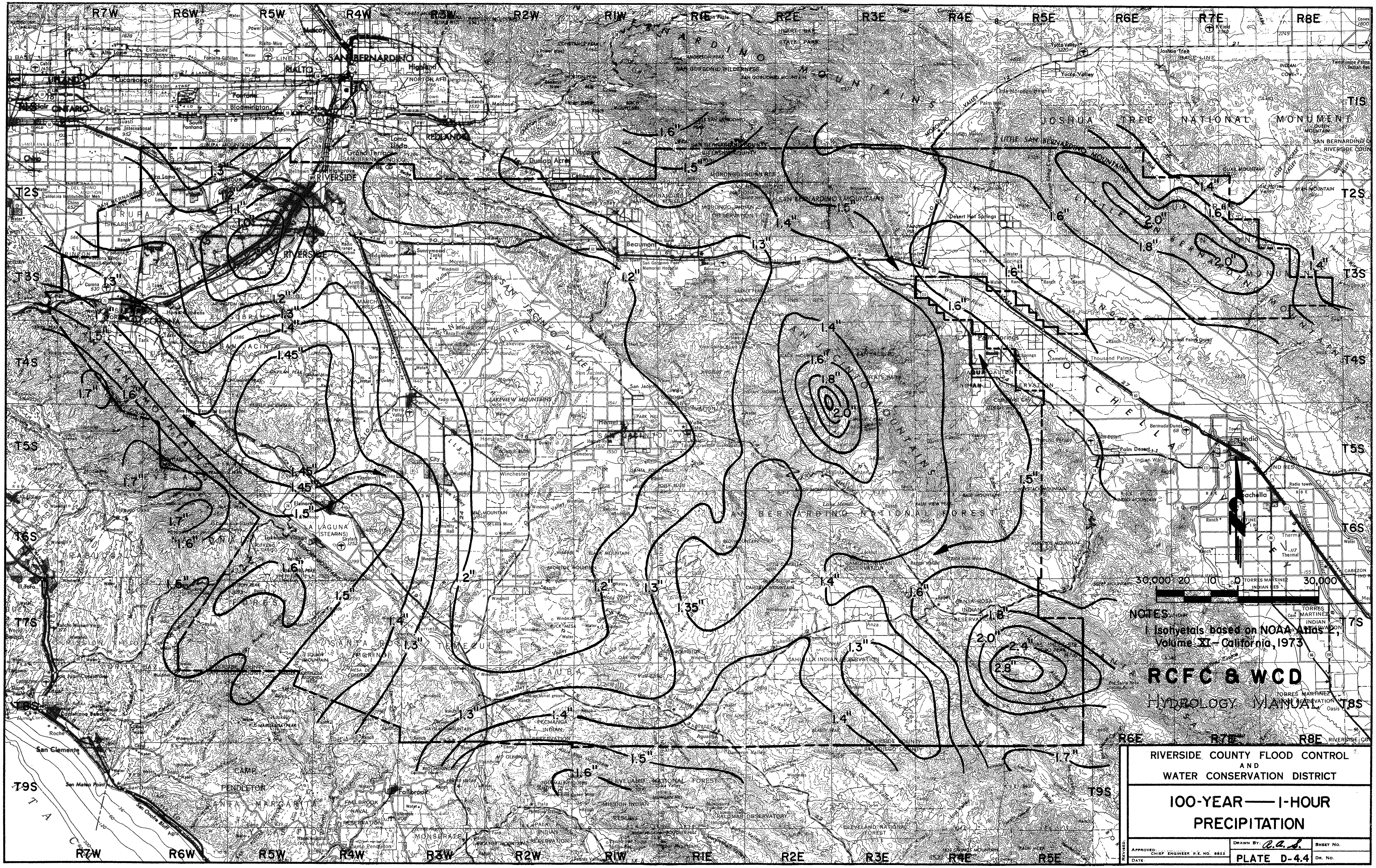
RUNOFF INDEX NUMBERS FOR PERVIOUS AREAS



RCFC & WCD

HYDROLOGY MANUAL

INFILTRATION RATE FOR PERVIOUS AREAS VERSUS RUNOFF INDEX NUMBERS


RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
100-YEAR — 1-HOUR PRECIPITATION
PLATE D-4.4
RCFC & WCD
HYDROLOGY MANUAL
NOTES
1. Isohyetals based on NOAA Atlas 2, Volume XI - California, 1973
30,000 20 10 0 30,000

Appendix B - Rational Method Calculation Results

```
____________________________________________________________________________
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                      (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-2011 Advanced Engineering Software (aes)
                      (Rational Tabling Version 18.0)
                   Release Date: 07/01/2011  License ID 1499

                           Analysis prepared by:

                      Kimley-Horn and Associates, Inc.
                             765 The City Drive
                                 Suite 200
                              Orange, CA 92868

 ************************** DESCRIPTION OF STUDY **************************
* THE HOMESTEAD                                                            *
* 100 YR EXISTING                                                          *
* EASTVALE CA                                                              *
 **************************************************************************

  FILE NAME: HMSTDE.DAT
  TIME/DATE OF STUDY: 18:03 06/24/2019
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   8.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.80
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  1.970
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.864
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.080
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.350
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.4600036
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.4603434
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.350
  SLOPE OF INTENSITY DURATION CURVE = 0.4603
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *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   55.0     20.0    0.020/0.020/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.80 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  5.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

+--------------------------------------------------------------------------+
| EXISTING SUBAREA DA-1                                                    |
| AREA 57.1 AC                                                             |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS: UNDEVELOPED WITH POOR COVER
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  UPSTREAM ELEVATION(FEET) =    648.00
  DOWNSTREAM ELEVATION(FEET) =    644.00
  ELEVATION DIFFERENCE(FEET) =      4.00
  TC = 0.533*[(  300.00**3)/(     4.00)]**.2 =   12.367
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.793
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .7411
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      2.07
  TOTAL AREA(ACRES) =      1.00   TOTAL RUNOFF(CFS) =      2.07

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =    644.00
  DOWNSTREAM NODE ELEVATION(FEET) =    633.00
  CHANNEL LENGTH THRU SUBAREA(FEET) =  3000.00
  "V" GUTTER WIDTH(FEET) =   5.00   GUTTER HIKE(FEET) =  0.500
  PAVEMENT LIP(FEET) =  0.160   MANNING'S N = .0100
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01000
  MAXIMUM DEPTH(FEET) =   8.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.992
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .6919
  SOIL CLASSIFICATION IS "C"
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =     40.97
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.73
  AVERAGE FLOW DEPTH(FEET) =   0.94   FLOOD WIDTH(FEET) =   60.01
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =  13.41   Tc(MIN.) =   25.78
  SUBAREA AREA(ACRES) =   56.01       SUBAREA RUNOFF(CFS) =   77.18
  TOTAL AREA(ACRES) =       57.0         PEAK FLOW RATE(CFS) =      79.25

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  1.06   FLOOD WIDTH(FEET) =   85.10
  FLOW VELOCITY(FEET/SEC.) =   3.94   DEPTH*VELOCITY(FT*FT/SEC) =   4.18
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =    3300.00 FEET.

+--------------------------------------------------------------------------+
| EXISTING SUBAREA DA-2                                                    |
| AREA 2.89 AC                                                             |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS SINGLE FAMILY(1-ACRE LOTS)
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   300.00
  UPSTREAM ELEVATION(FEET) =    644.00
  DOWNSTREAM ELEVATION(FEET) =    642.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  TC = 0.469*[(  300.00**3)/(     2.00)]**.2 =   12.517
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.778
```

```
  SINGLE-FAMILY(1-ACRE LOT) RUNOFF COEFFICIENT = .7723
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      6.20
  TOTAL AREA(ACRES) =      2.89   TOTAL RUNOFF(CFS) =      6.20
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        2.9  TC(MIN.) =     12.52
  PEAK FLOW RATE(CFS)   =       6.20
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS

FF
```

```
****************************************************************************
              RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                     (RCFC&WCD)  1978 HYDROLOGY MANUAL
          (c) Copyright 1982-2011 Advanced Engineering Software (aes)
                     (Rational Tabling Version 18.0)
                  Release Date: 07/01/2011  License ID 1499

                         Analysis prepared by:

                     Kimley-Horn and Associates, Inc.
                            765 The City Drive
                                Suite 200
                             Orange, CA 92868

 ************************** DESCRIPTION OF STUDY **************************
* THE HOMESTEAD                                                            *
* 100 YR                                                                   *
* EASTVALE CA                                                              *
 **************************************************************************

  FILE NAME: HMSTD.DAT
  TIME/DATE OF STUDY: 12:09 06/24/2019
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =   8.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.80
  10-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  1.970
  10-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  0.864
  100-YEAR STORM 10-MINUTE INTENSITY(INCH/HOUR) =  3.080
  100-YEAR STORM 60-MINUTE INTENSITY(INCH/HOUR) =  1.350
  SLOPE OF 10-YEAR INTENSITY-DURATION CURVE =  0.4600036
  SLOPE OF 100-YEAR INTENSITY-DURATION CURVE =  0.4603434
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.350
  SLOPE OF INTENSITY DURATION CURVE = 0.4603
  RCFC&WCD HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
  NOTE: COMPUTE CONFLUENCE VALUES ACCORDING TO RCFC&WCD HYDROLOGY MANUAL
        AND IGNORE OTHER CONFLUENCE COMBINATIONS FOR DOWNSTREAM ANALYSES
  *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   55.0     20.0    0.020/0.020/0.020   0.67    2.00 0.0313 0.167 0.0150

  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.80 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  5.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

+--------------------------------------------------------------------------+
| SUBAREA DA-R1                                                            |
| 2.67 AC (SPLIT INTO INITAL AND STREET FLOW)                              |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE      1.00 TO NODE      2.00 IS CODE =  21
```

```
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =    55.00
  UPSTREAM ELEVATION(FEET) =    645.00
  DOWNSTREAM ELEVATION(FEET) =    642.10
  ELEVATION DIFFERENCE(FEET) =      2.90
  TC = 0.303*[(   55.00**3)/(     2.90)]**.2 =    2.712
  COMPUTED TIME OF CONCENTRATION INCREASED TO 5 MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.238
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8889
  SOIL CLASSIFICATION IS "C"
  SUBAREA RUNOFF(CFS) =      0.38
  TOTAL AREA(ACRES) =      0.10   TOTAL RUNOFF(CFS) =      0.38

****************************************************************************
  FLOW PROCESS FROM NODE      2.00 TO NODE      3.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  642.10  DOWNSTREAM ELEVATION(FEET) =  639.30
  STREET LENGTH(FEET) =   550.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 55.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       3.85
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =    9.90
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.65
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.59
  STREET FLOW TRAVEL TIME(MIN.) =   5.56   Tc(MIN.) =   10.56
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.004
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8850
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =    2.57      SUBAREA RUNOFF(CFS) =    6.83
  TOTAL AREA(ACRES) =        2.7        PEAK FLOW RATE(CFS) =       7.21

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  13.05
  FLOW VELOCITY(FEET/SEC.) =  1.90   DEPTH*VELOCITY(FT*FT/SEC.) =   0.80
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      3.00 =     605.00 FEET.

+--------------------------------------------------------------------------+
| SUBAREA DA-R2                                                            |
| AREA 2.65 AC                                                             |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE      3.00 TO NODE      4.00 IS CODE =  62
----------------------------------------------------------------------------
```

```
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  639.30  DOWNSTREAM ELEVATION(FEET) =  635.70
  STREET LENGTH(FEET) =   760.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 55.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      10.04
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.46
    HALFSTREET FLOOD WIDTH(FEET) =   15.25
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    2.00
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.93
  STREET FLOW TRAVEL TIME(MIN.) =   6.34   Tc(MIN.) =   16.90
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.419
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8821
  SOIL CLASSIFICATION IS "C"
  SUBAREA AREA(ACRES) =    2.65      SUBAREA RUNOFF(CFS) =    5.66
  TOTAL AREA(ACRES) =        5.3        PEAK FLOW RATE(CFS) =      12.86

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.50   HALFSTREET FLOOD WIDTH(FEET) =  16.86
  FLOW VELOCITY(FEET/SEC.) =  2.12   DEPTH*VELOCITY(FT*FT/SEC.) =   1.05
  LONGEST FLOWPATH FROM NODE      1.00 TO NODE      4.00 =    1365.00 FEET.

+--------------------------------------------------------------------------+
| SUBAREA DA-R3                                                            |
| AREA 5.14 AC                                                             |
|                                                                          |
+--------------------------------------------------------------------------+

****************************************************************************
  FLOW PROCESS FROM NODE      4.00 TO NODE      5.00 IS CODE =  62
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STREET TABLE SECTION #  1 USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =  650.80  DOWNSTREAM ELEVATION(FEET) =  635.10
  STREET LENGTH(FEET) =  1040.00   CURB HEIGHT(INCHES) =  8.0
  STREET HALFWIDTH(FEET) = 55.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.020
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.020

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  2
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.020
  Manning's FRICTION FACTOR for Streetflow Section(curb-to-curb) =   0.0150
  Manning's FRICTION FACTOR for Back-of-Walk Flow Section =   0.0200

    **TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      17.74
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.46
    HALFSTREET FLOOD WIDTH(FEET) =   15.18
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.56
```

```
     PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.64
   STREET FLOW TRAVEL TIME(MIN.) =   4.87   Tc(MIN.) =   21.77
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.153
   COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8804
   SOIL CLASSIFICATION IS "C"
   SUBAREA AREA(ACRES) =    5.14      SUBAREA RUNOFF(CFS) =    9.74
   TOTAL AREA(ACRES) =       10.5        PEAK FLOW RATE(CFS) =      22.61

   END OF SUBAREA STREET FLOW HYDRAULICS:
   DEPTH(FEET) = 0.49   HALFSTREET FLOOD WIDTH(FEET) =  16.73
   FLOW VELOCITY(FEET/SEC.) =  3.78   DEPTH*VELOCITY(FT*FT/SEC.) =   1.86
   LONGEST FLOWPATH FROM NODE      1.00 TO NODE      5.00 =    2405.00 FEET.

 +--------------------------------------------------------------------------+
 | DRAINAGE AREA DA-1                                                       |
 | AREA 12.63 AC                                                            |
 |                                                                          |
 +--------------------------------------------------------------------------+

****************************************************************************
   FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  22
----------------------------------------------------------------------------
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
          ASSUMED INITIAL SUBAREA UNIFORM
          DEVELOPMENT IS COMMERCIAL
   USER SPECIFIED Tc(MIN.) =    8.000
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.413
   COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8866
   SOIL CLASSIFICATION IS "C"
   SUBAREA RUNOFF(CFS) =     38.22
   TOTAL AREA(ACRES) =     12.63   TOTAL RUNOFF(CFS) =     38.22

 +--------------------------------------------------------------------------+
 | DRAINAGE AREA DA-2                                                       |
 | AREA 26.39 AC                                                            |
 |                                                                          |
 +--------------------------------------------------------------------------+

****************************************************************************
   FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =  22
----------------------------------------------------------------------------
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
          ASSUMED INITIAL SUBAREA UNIFORM
          DEVELOPMENT IS COMMERCIAL
   USER SPECIFIED Tc(MIN.) =    8.000
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.413
   COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8866
   SOIL CLASSIFICATION IS "C"
   SUBAREA RUNOFF(CFS) =     79.86
   TOTAL AREA(ACRES) =     26.39   TOTAL RUNOFF(CFS) =     79.86

 +--------------------------------------------------------------------------+
 | DRAINAGE AREA DA-3                                                       |
 | AREA 8.60 AC                                                             |
 |                                                                          |
 +--------------------------------------------------------------------------+

****************************************************************************
   FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =  22
----------------------------------------------------------------------------
   >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
```

```
          ASSUMED INITIAL SUBAREA UNIFORM
          DEVELOPMENT IS COMMERCIAL
   USER SPECIFIED Tc(MIN.) =    8.000
    100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.413
   COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8866
   SOIL CLASSIFICATION IS "C"
   SUBAREA RUNOFF(CFS) =     26.02
   TOTAL AREA(ACRES) =      8.60   TOTAL RUNOFF(CFS) =     26.02
=============================================================================
   END OF STUDY SUMMARY:
   TOTAL AREA(ACRES)     =        8.6  TC(MIN.) =      8.00
   PEAK FLOW RATE(CFS)   =      26.02
=============================================================================
=============================================================================
   END OF RATIONAL METHOD ANALYSIS

FF
```

Appendix C - Hydrograph Calculation Results

```
____________________________________________________________________________
****************************************************************************

              F L O O D   R O U T I N G   A N A L Y S I S

ACCORDING TO RIVERSIDE COUNTY FLOOD CONTORL AND WATER CONSERVATION DISTRICT
                      (RCFC&WCD) 1978 HYDROLOGY MANUAL
         (c) Copyright 1989-2011 Advanced Engineering Software (aes)
                 (Synthetic Unit Hydrograph Version 18.0)
                 Release Date: 05/01/2011  License ID 1499

                           Analysis prepared by:

                      Kimley-Horn and Associates, Inc.
                             765 The City Drive
                                 Suite 200
                              Orange, CA 92868

 ************************* DESCRIPTION OF STUDY *************************
* HOMESTEAD 100 YR 1 HR HYDROGRAPH                                         *
*                                                                          *
*                                                                          *
 **************************************************************************

  FILE NAME: HMSTDHYD.DAT
  TIME/DATE OF STUDY: 13:56 06/24/2019

+--------------------------------------------------------------------------+
| DRAINAGE AREA DA-1                                                       |
| AREA 12.63 AC                                                            |
|                                                                          |
+--------------------------------------------------------------------------+


****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>SUBAREA RUNOFF (UNIT-HYDROGRAPH ANALYSIS)<<<<<
============================================================================

      (UNIT-HYDROGRAPH ADDED TO STREAM #1)

         WATERSHED AREA =      12.630 ACRES
         BASEFLOW =   0.000 CFS/SQUARE-MILE
         *USER ENTERED "LAG" TIME =    0.110 HOURS
          CAUTION: LAG TIME IS LESS THAN 0.50 HOURS.
          THE 5-MINUTE PERIOD UH MODEL (USED IN THIS COMPUTER PROGRAM)
          MAY BE TOO LARGE FOR PEAK FLOW ESTIMATES.
         VALLEY S-GRAPH SELECTED
         UNIFORM MEAN SOIL-LOSS(INCH/HOUR) =  0.070
         LOW SOIL-LOSS RATE PERCENT(DECIMAL) = 0.500
         USER-ENTERED RAINFALL =  1.35 INCHES
         RCFC&WCD 1-Hour Storm (5-Minute period) SELECTED
         (SLOPE OF INTENSITY-DURATION CURVE = 0.46)
         RCFC&WCD DEPTH-AREA ADJUSTMENT FACTOR(PLATE E-5.8) = 1.0000


         UNIT HYDROGRAPH TIME UNIT =   5.000 MINUTES
         UNIT INTERVAL PERCENTAGE OF LAG-TIME =  75.758



============================================================================
                      UNIT HYDROGRAPH DETERMINATION
```

```

----------------------------------------------------------------------------
    INTERVAL          "S" GRAPH         UNIT HYDROGRAPH
     NUMBER          MEAN VALUES         ORDINATES(CFS)
----------------------------------------------------------------------------
        1                11.878                 18.144
        2                54.928                 65.756
        3                76.148                 32.412
        4                84.767                 13.165
        5                89.774                  7.647
        6                93.122                  5.114
        7                95.509                  3.646
        8                97.169                  2.535
        9                98.235                  1.628
       10                98.780                  0.833
       11                99.316                  0.818
       12                99.726                  0.627
       13                99.932                  0.314
       14               100.000                  0.105


----------------------------------------------------------------------------

         TOTAL STORM RAINFALL(INCHES) =  1.35
         TOTAL SOIL-LOSS(INCHES) =  0.07
         TOTAL EFFECTIVE RAINFALL(INCHES) =  1.28

----------------------------------------------------------------------------
    TOTAL SOIL-LOSS VOLUME(ACRE-FEET) =       0.0737
    TOTAL STORM RUNOFF VOLUME(ACRE-FEET) =       1.3465
----------------------------------------------------------------------------
FF
============================================================================

                          1 - 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 FIVE-MINUTE UNIT INTERVALS(CFS)
        (Note: Time indicated is at END of Each Unit Intervals)
----------------------------------------------------------------------------
 TIME(HRS) VOLUME(AF)   Q(CFS) 0.       10.0      20.0      30.0      40.0
----------------------------------------------------------------------------
   0.083      0.0071      1.03  VQ        .         .         .         .
   0.167      0.0402      4.81  .V  Q     .         .         .         .
   0.250      0.0881      6.94  . V   Q   .         .         .         .
   0.333      0.1444      8.18  .   V   Q .         .         .         .
   0.417      0.2085      9.31  .     V  Q.         .         .         .
   0.500      0.2799     10.36  .       V Q         .         .         .
   0.583      0.3612     11.80  .         VQ        .         .         .
   0.667      0.4549     13.61  .         .  Q      .         .         .
   0.750      0.5657     16.09  .         .     Q   .         .         .
   0.833      0.7277     23.53  .         .         .V Q      .         .
   0.917      0.9510     32.42  .         .         .       V . Q       .
   1.000      1.1053     22.41  .         .         . Q       . V       .
   1.083      1.2035     14.26  .         .   Q     .         .    V    .
   1.167      1.2563      7.66  .      Q  .         .         .      V  .
   1.250      1.2873      4.50  .   Q     .         .         .       V .
   1.333      1.3080      3.01  .  Q      .         .         .       V .
   1.417      1.3221      2.04  . Q       .         .         .        V.
   1.500      1.3313      1.34  .Q        .         .         .        V.
   1.583      1.3370      0.84  Q         .         .         .        V.
   1.667      1.3412      0.60  Q         .         .         .        V.
   1.750      1.3439      0.40  Q         .         .         .        V.
```

```
   1.833      1.3455      0.23  Q         .         .         .        V.
   1.917      1.3463      0.10  Q         .         .         .        V.
   2.000      1.3465      0.03  Q         .         .         .        V.
   2.083      1.3465      0.01  Q         .         .         .        V.
-------------------------------------------------------------------------------
   TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
   (Note: 100% of Peak Flow Rate estimate assumed to have
   an instantaneous time duration)

   Percentile of Estimated                 Duration
       Peak Flow Rate                      (minutes)
   =======================                 =========
             0%                              125.0
            10%                               70.0
            20%                               60.0
            30%                               40.0
            40%                               30.0
            50%                               15.0
            60%                               15.0
            70%                               10.0
            80%                                5.0
            90%                                5.0

 +----------------------------------------------------------------------------+
 | DRAINAGE ARAE DA-2                                                         |
 | AREA 26.39 AC                                                              |
 |                                                                            |
 +----------------------------------------------------------------------------+


 ****************************************************************************
   FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 IS CODE =   1
 ----------------------------------------------------------------------------
   >>>>>SUBAREA RUNOFF (UNIT-HYDROGRAPH ANALYSIS)<<<<<
 ============================================================================

       (UNIT-HYDROGRAPH ADDED TO STREAM #1)

          WATERSHED AREA =      26.390 ACRES
          BASEFLOW =   0.000 CFS/SQUARE-MILE
          *USER ENTERED "LAG" TIME =    0.100 HOURS
           CAUTION: LAG TIME IS LESS THAN 0.50 HOURS.
           THE 5-MINUTE PERIOD UH MODEL (USED IN THIS COMPUTER PROGRAM)
           MAY BE TOO LARGE FOR PEAK FLOW ESTIMATES.
          VALLEY S-GRAPH SELECTED
          UNIFORM MEAN SOIL-LOSS(INCH/HOUR) =  0.050
          LOW SOIL-LOSS RATE PERCENT(DECIMAL) = 0.500
          USER-ENTERED RAINFALL =  1.35 INCHES
          RCFC&WCD 1-Hour Storm (5-Minute period) SELECTED
          (SLOPE OF INTENSITY-DURATION CURVE = 0.46)
          RCFC&WCD DEPTH-AREA ADJUSTMENT FACTOR(PLATE E-5.8) = 1.0000


          UNIT HYDROGRAPH TIME UNIT =   5.000 MINUTES
          UNIT INTERVAL PERCENTAGE OF LAG-TIME =  83.333



 ============================================================================
                      UNIT HYDROGRAPH DETERMINATION

 ----------------------------------------------------------------------------
    INTERVAL          "S" GRAPH         UNIT HYDROGRAPH
     NUMBER          MEAN VALUES         ORDINATES(CFS)
```

```
---------------------------------------------------------------------------
         1               13.994                  44.662
         2               59.664                 145.759
         3               78.792                  61.049
         4               86.766                  25.448
         5               91.428                  14.879
         6               94.514                   9.850
         7               96.650                   6.816
         8               98.044                   4.450
         9               98.699                   2.088
        10               99.289                   1.885
        11               99.716                   1.361
        12               99.929                   0.681
        13              100.000                   0.227


FF
***************************************************************************
         UNIT              UNIT            UNIT              EFFECTIVE
        PERIOD           RAINFALL       SOIL-LOSS            RAINFALL
       (NUMBER)          (INCHES)        (INCHES)            (INCHES)
---------------------------------------------------------------------------
            1             0.0625          0.0042              0.0583
            2             0.0658          0.0042              0.0616
            3             0.0698          0.0042              0.0656
            4             0.0766          0.0042              0.0725
            5             0.0806          0.0042              0.0765
            6             0.0913          0.0042              0.0871
            7             0.1064          0.0042              0.1022
            8             0.1164          0.0042              0.1123
            9             0.1722          0.0042              0.1681
           10             0.3411          0.0042              0.3369
           11             0.0987          0.0042              0.0945
           12             0.0687          0.0042              0.0645

         TOTAL STORM RAINFALL(INCHES) =  1.35
         TOTAL SOIL-LOSS(INCHES) =  0.05
         TOTAL EFFECTIVE RAINFALL(INCHES) =  1.30

---------------------------------------------------------------------------
    TOTAL SOIL-LOSS VOLUME(ACRE-FEET) =       0.1100
    TOTAL STORM RUNOFF VOLUME(ACRE-FEET) =       2.8574
---------------------------------------------------------------------------
FF
===========================================================================

                          1 - 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 FIVE-MINUTE UNIT INTERVALS(CFS)
        (Note: Time indicated is at END of Each Unit Intervals)
---------------------------------------------------------------------------
 TIME(HRS) VOLUME(AF)   Q(CFS) 0.       20.0      40.0      60.0      80.0
---------------------------------------------------------------------------
   0.083      0.0179      2.60  VQ        .         .         .         .
   0.167      0.0954     11.25  .V   Q    .         .         .         .
   0.250      0.2019     15.47  . V    Q  .         .         .         .
   0.333      0.3262     18.04  .   V    Q.         .         .         .
   0.417      0.4668     20.42  .     V   Q         .         .         .
   0.500      0.6226     22.62  .       V .Q        .         .         .
   0.583      0.8000     25.75  .         .VQ       .         .         .
   0.667      1.0037     29.58  .         .   Q     .         .         .
   0.750      1.2448     35.02  .         .      Q  .         .         .
```

```
    0.833      1.6035     52.07  .         .         . V   Q   .         .
    0.917      2.0856     70.00  .         .         .       V.    Q     .
    1.000      2.3990     45.51  .         .         . Q       .  V      .
    1.083      2.5979     28.88  .         .   Q     .         .     V   .
    1.167      2.6992     14.71  .      Q  .         .         .      V  .
    1.250      2.7582      8.56  .   Q     .         .         .       V .
    1.333      2.7964      5.55  . Q       .         .         .        V.
    1.417      2.8209      3.56  .Q        .         .         .        V.
    1.500      2.8355      2.12  .Q        .         .         .        V.
    1.583      2.8455      1.45  Q         .         .         .        V.
    1.667      2.8517      0.91  Q         .         .         .        V.
    1.750      2.8553      0.52  Q         .         .         .        V.
    1.833      2.8569      0.23  Q         .         .         .        V.
    1.917      2.8573      0.07  Q         .         .         .        V.
    2.000      2.8574      0.01  Q         .         .         .        V.
-------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                 Duration
        Peak Flow Rate                      (minutes)
    =======================                 =========
              0%                              120.0
             10%                               70.0
             20%                               60.0
             30%                               40.0
             40%                               30.0
             50%                               20.0
             60%                               15.0
             70%                               10.0
             80%                                5.0
             90%                                5.0

 +----------------------------------------------------------------------------+
 | DRAINAGE AREA DA-3                                                          |
 | AREA 8.60 AC                                                                |
 |                                                                             |
 +----------------------------------------------------------------------------+


 ****************************************************************************
   FLOW PROCESS FROM NODE    300.00 TO NODE    301.00 IS CODE =   1
 ----------------------------------------------------------------------------
   >>>>>SUBAREA RUNOFF (UNIT-HYDROGRAPH ANALYSIS)<<<<<
 ============================================================================

      (UNIT-HYDROGRAPH ADDED TO STREAM #1)

         WATERSHED AREA =       8.600 ACRES
         BASEFLOW =   0.000 CFS/SQUARE-MILE
   Warning: Watershed Area is less than 10 acres
         *USER ENTERED "LAG" TIME =    0.110 HOURS
          CAUTION: LAG TIME IS LESS THAN 0.50 HOURS.
          THE 5-MINUTE PERIOD UH MODEL (USED IN THIS COMPUTER PROGRAM)
          MAY BE TOO LARGE FOR PEAK FLOW ESTIMATES.
         VALLEY S-GRAPH SELECTED
         UNIFORM MEAN SOIL-LOSS(INCH/HOUR) =  0.070
         LOW SOIL-LOSS RATE PERCENT(DECIMAL) = 0.500
         USER-ENTERED RAINFALL =  1.35 INCHES
         RCFC&WCD 1-Hour Storm (5-Minute period) SELECTED
         (SLOPE OF INTENSITY-DURATION CURVE = 0.46)
         RCFC&WCD DEPTH-AREA ADJUSTMENT FACTOR(PLATE E-5.8) = 1.0000
```

UNIT HYDROGRAPH TIME UNIT = 5.000 MINUTES
UNIT INTERVAL PERCENTAGE OF LAG-TIME = 75.758

==

UNIT HYDROGRAPH DETERMINATION

INTERVAL NUMBER	"S" GRAPH MEAN VALUES	UNIT HYDROGRAPH ORDINATES(CFS)
1	11.878	12.354
2	54.928	44.774
3	76.148	22.070
4	84.767	8.965
5	89.774	5.207
6	93.122	3.482
7	95.509	2.483
8	97.169	1.726
9	98.235	1.109
10	98.780	0.567
11	99.316	0.557
12	99.726	0.427
13	99.932	0.214
14	100.000	0.071

FF

****

UNIT PERIOD (NUMBER)	UNIT RAINFALL (INCHES)	UNIT SOIL-LOSS (INCHES)	EFFECTIVE RAINFALL (INCHES)
1	0.0625	0.0058	0.0566
2	0.0658	0.0058	0.0600
3	0.0698	0.0058	0.0639
4	0.0766	0.0058	0.0708
5	0.0806	0.0058	0.0748
6	0.0913	0.0058	0.0854
7	0.1064	0.0058	0.1005
8	0.1164	0.0058	0.1106
9	0.1722	0.0058	0.1664
10	0.3411	0.0058	0.3352
11	0.0987	0.0058	0.0928
12	0.0687	0.0058	0.0628

TOTAL STORM RAINFALL(INCHES) = 1.35
TOTAL SOIL-LOSS(INCHES) = 0.07
TOTAL EFFECTIVE RAINFALL(INCHES) = 1.28

TOTAL SOIL-LOSS VOLUME(ACRE-FEET) = 0.0502
TOTAL STORM RUNOFF VOLUME(ACRE-FEET) = 0.9169

FF

==

1 - 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 FIVE-MINUTE UNIT INTERVALS(CFS)

```
         (Note: Time indicated is at END of Each Unit Intervals)
 ----------------------------------------------------------------------------
  TIME(HRS) VOLUME(AF)   Q(CFS) 0.        7.5      15.0      22.5      30.0
 ----------------------------------------------------------------------------
    0.083      0.0048      0.70  Q         .         .         .         .
    0.167      0.0274      3.28  .V  Q     .         .         .         .
    0.250      0.0599      4.72  . V   Q   .         .         .         .
    0.333      0.0983      5.57  .   V  Q  .         .         .         .
    0.417      0.1419      6.34  .     V Q .         .         .         .
    0.500      0.1905      7.05  .       VQ.         .         .         .
    0.583      0.2458      8.04  .         Q         .         .         .
    0.667      0.3096      9.26  .         . QV      .         .         .
    0.750      0.3850     10.95  .         .   Q V   .         .         .
    0.833      0.4954     16.02  .         .         .Q        .         .
    0.917      0.6475     22.09  .         .         .       VQ.         .
    1.000      0.7526     15.26  .         .         Q         . V       .
    1.083      0.8195      9.71  .         . Q       .         .    V    .
    1.167      0.8554      5.21  .     Q   .         .         .      V  .
    1.250      0.8765      3.07  .   Q     .         .         .       V .
    1.333      0.8906      2.05  . Q       .         .         .       V .
    1.417      0.9002      1.39  .Q        .         .         .        V.
    1.500      0.9065      0.91  .Q        .         .         .        V.
    1.583      0.9104      0.57  Q         .         .         .        V.
    1.667      0.9132      0.41  Q         .         .         .        V.
    1.750      0.9151      0.27  Q         .         .         .        V.
    1.833      0.9162      0.16  Q         .         .         .        V.
    1.917      0.9167      0.07  Q         .         .         .        V.
    2.000      0.9168      0.02  Q         .         .         .        V.
    2.083      0.9169      0.00  Q         .         .         .         V
--------------------------------------------------------------------------------
    TIME DURATION(minutes) OF PERCENTILES OF ESTIMATED PEAK FLOW RATE:
    (Note: 100% of Peak Flow Rate estimate assumed to have
    an instantaneous time duration)

    Percentile of Estimated                 Duration
        Peak Flow Rate                      (minutes)
    =======================                 =========
               0%                             125.0
              10%                              70.0
              20%                              60.0
              30%                              40.0
              40%                              30.0
              50%                              15.0
              60%                              15.0
              70%                              10.0
              80%                               5.0
              90%                               5.0
 ============================================================================

   END OF FLOODSCx ROUTING ANALYSIS
```

Appendix D - Detention Basin Calculation Results

Homestead_Basin1.ppc

Scenario Summary

ID	1
Label	Base
Notes	
Active Topology	Base Active Topology
Hydrology	Base Hydrology
Rainfall Runoff	Base Rainfall Runoff
Physical	Base Physical
Initial Condition	Base Initial Condition
Boundary Condition	Base Boundary Condition
Infiltration and Inflow	Base Infiltration and Inflow
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	Base Calculation Options

Output Summary

Output Increment	3.000 min	Duration	1,440.000 min

Rainfall Summary

Return Event Tag		Rainfall Type	(N/A)
Total Depth	(N/A) in	Storm Event	(N/A)

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft^3)	Time to Peak (min)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft^3)
DA1	Base	0	None	62,052.00	55.000	44.27	(N/A)	(N/A)
O-1	Base	0	None	61,841.00	63.000	18.83	(N/A)	(N/A)
RDF-1 (IN)	Base	0	None	61,841.00	54.000	40.12	(N/A)	(N/A)
RDF-1 (OUT)	Base	0	None	61,841.00	63.000	18.83	105.91	18,458.00

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ft^3)	Peak Time (min)	Peak Flow (ft^3/s)	End Point	Node Flow Direction
Outlet-1	Pond Outlet	Upstream	61,841.00	54.000	40.12	RDF-1	Pond Inflow
Outlet-1	Pond Outlet	Outflow	61,841.00	63.000	18.83	RDF-1	Pond Outflow
Outlet-1	Pond Outlet	Link	61,841.00	63.000	18.83		
Outlet-1	Pond Outlet	Downstream	61,841.00	63.000	18.83	O-1	

Homestead_Basin1.ppc
Orifice Calculation

Element Details

Label	Composite Outlet Structure - 1	Notes	

Headwater Range

Headwater Type	Use Pond for Headwater Range	Maximum (Headwater)	106.00 ft
Pond	RDF-1	Increment (Headwater)	0.10 ft
Minimum (Headwater)	100.00 ft		

SpotElevation (ft)

Tailwater Setup

Tailwater Type	Free Outfall

Tailwater Tolerances

Maximum Iterations	30	Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft	Flow Tolerance (Minimum)	0.001 ft³/s
Headwater Tolerance (Maximum)	0.50 ft	Flow Tolerance (Maximum)	10.000 ft³/s
Tailwater Tolerance (Minimum)	0.01 ft		

Outlet Structure

Outlet Structure Type	Orifice

Outlet Structure (IDs and Direction)

Outlet ID	Orifice - 1	Downstream ID	Tailwater
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)

Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

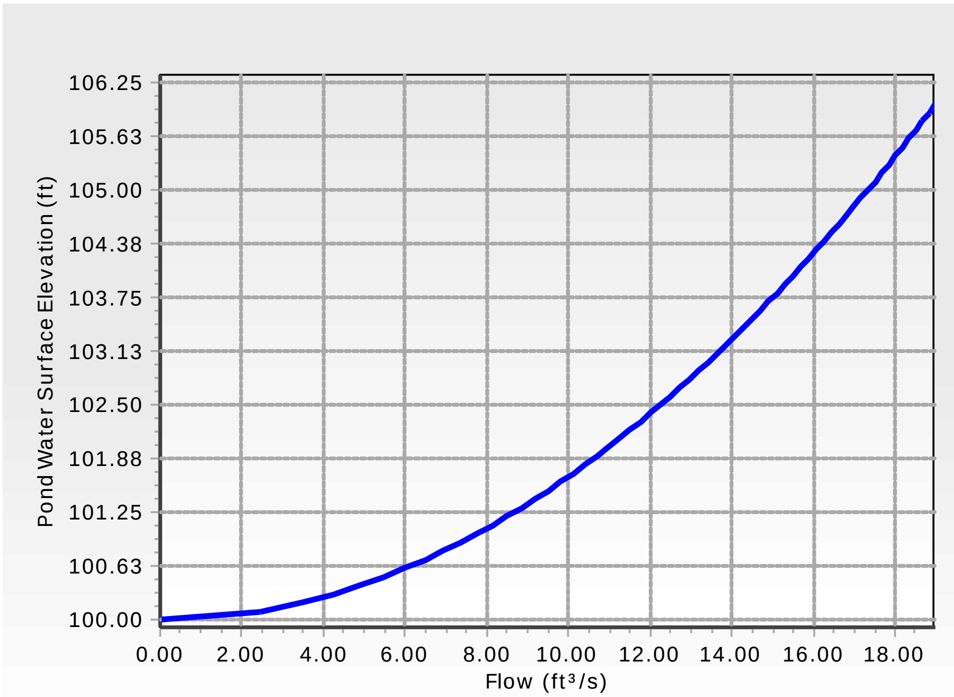
Outlet Structure (Orifice)

Orifice	Area Orifice	Orifice Area	1.61 ft²
Number of Openings	1	Orifice Orientation	Parallel Orifice
Orifice Coefficient	0.600		

Outlet Structure (Common)

Elevation	100.00 ft

Homestead_Basin1.ppc
Orifice Calculation



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
100.00	0.00	(N/A)	0.00
100.10	2.45	(N/A)	0.00
100.20	3.47	(N/A)	0.00
100.30	4.24	(N/A)	0.00
100.40	4.90	(N/A)	0.00
100.50	5.48	(N/A)	0.00
100.60	6.00	(N/A)	0.00
100.70	6.48	(N/A)	0.00
100.80	6.93	(N/A)	0.00
100.90	7.35	(N/A)	0.00
101.00	7.75	(N/A)	0.00
101.10	8.13	(N/A)	0.00
101.20	8.49	(N/A)	0.00
101.30	8.84	(N/A)	0.00
101.40	9.17	(N/A)	0.00

Homestead_Basin1.ppc
Orifice Calculation

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
101.50	9.49	(N/A)	0.00
101.60	9.80	(N/A)	0.00
101.70	10.10	(N/A)	0.00
101.80	10.40	(N/A)	0.00
101.90	10.68	(N/A)	0.00
102.00	10.96	(N/A)	0.00
102.10	11.23	(N/A)	0.00
102.20	11.49	(N/A)	0.00
102.30	11.75	(N/A)	0.00
102.40	12.00	(N/A)	0.00
102.50	12.25	(N/A)	0.00
102.60	12.49	(N/A)	0.00
102.70	12.73	(N/A)	0.00
102.80	12.97	(N/A)	0.00
102.90	13.20	(N/A)	0.00
103.00	13.42	(N/A)	0.00
103.10	13.64	(N/A)	0.00
103.20	13.86	(N/A)	0.00
103.30	14.08	(N/A)	0.00
103.40	14.29	(N/A)	0.00
103.50	14.50	(N/A)	0.00
103.60	14.70	(N/A)	0.00
103.70	14.91	(N/A)	0.00
103.80	15.11	(N/A)	0.00
103.90	15.30	(N/A)	0.00
104.00	15.50	(N/A)	0.00
104.10	15.69	(N/A)	0.00
104.20	15.88	(N/A)	0.00
104.30	16.07	(N/A)	0.00
104.40	16.25	(N/A)	0.00
104.50	16.44	(N/A)	0.00
104.60	16.62	(N/A)	0.00
104.70	16.80	(N/A)	0.00
104.80	16.98	(N/A)	0.00
104.90	17.15	(N/A)	0.00
105.00	17.33	(N/A)	0.00
105.10	17.50	(N/A)	0.00
105.20	17.67	(N/A)	0.00
105.30	17.84	(N/A)	0.00

Homestead_Basin1.ppc
Orifice Calculation

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
105.40	18.01	(N/A)	0.00
105.50	18.17	(N/A)	0.00
105.60	18.34	(N/A)	0.00
105.70	18.50	(N/A)	0.00
105.80	18.66	(N/A)	0.00
105.90	18.82	(N/A)	0.00
106.00	18.98	(N/A)	0.00

Computation Messages
H =.00
H =.10
H =.20
H =.30
H =.40
H =.50
H =.60
H =.70
H =.80
H =.90
H =1.00
H =1.10
H =1.20
H =1.30
H =1.40
H =1.50
H =1.60
H =1.70
H =1.80
H =1.90
H =2.00
H =2.10
H =2.20
H =2.30
H =2.40
H =2.50
H =2.60
H =2.70
H =2.80
H =2.90
H =3.00

Homestead_Basin1.ppc
Orifice Calculation

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Computation Messages
H =3.10
H =3.20
H =3.30
H =3.40
H =3.50
H =3.60
H =3.70
H =3.80
H =3.90
H =4.00
H =4.10
H =4.20
H =4.30
H =4.40
H =4.50
H =4.60
H =4.70
H =4.80
H =4.90
H =5.00
H =5.10
H =5.20
H =5.30
H =5.40
H =5.50
H =5.60
H =5.70
H =5.80
H =5.90
H =6.00

Homestead_Basin1.ppc
Orifice Calculation

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
100.00	0.00	(N/A)	0.00
100.10	2.45	(N/A)	0.00
100.20	3.47	(N/A)	0.00
100.30	4.24	(N/A)	0.00
100.40	4.90	(N/A)	0.00
100.50	5.48	(N/A)	0.00
100.60	6.00	(N/A)	0.00
100.70	6.48	(N/A)	0.00
100.80	6.93	(N/A)	0.00
100.90	7.35	(N/A)	0.00
101.00	7.75	(N/A)	0.00
101.10	8.13	(N/A)	0.00
101.20	8.49	(N/A)	0.00
101.30	8.84	(N/A)	0.00
101.40	9.17	(N/A)	0.00
101.50	9.49	(N/A)	0.00
101.60	9.80	(N/A)	0.00
101.70	10.10	(N/A)	0.00
101.80	10.40	(N/A)	0.00
101.90	10.68	(N/A)	0.00
102.00	10.96	(N/A)	0.00
102.10	11.23	(N/A)	0.00
102.20	11.49	(N/A)	0.00
102.30	11.75	(N/A)	0.00
102.40	12.00	(N/A)	0.00
102.50	12.25	(N/A)	0.00
102.60	12.49	(N/A)	0.00
102.70	12.73	(N/A)	0.00
102.80	12.97	(N/A)	0.00
102.90	13.20	(N/A)	0.00
103.00	13.42	(N/A)	0.00
103.10	13.64	(N/A)	0.00
103.20	13.86	(N/A)	0.00
103.30	14.08	(N/A)	0.00
103.40	14.29	(N/A)	0.00
103.50	14.50	(N/A)	0.00
103.60	14.70	(N/A)	0.00
103.70	14.91	(N/A)	0.00
103.80	15.11	(N/A)	0.00
103.90	15.30	(N/A)	0.00
104.00	15.50	(N/A)	0.00
104.10	15.69	(N/A)	0.00
104.20	15.88	(N/A)	0.00
104.30	16.07	(N/A)	0.00

Homestead_Basin1.ppc
Orifice Calculation

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
104.40	16.25	(N/A)	0.00
104.50	16.44	(N/A)	0.00
104.60	16.62	(N/A)	0.00
104.70	16.80	(N/A)	0.00
104.80	16.98	(N/A)	0.00
104.90	17.15	(N/A)	0.00
105.00	17.33	(N/A)	0.00
105.10	17.50	(N/A)	0.00
105.20	17.67	(N/A)	0.00
105.30	17.84	(N/A)	0.00
105.40	18.01	(N/A)	0.00
105.50	18.17	(N/A)	0.00
105.60	18.34	(N/A)	0.00
105.70	18.50	(N/A)	0.00
105.80	18.66	(N/A)	0.00
105.90	18.82	(N/A)	0.00
106.00	18.98	(N/A)	0.00

Contributing Structures
Orifice - 1
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Homestead_Basin1.ppc
Orifice Calculation

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Contributing Structures
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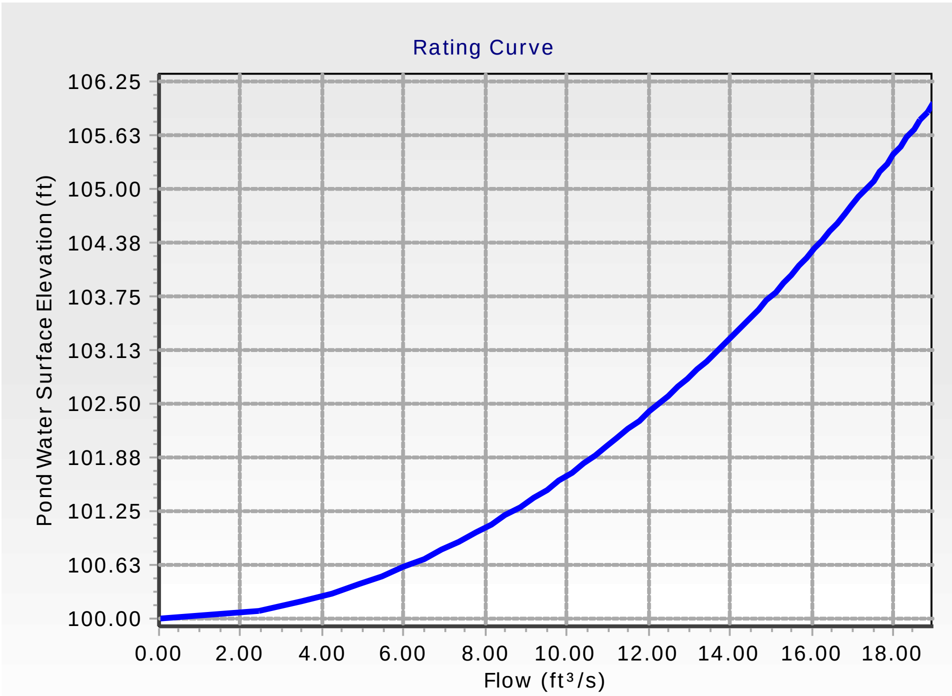
Homestead_Basin1.ppc
Orifice Calculation



Homestead_Basin2.ppc

Scenario Summary

ID	1
Label	Base
Notes	
Active Topology	Base Active Topology
Hydrology	Base Hydrology
Rainfall Runoff	Base Rainfall Runoff
Physical	Base Physical
Initial Condition	Base Initial Condition
Boundary Condition	Base Boundary Condition
Infiltration and Inflow	Base Infiltration and Inflow
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	Base Calculation Options

Output Summary

Output Increment	0.050 hours	Duration	24.000 hours

Rainfall Summary

Return Event Tag		Rainfall Type	(N/A)
Total Depth	(N/A) in	Storm Event	(N/A)

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft^3)	Time to Peak (hours)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft^3)
DA2	Base	0	None	127,044.00	0.917	79.86	(N/A)	(N/A)
O-1	Base	0	None	126,730.00	1.050	38.89	(N/A)	(N/A)
RDF-2 (IN)	Base	0	None	126,730.00	0.900	74.30	(N/A)	(N/A)
RDF-2 (OUT)	Base	0	None	126,730.00	1.050	38.89	106.00	36,185.00

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ft^3)	Peak Time (hours)	Peak Flow (ft^3/s)	End Point	Node Flow Direction
Outlet-1	Pond Outlet	Upstream	126,730.00	0.900	74.30	RDF-2	Pond Inflow
Outlet-1	Pond Outlet	Outflow	126,730.00	1.050	38.89	RDF-2	Pond Outflow
Outlet-1	Pond Outlet	Link	126,730.00	1.050	38.89		
Outlet-1	Pond Outlet	Downstream	126,730.00	1.050	38.89	O-1	

Homestead_Basin2.ppc
Orifice Calculation

Element Details

Label	Composite Outlet Structure - 1	Notes	

Headwater Range

Headwater Type	Use Pond for Headwater Range	Maximum (Headwater)	106.00 ft
Pond	RDF-2	Increment (Headwater)	0.10 ft
Minimum (Headwater)	100.00 ft		

SpotElevation (ft)

Tailwater Setup

Tailwater Type	Free Outfall

Tailwater Tolerances

Maximum Iterations	30	Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft	Flow Tolerance (Minimum)	0.001 ft³/s
Headwater Tolerance (Maximum)	0.50 ft	Flow Tolerance (Maximum)	10.000 ft³/s
Tailwater Tolerance (Minimum)	0.01 ft		

Outlet Structure

Outlet Structure Type	Orifice

Outlet Structure (IDs and Direction)

Outlet ID	Orifice - 1	Downstream ID	Tailwater
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)

Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

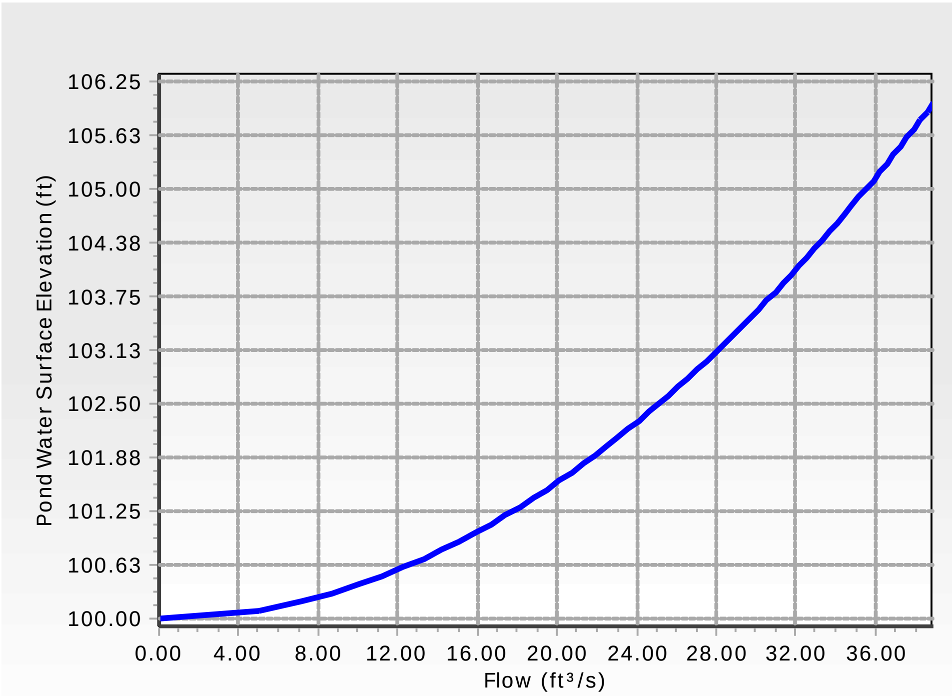
Outlet Structure (Orifice)

Orifice	Area Orifice	Orifice Area	3.30 ft²
Number of Openings	1	Orifice Orientation	Parallel Orifice
Orifice Coefficient	0.600		

Outlet Structure (Common)

Elevation	100.00 ft

Homestead_Basin2.ppc
Orifice Calculation



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
100.00	0.00	(N/A)	0.00
100.10	5.02	(N/A)	0.00
100.20	7.10	(N/A)	0.00
100.30	8.70	(N/A)	0.00
100.40	10.05	(N/A)	0.00
100.50	11.23	(N/A)	0.00
100.60	12.30	(N/A)	0.00
100.70	13.29	(N/A)	0.00
100.80	14.21	(N/A)	0.00
100.90	15.07	(N/A)	0.00
101.00	15.88	(N/A)	0.00
101.10	16.66	(N/A)	0.00
101.20	17.40	(N/A)	0.00
101.30	18.11	(N/A)	0.00
101.40	18.79	(N/A)	0.00

Homestead_Basin2.ppc
Orifice Calculation

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
101.50	19.45	(N/A)	0.00
101.60	20.09	(N/A)	0.00
101.70	20.71	(N/A)	0.00
101.80	21.31	(N/A)	0.00
101.90	21.89	(N/A)	0.00
102.00	22.46	(N/A)	0.00
102.10	23.02	(N/A)	0.00
102.20	23.56	(N/A)	0.00
102.30	24.09	(N/A)	0.00
102.40	24.61	(N/A)	0.00
102.50	25.11	(N/A)	0.00
102.60	25.61	(N/A)	0.00
102.70	26.10	(N/A)	0.00
102.80	26.58	(N/A)	0.00
102.90	27.05	(N/A)	0.00
103.00	27.51	(N/A)	0.00
103.10	27.96	(N/A)	0.00
103.20	28.41	(N/A)	0.00
103.30	28.85	(N/A)	0.00
103.40	29.29	(N/A)	0.00
103.50	29.71	(N/A)	0.00
103.60	30.14	(N/A)	0.00
103.70	30.55	(N/A)	0.00
103.80	30.96	(N/A)	0.00
103.90	31.37	(N/A)	0.00
104.00	31.77	(N/A)	0.00
104.10	32.16	(N/A)	0.00
104.20	32.55	(N/A)	0.00
104.30	32.94	(N/A)	0.00
104.40	33.32	(N/A)	0.00
104.50	33.69	(N/A)	0.00
104.60	34.07	(N/A)	0.00
104.70	34.43	(N/A)	0.00
104.80	34.80	(N/A)	0.00
104.90	35.16	(N/A)	0.00
105.00	35.52	(N/A)	0.00
105.10	35.87	(N/A)	0.00
105.20	36.22	(N/A)	0.00
105.30	36.57	(N/A)	0.00

Homestead_Basin2.ppc
Orifice Calculation

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
105.40	36.91	(N/A)	0.00
105.50	37.25	(N/A)	0.00
105.60	37.59	(N/A)	0.00
105.70	37.92	(N/A)	0.00
105.80	38.25	(N/A)	0.00
105.90	38.58	(N/A)	0.00
106.00	38.91	(N/A)	0.00

Computation Messages
H =.00
H =.10
H =.20
H =.30
H =.40
H =.50
H =.60
H =.70
H =.80
H =.90
H =1.00
H =1.10
H =1.20
H =1.30
H =1.40
H =1.50
H =1.60
H =1.70
H =1.80
H =1.90
H =2.00
H =2.10
H =2.20
H =2.30
H =2.40
H =2.50
H =2.60
H =2.70
H =2.80
H =2.90
H =3.00

Homestead_Basin2.ppc
Orifice Calculation

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Computation Messages
H =3.10
H =3.20
H =3.30
H =3.40
H =3.50
H =3.60
H =3.70
H =3.80
H =3.90
H =4.00
H =4.10
H =4.20
H =4.30
H =4.40
H =4.50
H =4.60
H =4.70
H =4.80
H =4.90
H =5.00
H =5.10
H =5.20
H =5.30
H =5.40
H =5.50
H =5.60
H =5.70
H =5.80
H =5.90
H =6.00

Homestead_Basin2.ppc
Orifice Calculation

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
100.00	0.00	(N/A)	0.00
100.10	5.02	(N/A)	0.00
100.20	7.10	(N/A)	0.00
100.30	8.70	(N/A)	0.00
100.40	10.05	(N/A)	0.00
100.50	11.23	(N/A)	0.00
100.60	12.30	(N/A)	0.00
100.70	13.29	(N/A)	0.00
100.80	14.21	(N/A)	0.00
100.90	15.07	(N/A)	0.00
101.00	15.88	(N/A)	0.00
101.10	16.66	(N/A)	0.00
101.20	17.40	(N/A)	0.00
101.30	18.11	(N/A)	0.00
101.40	18.79	(N/A)	0.00
101.50	19.45	(N/A)	0.00
101.60	20.09	(N/A)	0.00
101.70	20.71	(N/A)	0.00
101.80	21.31	(N/A)	0.00
101.90	21.89	(N/A)	0.00
102.00	22.46	(N/A)	0.00
102.10	23.02	(N/A)	0.00
102.20	23.56	(N/A)	0.00
102.30	24.09	(N/A)	0.00
102.40	24.61	(N/A)	0.00
102.50	25.11	(N/A)	0.00
102.60	25.61	(N/A)	0.00
102.70	26.10	(N/A)	0.00
102.80	26.58	(N/A)	0.00
102.90	27.05	(N/A)	0.00
103.00	27.51	(N/A)	0.00
103.10	27.96	(N/A)	0.00
103.20	28.41	(N/A)	0.00
103.30	28.85	(N/A)	0.00
103.40	29.29	(N/A)	0.00
103.50	29.71	(N/A)	0.00
103.60	30.14	(N/A)	0.00
103.70	30.55	(N/A)	0.00
103.80	30.96	(N/A)	0.00
103.90	31.37	(N/A)	0.00
104.00	31.77	(N/A)	0.00
104.10	32.16	(N/A)	0.00
104.20	32.55	(N/A)	0.00
104.30	32.94	(N/A)	0.00

Homestead_Basin2.ppc
Orifice Calculation

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
104.40	33.32	(N/A)	0.00
104.50	33.69	(N/A)	0.00
104.60	34.07	(N/A)	0.00
104.70	34.43	(N/A)	0.00
104.80	34.80	(N/A)	0.00
104.90	35.16	(N/A)	0.00
105.00	35.52	(N/A)	0.00
105.10	35.87	(N/A)	0.00
105.20	36.22	(N/A)	0.00
105.30	36.57	(N/A)	0.00
105.40	36.91	(N/A)	0.00
105.50	37.25	(N/A)	0.00
105.60	37.59	(N/A)	0.00
105.70	37.92	(N/A)	0.00
105.80	38.25	(N/A)	0.00
105.90	38.58	(N/A)	0.00
106.00	38.91	(N/A)	0.00

Contributing Structures
Orifice - 1
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Homestead_Basin2.ppc
Orifice Calculation

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Contributing Structures
Orifice - 1
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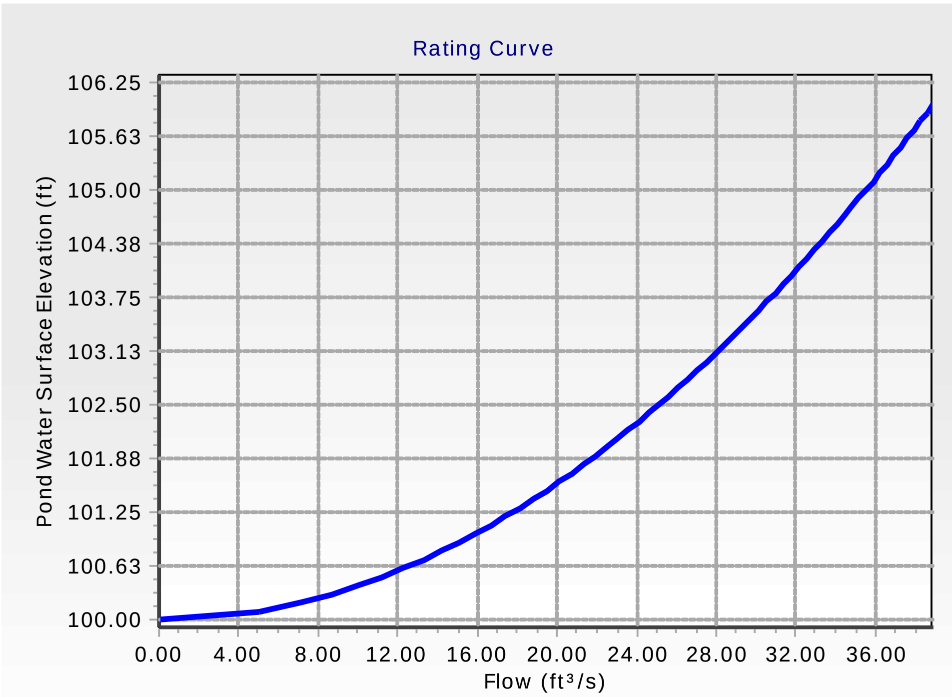
Homestead_Basin2.ppc
Orifice Calculation



Homestead_Basin3.ppc

Scenario Summary

ID	1
Label	Base
Notes	
Active Topology	Base Active Topology
Hydrology	Base Hydrology
Rainfall Runoff	Base Rainfall Runoff
Physical	Base Physical
Initial Condition	Base Initial Condition
Boundary Condition	Base Boundary Condition
Infiltration and Inflow	Base Infiltration and Inflow
Output	Base Output
User Data Extensions	Base User Data Extensions
PondPack Engine Calculation Options	Base Calculation Options

Output Summary

Output Increment	3.000 min	Duration	1,440.000 min

Rainfall Summary

Return Event Tag		Rainfall Type	(N/A)
Total Depth	(N/A) in	Storm Event	(N/A)

Executive Summary (Nodes)

Label	Scenario	Return Event (years)	Truncation	Hydrograph Volume (ft^3)	Time to Peak (min)	Peak Flow (ft^3/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ft^3)
DA3	Base	0	None	39,831.00	55.000	22.09	(N/A)	(N/A)
O-1	Base	0	None	39,784.00	63.000	11.80	(N/A)	(N/A)
RDF-3 (IN)	Base	0	None	39,784.00	54.000	20.88	(N/A)	(N/A)
RDF-3 (OUT)	Base	0	None	39,784.00	63.000	11.80	105.89	11,122.00

Executive Summary (Links)

Label	Type	Location	Hydrograph Volume (ft^3)	Peak Time (min)	Peak Flow (ft^3/s)	End Point	Node Flow Direction
Outlet-3	Pond Outlet	Upstream	39,784.00	54.000	20.88	RDF-3	Pond Inflow
Outlet-3	Pond Outlet	Outflow	39,784.00	63.000	11.80	RDF-3	Pond Outflow
Outlet-3	Pond Outlet	Link	39,784.00	63.000	11.80		
Outlet-3	Pond Outlet	Downstream	39,784.00	63.000	11.80	O-1	

Homestead_Basin3.ppc
Orifice Calculation

Element Details

Label	Composite Outlet Structure - 1	Notes	

Headwater Range

Headwater Type	Use Pond for Headwater Range	Maximum (Headwater)	106.00 ft
Pond	RDF-3	Increment (Headwater)	0.10 ft
Minimum (Headwater)	100.00 ft		

SpotElevation (ft)

Tailwater Setup

Tailwater Type	Free Outfall

Tailwater Tolerances

Maximum Iterations	30	Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft	Flow Tolerance (Minimum)	0.001 ft³/s
Headwater Tolerance (Maximum)	0.50 ft	Flow Tolerance (Maximum)	10.000 ft³/s
Tailwater Tolerance (Minimum)	0.01 ft		

Outlet Structure

Outlet Structure Type	Orifice

Outlet Structure (IDs and Direction)

Outlet ID	Orifice - 1	Downstream ID	Tailwater
Flow Direction	Forward Flow Only	Notes	

Outlet Structure (Advanced)

Elevation (On)	0.00 ft	Elevation (Off)	0.00 ft

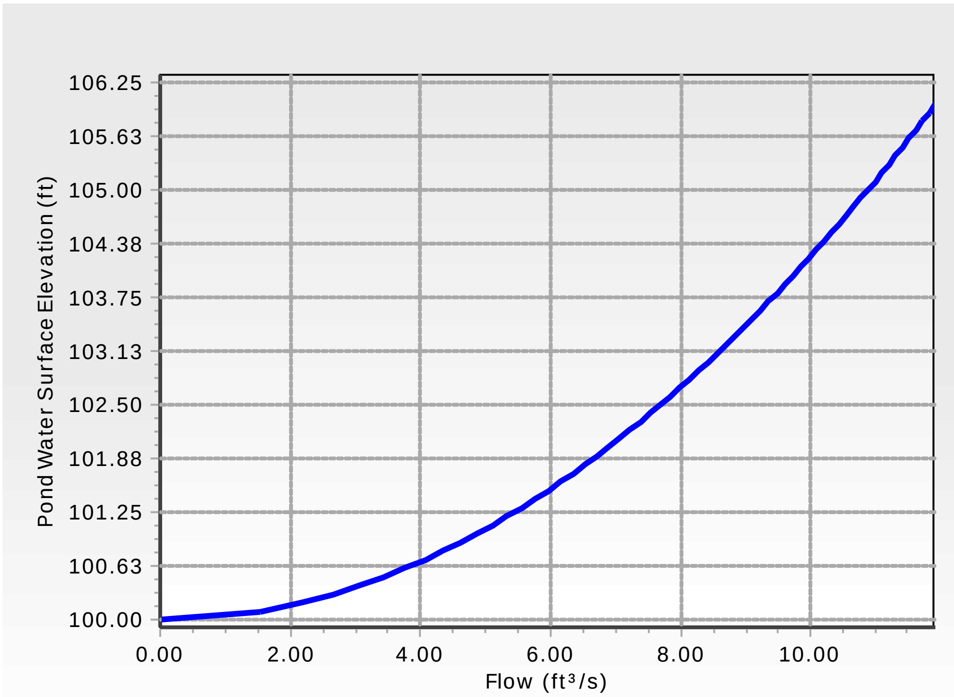
Outlet Structure (Orifice)

Orifice	Area Orifice	Orifice Area	1.01 ft²
Number of Openings	1	Orifice Orientation	Parallel Orifice
Orifice Coefficient	0.600		

Outlet Structure (Common)

Elevation	100.00 ft

Homestead_Basin3.ppc
Orifice Calculation



RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
100.00	0.00	(N/A)	0.00
100.10	1.54	(N/A)	0.00
100.20	2.17	(N/A)	0.00
100.30	2.66	(N/A)	0.00
100.40	3.07	(N/A)	0.00
100.50	3.44	(N/A)	0.00
100.60	3.77	(N/A)	0.00
100.70	4.07	(N/A)	0.00
100.80	4.35	(N/A)	0.00
100.90	4.61	(N/A)	0.00
101.00	4.86	(N/A)	0.00
101.10	5.10	(N/A)	0.00
101.20	5.33	(N/A)	0.00
101.30	5.54	(N/A)	0.00
101.40	5.75	(N/A)	0.00

Homestead_Basin3.ppc
Orifice Calculation

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
101.50	5.95	(N/A)	0.00
101.60	6.15	(N/A)	0.00
101.70	6.34	(N/A)	0.00
101.80	6.52	(N/A)	0.00
101.90	6.70	(N/A)	0.00
102.00	6.87	(N/A)	0.00
102.10	7.04	(N/A)	0.00
102.20	7.21	(N/A)	0.00
102.30	7.37	(N/A)	0.00
102.40	7.53	(N/A)	0.00
102.50	7.69	(N/A)	0.00
102.60	7.84	(N/A)	0.00
102.70	7.99	(N/A)	0.00
102.80	8.13	(N/A)	0.00
102.90	8.28	(N/A)	0.00
103.00	8.42	(N/A)	0.00
103.10	8.56	(N/A)	0.00
103.20	8.70	(N/A)	0.00
103.30	8.83	(N/A)	0.00
103.40	8.96	(N/A)	0.00
103.50	9.09	(N/A)	0.00
103.60	9.22	(N/A)	0.00
103.70	9.35	(N/A)	0.00
103.80	9.48	(N/A)	0.00
103.90	9.60	(N/A)	0.00
104.00	9.72	(N/A)	0.00
104.10	9.84	(N/A)	0.00
104.20	9.96	(N/A)	0.00
104.30	10.08	(N/A)	0.00
104.40	10.20	(N/A)	0.00
104.50	10.31	(N/A)	0.00
104.60	10.43	(N/A)	0.00
104.70	10.54	(N/A)	0.00
104.80	10.65	(N/A)	0.00
104.90	10.76	(N/A)	0.00
105.00	10.87	(N/A)	0.00
105.10	10.98	(N/A)	0.00
105.20	11.09	(N/A)	0.00
105.30	11.19	(N/A)	0.00

Homestead_Basin3.ppc
Orifice Calculation

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
105.40	11.30	(N/A)	0.00
105.50	11.40	(N/A)	0.00
105.60	11.50	(N/A)	0.00
105.70	11.61	(N/A)	0.00
105.80	11.71	(N/A)	0.00
105.90	11.81	(N/A)	0.00
106.00	11.91	(N/A)	0.00

Computation Messages
H =.00
H =.10
H =.20
H =.30
H =.40
H =.50
H =.60
H =.70
H =.80
H =.90
H =1.00
H =1.10
H =1.20
H =1.30
H =1.40
H =1.50
H =1.60
H =1.70
H =1.80
H =1.90
H =2.00
H =2.10
H =2.20
H =2.30
H =2.40
H =2.50
H =2.60
H =2.70
H =2.80
H =2.90
H =3.00

Homestead_Basin3.ppc
Orifice Calculation

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Orifice - 1 (Orifice-Area)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Computation Messages
H =3.10
H =3.20
H =3.30
H =3.40
H =3.50
H =3.60
H =3.70
H =3.80
H =3.90
H =4.00
H =4.10
H =4.20
H =4.30
H =4.40
H =4.50
H =4.60
H =4.70
H =4.80
H =4.90
H =5.00
H =5.10
H =5.20
H =5.30
H =5.40
H =5.50
H =5.60
H =5.70
H =5.80
H =5.90
H =6.00

Homestead_Basin3.ppc
Orifice Calculation

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
100.00	0.00	(N/A)	0.00
100.10	1.54	(N/A)	0.00
100.20	2.17	(N/A)	0.00
100.30	2.66	(N/A)	0.00
100.40	3.07	(N/A)	0.00
100.50	3.44	(N/A)	0.00
100.60	3.77	(N/A)	0.00
100.70	4.07	(N/A)	0.00
100.80	4.35	(N/A)	0.00
100.90	4.61	(N/A)	0.00
101.00	4.86	(N/A)	0.00
101.10	5.10	(N/A)	0.00
101.20	5.33	(N/A)	0.00
101.30	5.54	(N/A)	0.00
101.40	5.75	(N/A)	0.00
101.50	5.95	(N/A)	0.00
101.60	6.15	(N/A)	0.00
101.70	6.34	(N/A)	0.00
101.80	6.52	(N/A)	0.00
101.90	6.70	(N/A)	0.00
102.00	6.87	(N/A)	0.00
102.10	7.04	(N/A)	0.00
102.20	7.21	(N/A)	0.00
102.30	7.37	(N/A)	0.00
102.40	7.53	(N/A)	0.00
102.50	7.69	(N/A)	0.00
102.60	7.84	(N/A)	0.00
102.70	7.99	(N/A)	0.00
102.80	8.13	(N/A)	0.00
102.90	8.28	(N/A)	0.00
103.00	8.42	(N/A)	0.00
103.10	8.56	(N/A)	0.00
103.20	8.70	(N/A)	0.00
103.30	8.83	(N/A)	0.00
103.40	8.96	(N/A)	0.00
103.50	9.09	(N/A)	0.00
103.60	9.22	(N/A)	0.00
103.70	9.35	(N/A)	0.00
103.80	9.48	(N/A)	0.00
103.90	9.60	(N/A)	0.00
104.00	9.72	(N/A)	0.00
104.10	9.84	(N/A)	0.00
104.20	9.96	(N/A)	0.00
104.30	10.08	(N/A)	0.00

Homestead_Basin3.ppc
Orifice Calculation

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
104.40	10.20	(N/A)	0.00
104.50	10.31	(N/A)	0.00
104.60	10.43	(N/A)	0.00
104.70	10.54	(N/A)	0.00
104.80	10.65	(N/A)	0.00
104.90	10.76	(N/A)	0.00
105.00	10.87	(N/A)	0.00
105.10	10.98	(N/A)	0.00
105.20	11.09	(N/A)	0.00
105.30	11.19	(N/A)	0.00
105.40	11.30	(N/A)	0.00
105.50	11.40	(N/A)	0.00
105.60	11.50	(N/A)	0.00
105.70	11.61	(N/A)	0.00
105.80	11.71	(N/A)	0.00
105.90	11.81	(N/A)	0.00
106.00	11.91	(N/A)	0.00

Contributing Structures
Orifice - 1
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Homestead_Basin3.ppc
Orifice Calculation

Composite Rating Table
Tailwater Elevation = Free Outfall (Composite Outlet Structure - 1)

Contributing Structures
Orifice - 1
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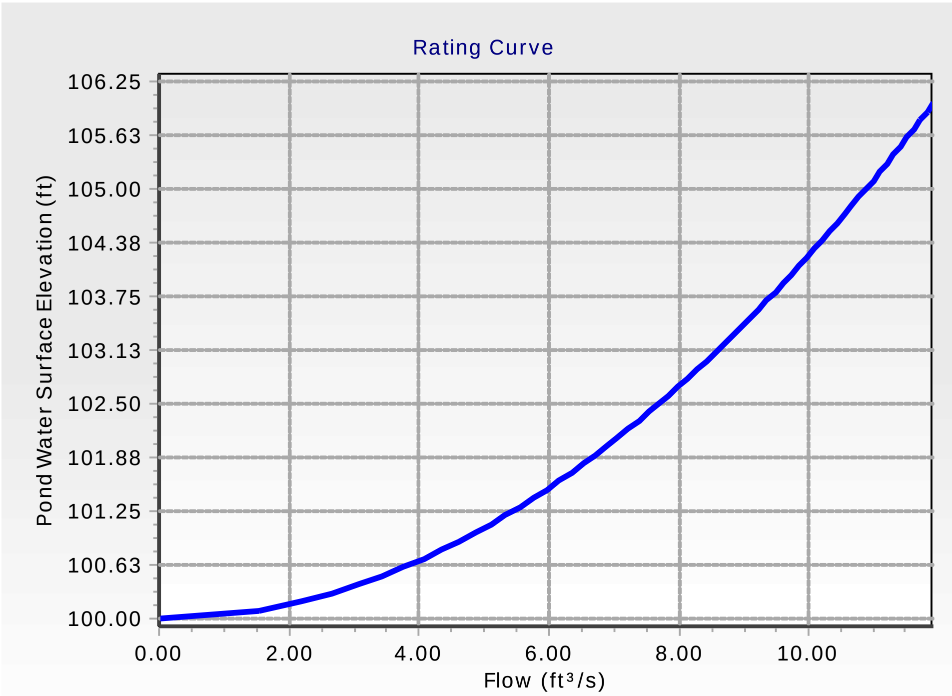
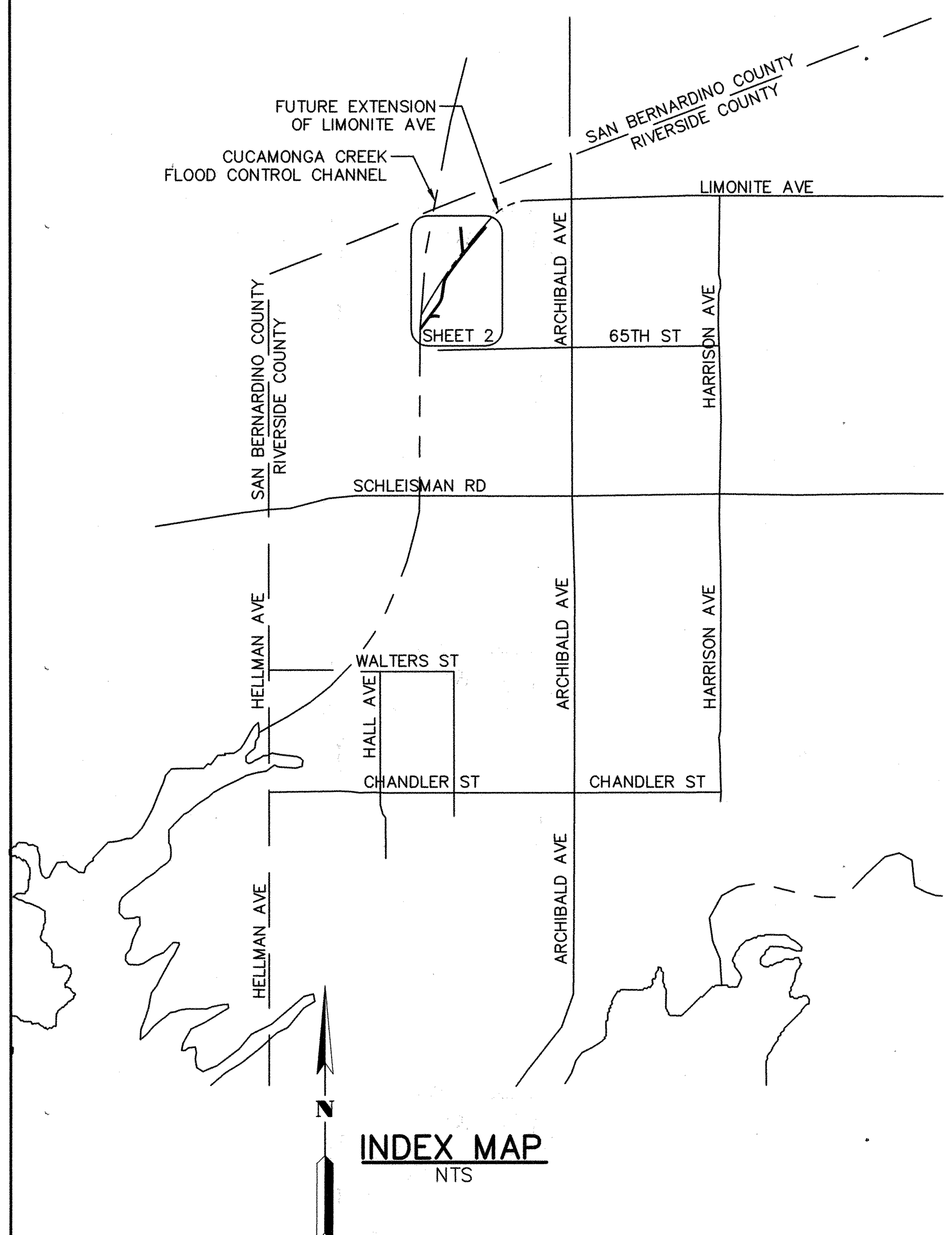
Homestead_Basin3.ppc
Orifice Calculation



Appendix E – Riverside County Flood Control Lateral "F-3" as built plans

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT



INDEX MAP
NTS

GENERAL NOTES

1. THE CONTRACTOR SHALL CONSTRUCT THE FLOOD CONTROL IMPROVEMENTS SHOWN ON THE DRAWINGS IN CONFORMANCE WITH THE REQUIREMENTS OF THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT'S M.O.U. STANDARD SPECIFICATIONS DATED JUNE 24, 2008, AND RCFC&WCD STANDARD MANUAL. FOR THE LATEST DRAWINGS OF THE STANDARD MANUAL, PLEASE REFER TO THE "PUBLICATIONS AND RECORDS" PAGE FOUND ON THE DISTRICT'S WEBSITE.
2. CONTACT THE ENCROACHMENT PERMIT ENGINEER AT 951.955.1266 IF AN ENCROACHMENT PERMIT IS REQUIRED FROM RIVERSIDE COUNTY FLOOD CONTROL. AFTER THE PERMIT IS ISSUED THE DISTRICT MUST BE NOTIFIED ONE WEEK PRIOR TO CONSTRUCTION.
3. CONTACT CONTRACT ADMINISTRATION AT 951.955.1288 IF CONSTRUCTION INSPECTION WILL BE PERFORMED BY RIVERSIDE COUNTY FLOOD CONTROL. THE DISTRICT MUST BE NOTIFIED TWENTY DAYS (20) PRIOR TO CONSTRUCTION.
4. ALL STATIONING REFERS TO CENTERLINE OF CONSTRUCTION UNLESS OTHERWISE NOTED.
5. STATIONING FOR LATERALS AND CONNECTOR PIPE REFER TO THE CENTERLINE INTERSECTION STATIONS.
6. FORTY-EIGHT HOURS BEFORE EXCAVATION, CALL UNDERGROUND SERVICE ALERT 1.800.227.2600.
7. ALL ELEVATIONS SHOWN ARE IN FEET AND DECIMALS THEREOF BASED ON THE NORTH GEODETIC VERTICAL DATUM (NGVD 29). (NAVD88 = NGVD29+2.42 FT)
8. ALL COORDINATES ARE SHOWN IN FEET AND DECIMALS THEREOF BASED ON THE NORTH AMERICAN DATUM (NAD 83), CALIFORNIA COORDINATE SYSTEM (CCS), ZONE 6 AND EPOCH 2007.00.
9. ALL CROSS SECTIONS ARE TAKEN LOOKING DOWNSTREAM.
10. ELEVATIONS OF UTILITIES ARE APPROXIMATE UNLESS OTHERWISE NOTED.
11. UNLESS OTHERWISE SPECIFIED, MINIMUM STREET RECONSTRUCTION SHALL BE 4" TYPE "B" HOT MIX ASPHALT OVER 6" CLASS 2 AGGREGATE BASE OR AS SPECIFIED BY THE ENGINEER.
12. OPENINGS RESULTING FROM THE CUTTING OR PARTIAL REMOVAL OF EXISTING CULVERTS, PIPES OR SIMILAR STRUCTURES TO BE ABANDONED SHALL BE SEALED WITH 6" OF CLASS "B" CONCRETE.
13. PIPE CONNECTED TO THE MAINLINE PIPE SHALL CONFORM TO JUNCTION STRUCTURE NO.4 (JS 229) UNLESS OTHERWISE NOTED.
14. PIPE BEDDING SHALL CONFORM TO RCFC&WCD STD. DWG. NO. M815 EXCEPT FOR COVER <2 FEET. FOR COVER <2 FEET, CONCRETE SLURRY (2000 PSI- 2 SACK) SHALL BE USED. THE ENTIRE TRENCH SHALL BE SLURRY EXTENDING 4 INCHES MINIMUM AND 12 INCHES MAXIMUM ABOVE THE TOP OF THE PIPE.
15. BH-1 INDICATES SOIL BORING LOCATIONS BASED ON THE SOILS REPORT DATED 06/13/2014. LOCATIONS SHOWN ARE APPROXIMATE.
16. "V" IS THE DEPTH OF CATCH BASINS MEASURED FROM THE TOP OF CURB TO INVERT OF CONNECTOR PIPE.
17. CATCH BASINS SHALL BE LOCATED SO THAT LOCAL DEPRESSION SHALL BEGIN AT EXISTING CURB RETURN JOINT, UNLESS OTHERWISE SPECIFIED.
18. ALL CURBS, GUTTERS, SIDEWALKS, DRIVEWAYS AND OTHER EXISTING IMPROVEMENTS TO BE RECONSTRUCTED IN KIND AND AT THE SAME ELEVATION AND LOCATION AS THE EXISTING IMPROVEMENTS UNLESS OTHERWISE NOTED.
19. STANDARD DRAWINGS CALLED FOR ON THE PLAN AND PROFILE SHALL CONFORM TO DISTRICT STANDARD DRAWINGS UNLESS NOTED OTHERWISE.
20. THE CONTRACTOR IS REQUIRED TO CALL ALL UTILITY AGENCIES REGARDING TEMPORARY SHORING AND SUPPORT REQUIREMENTS FOR THE VARIOUS UTILITY LINES SHOWN ON THESE PLANS.
21. DURING ROUGH GRADING OPERATIONS AND PRIOR TO CONSTRUCTION OF PERMANENT DRAINAGE STRUCTURES, TEMPORARY DRAINAGE CONTROL SHOULD BE PROVIDED TO PREVENT PONDING WATER AND DAMAGE TO ADJACENT PROPERTIES.
22. APPROVAL OF THESE PLANS BY THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT DOES NOT RELIEVE THE DEVELOPER'S ENGINEER OF RESPONSIBILITY FOR THE ENGINEERING DESIGN. IF FIELD CHANGES ARE REQUIRED, IT WILL BE THE RESPONSIBILITY OF THE DESIGN ENGINEER TO MAKE THE NECESSARY CORRECTIONS
23. THE CONTRACTOR OR DEVELOPER SHALL SECURE ALL REQUIRED ENCROACHMENT AND/OR STATE AND FEDERAL REGULATORY PERMITS PRIOR TO THE COMMENCEMENT OF ANY WORK.
24. THE CONCRETE COATING ON THE INSIDE OF ALL REINFORCED CONCRETE PIPES MUST BE INCREASED TO PROVIDE A MINIMUM OF 1-1/2 INCHES OVER THE REINFORCING AND INCREASED TO A MINIMUM OF 3-1/2 INCHES OVER REINFORCING FOR BOX CULVERT, WHEN DESIGN VELOCITIES EXCEED 20 FEET PER SECOND. THE CONCRETE DESIGN STRENGTH IN THESE REACHES SHALL BE F'C=5,000 PSI FOR VELOCITIES EXCEEDING 20 FEET PER SECOND AND F'C=6,000 PSI FOR VELOCITIES EXCEEDING 30 FEET PER SECOND.
25. CONSTRUCTION JOINTS FOR CALTRANS STANDARD REINFORCED CONCRETE BOX SHALL BE PLACED ACCORDING TO RCFC&WCD STANDARD DRAWING NO. BOX401.

INDEX

SHEET NO.

R.C.F.C. & W.C.D. STANDARD DRAWINGS

MANHOLE NO. 4....................RCFCD MH 254
MANHOLE SHAFT....................RCFCD MH 257
STANDARD DROP STEP....................RCFCD MH 259
24" MANHOLE FRAME
AND COVER....................RCFCD MH 260
BULKHEAD....................RCFCD M816

CALTRANS STANDARD DRAWINGS

CMP RISER....................CALTRANS D93C
EXCAVATION AND BACKFILL
(IN SBCFCD/USACE R/W ONLY)..........CALTRANS A62D

S.B.C.F.C.D. STANDARD DRAWINGS

CONCRETE APRON....................SBCFCD D260

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER — DATE: 2/7/17

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4218
Tel: (619) 234-9411
PREPARED BY:
KATHRYN DANEKER, R.C.E. 81398 — DATE 12/16/2016

REGISTERED PROFESSIONAL ENGINEER · KATHRYN DANEKER · No. 81398 · CIVIL · STATE OF CALIFORNIA

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY BM NO. M.L. 34-1-64 AT THE N.E. COR OF THE "T" INT. OF ORANGE ST AND SUMNER AVE, 84.0 FEET E'LY AND 22.0 FEET S'LY OF THE CENTERLINE INT. OF SUMNER AVE AND ORANGE ST. TOP OF CURB 10 FEET E'LY OF THE S.E. ECR, A 3" ALUMINUM DISK @ TOP OF CURB STAMPED "M.L. 34-1 RESET"
ELEVATION 607.064 FEET
DATUM: NGVD 29 (NAVD88=NGVD29+2.42')

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

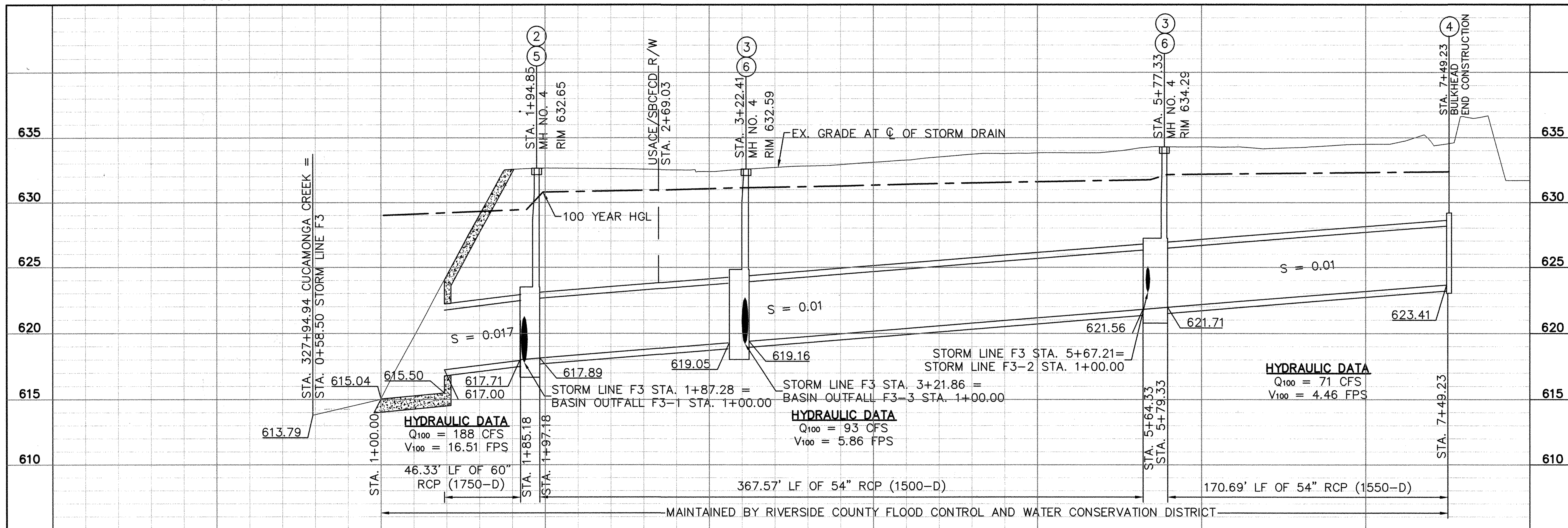
DESIGNED BY: KFD
DRAWN BY: WP
DATE DRAWN: 05/28/2014
CHECKED BY: JH

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: PLANNING ENGINEER DATE: 6/19/2017
APPROVED BY: CHIEF ENGINEER DATE: 6/20/2017

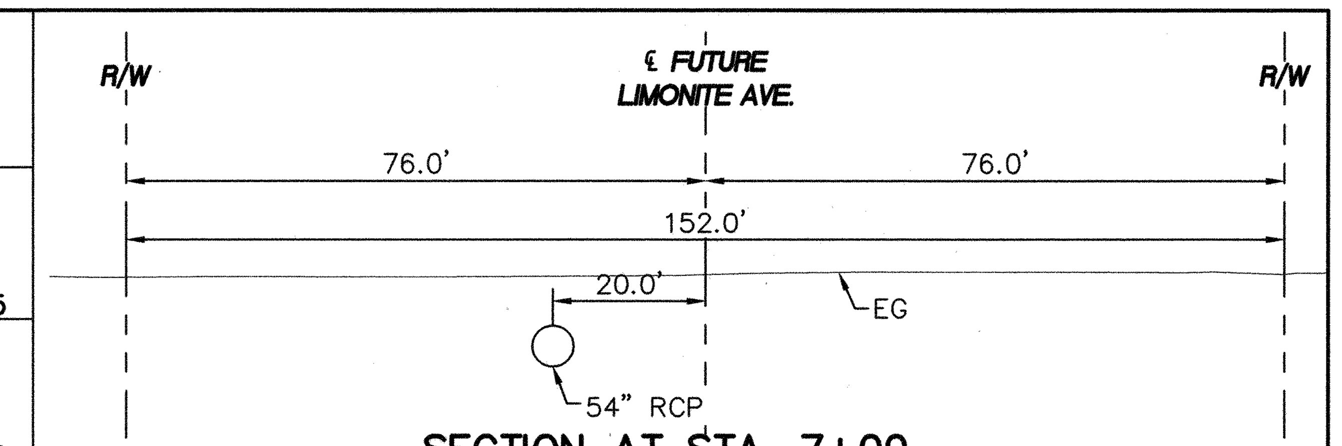
PM 35865

EASTVALE MDP LINE F-3
TITLE SHEET

PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 1 OF 18



PROFILE
VERTICAL SCALE: 1" = 5'



SECTION AT STA. 7+00
TYPICAL FROM STA. 4+50.00 TO 7+97.43

GRAPHIC SCALE IN FEET
0 10 20 40

CONSTRUCTION NOTES

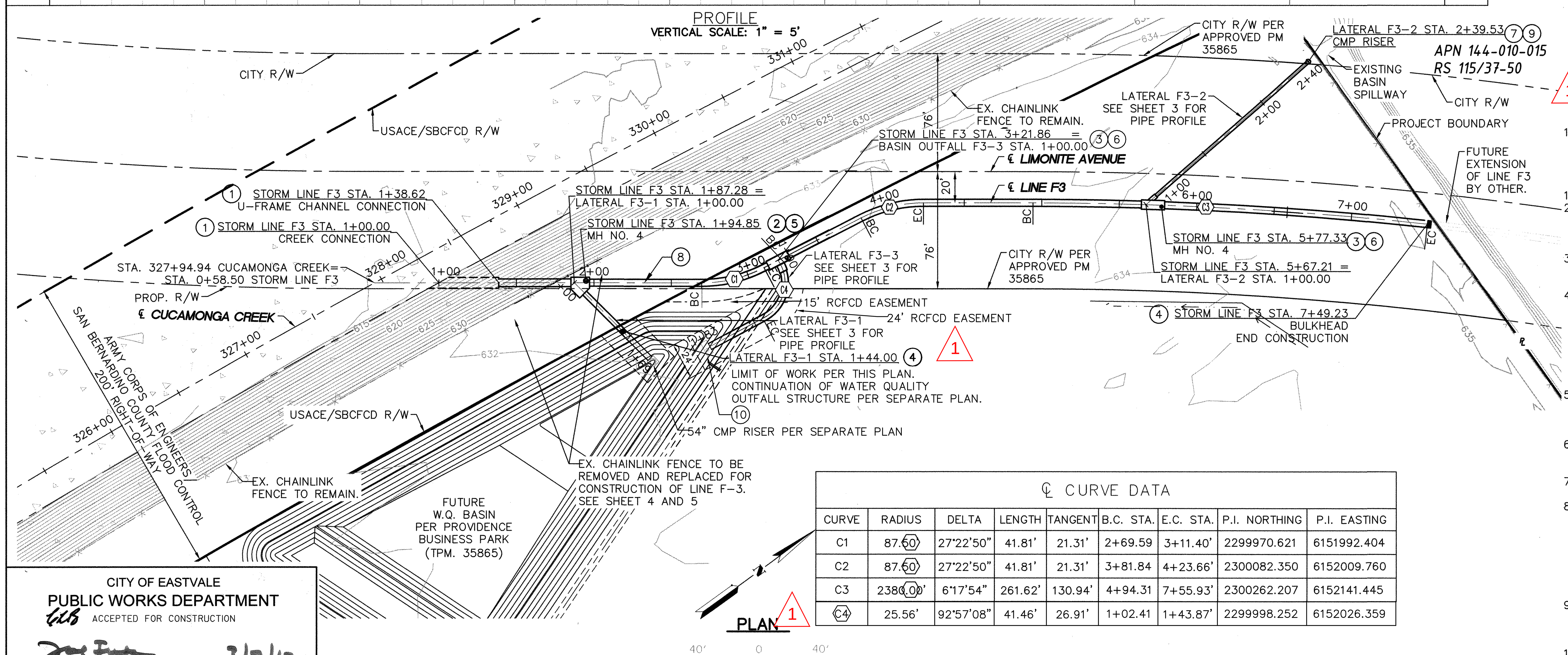
1. CONSTRUCT CUCAMONGA CREEK CONNECTION PER SHEET 5.
2. CONSTRUCT MANHOLE NO. 4 AND JUNCTION STRUCTURE PER DETAILS ON SHEET 7.
3. CONSTRUCT MANHOLE NO. 4 PER RCFCD STD. MH 254. A=43', B=24", C=7', D1=54", D2=54"
4. CONSTRUCT BULKHEAD PER RCFCD STD. M816.
5. CONSTRUCT A 8" THICK 5' SQUARE CONCRETE APRON AROUND MANHOLE PER SBCFCD STD. D260.
6. CONSTRUCT A 6" THICK 7' SQUARE CONCRETE APRON AROUND MANHOLE. PLACE #4 BARS 18" ON CENTER BOTH WAYS.
7. CONSTRUCT 36" CMP RISER PER 2010 CALTRANS STD. PLAN D93C TYPE A.
8. RCP PIPE EXCAVATION, BEDDING, AND BACKFILL WITHIN USACE/SBCFD R/W TO BE INSTALLED PER CALTRANS STD. PLAN A62D.
9. GRADE TO DRAIN TO PROVIDE TEMPORARY COLLECTION FOR EXISTING SPILLWAY.
10. CONSTRUCT CONCRETE DROP INLET PER RCFCD STD. CB 110 H=1.25', V=7.96', W=8', D=48" 1

GENERAL NOTES

1. PROPOSED RIVERSIDE COUNTY FLOOD CONTROL DISTRICT STORM LINE F3 PER CONDITION OF APPROVAL FOR TENTATIVE PARCEL MAP 35865.

USACE/SBCFCD R/W GENERAL NOTES

1. PROTECT UTILITY WITHIN THE USACE RIGHT-OF-WAY.
2. PROVISIONS SHALL BE MADE TO PREVENT DEBRIS FROM FALLING INTO THE CHANNEL DURING CONSTRUCTION. COMPACTION EQUIPMENT USED TO PLACE BACKFILL BEHIND CHANNEL WALL MUST NOT EXCEED 35,000 POUNDS INCLUDING DYNAMIC FORCES FROM VIBRATOR COMPACTOR.
3. NO EQUIPMENT IN EXCESS OF H-10 HIGHWAY LOADING (AASHTO), AND NO STOCKPILING OF MATERIAL WILL BE PERMITTED ALONG THE CHANNEL WITHIN A DISTANCE OF ONE-HALF WALL HEIGHT.
4. NO EQUIPMENT IN EXCESS OF H-20 HIGHWAY LOADING WILLBE PERMITTED TO OPERATE ON THE INVERT OF THE CHANNEL. ONLY RUBBER-TIRED, LEGALLY LOADED EQUIPMENT SHALL BE OPERATED ON THE EXPOSED CHANNEL INVERT. IF STEEL CRAWLER TYPE EQUIPMENT IS USED, WOODEN MATTING SHALL BE PROVIDED OVER THE INVERT IN THE OPERATING AREA. LOADS FROM TRACK VEHICLES SHALL NOT EXCEED 3000 PSF ON A SURFACE AT THE BOTTOM OF THE INVERT SLAB.
5. MATERIAL REMOVED FROM THE EXCAVATION SHALL BE STOCKPILED AND USED AS BACKFILL. BACKFILL SHALL BE PLACED AT A MINIMUM 90 PERCENT OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D1557.
6. THE EXCAVATION OF FILL WITHIN 5 FOOT ON ALL SIDES OF THE STRUCTURE PERIMETER EDGE OF THE STRUCTURE WILL BE DONE BY HAND.
7. THE MATERIAL AND METHOD OF PLACEMENT USED IN THE ORIGINAL CHANNEL CONSTRUCTION SHALL BE SPECIFIED IN THE PROJECT PLANS.
8. PRIOR TO CONSTRUCTION ACTIVITIES, THE CONTRACTOR SHALL IDENTIFY THE LOCATIONS OF THE EXISTING DRAINAGE STRUCTURES. THE CONTRACTOR SHALL STAKE OUT THE STRUCTURE LIMITS AT THE GROUND SURFACE. IF FILTER OR DRAINAGE MATERIALS ARE DISTURBED DURING INSTALLATION OF SIDE DRAINS, THE MATERIAL SHALL BE REPLACED IN-KIND AND AT NO COST TO THE GOVERNMENT IN A MANNER WHICH WILL PERMIT PROPER FUNCTIONING OF THE SUBDRAIN SYSTEM.
9. CONCRETE MIX DESIGNS SHALL BE SUBMITTED TO SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT FOR REVIEW AND APPROVAL AT LEAST 72 HOURS PRIOR TO CONCRETE PLACEMENT WITHIN DISTRICT RIGHT-OF-WAY.
10. ANY PORTION OF THE CHANNEL TO BE REMOVED SHALL BE REPLACED IN-KIND AND AT NO COST TO THE GOVERNMENT IN A MANNER WHICH WILL PERMIT PROPER FUNCTIONING OF THE CHANNEL.



℄ CURVE DATA

CURVE	RADIUS	DELTA	LENGTH	TANGENT	B.C. STA.	E.C. STA.	P.I. NORTHING	P.I. EASTING
C1	87.50	27°22'50"	41.81'	21.31'	2+69.59	3+11.40'	2299970.621	6151992.404
C2	87.50	27°22'50"	41.81'	21.31'	3+81.84	4+23.66'	2300082.350	6152009.760
C3	2380.00'	6°17'54"	261.62'	130.94'	4+94.31	7+55.93'	2300262.207	6152141.445
C4	25.56'	92°57'08"	41.46'	26.91'	1+02.41	1+43.87'	2299998.252	6152026.359

PLAN 1

40' 0 40'

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION

3/7/17
JOE INDRAWAN, CITY ENGINEER DATE:

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4216
Tel: (619) 234-9411
PREPARED BY:

12/16/2016
KATHRYN DANEKER, R.C.E. 81398 DATE

REGISTERED PROFESSIONAL ENGINEER
KATHRYN DANEKER
No. 81398
CIVIL
STATE OF CALIFORNIA

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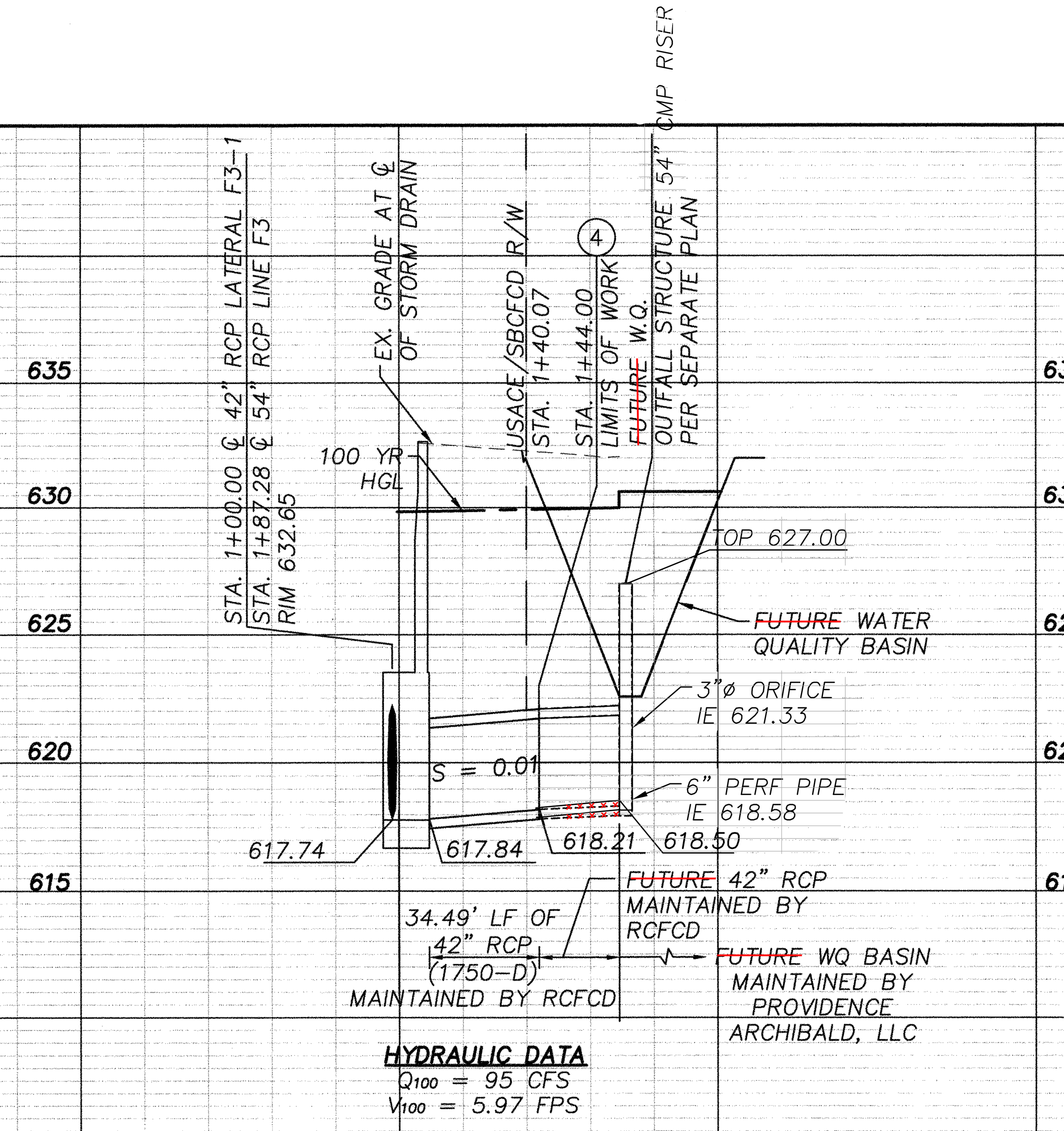
DRAWN BY: WP
DATE DRAWN: 05/28/2014
CHECKED BY: JH

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY:
DATE: 6/13/2017
APPROVED BY:
DATE: 6/19/2017

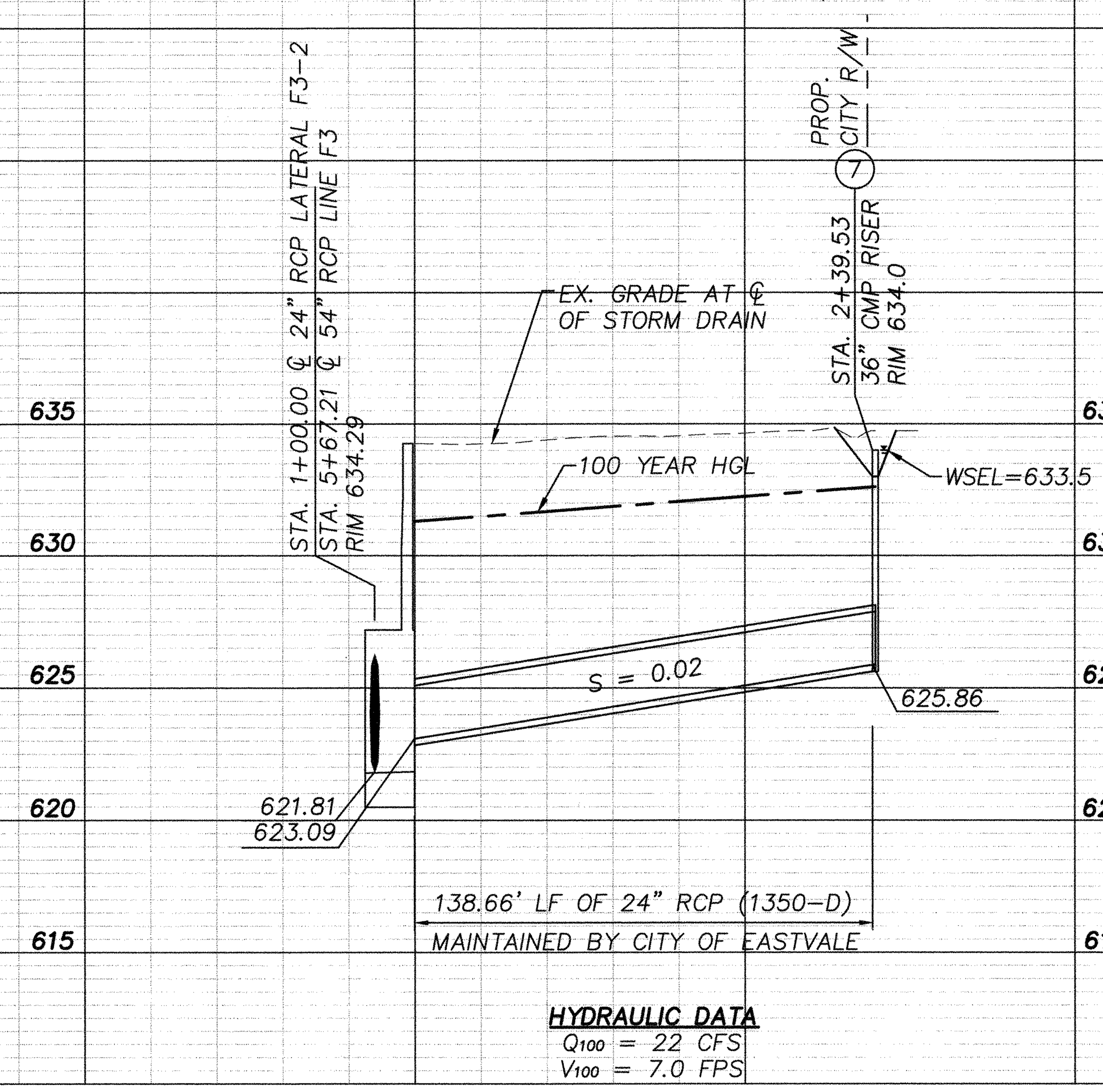
EASTVALE MDP LINE F-3
PLAN AND PROFILE

PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 2 OF 18

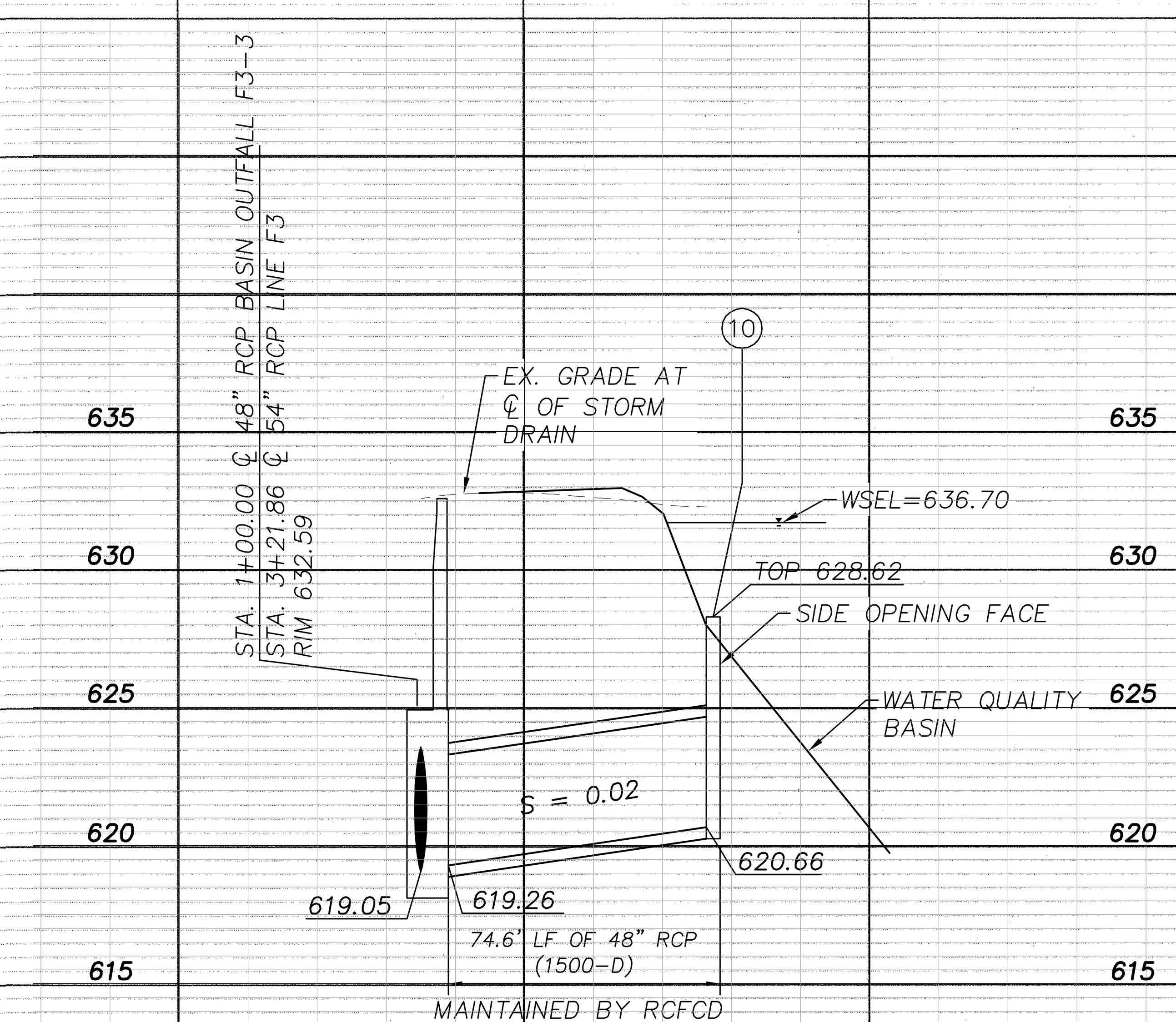
STORM LINE F3-3 BASIN OUTFALL STRUCTURES



PROFILE: LAT. F3-1
VERTICAL SCALE: 1" = 5'



PROFILE: LAT. F3-2
VERTICAL SCALE: 1" = 5'



PROFILE: BASIN OUTFALL F3-3 1
VERTICAL SCALE: 1" = 5'

40' 0 40'

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER
DATE: 3/7/17

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4216
Tel: (619) 234-9411
PREPARED BY:
KATHRYN DANEKER, R.C.E. 81398 DATE 12/16/2016

REGISTERED PROFESSIONAL ENGINEER KATHRYN DANEKER No. 81398 CIVIL STATE OF CALIFORNIA

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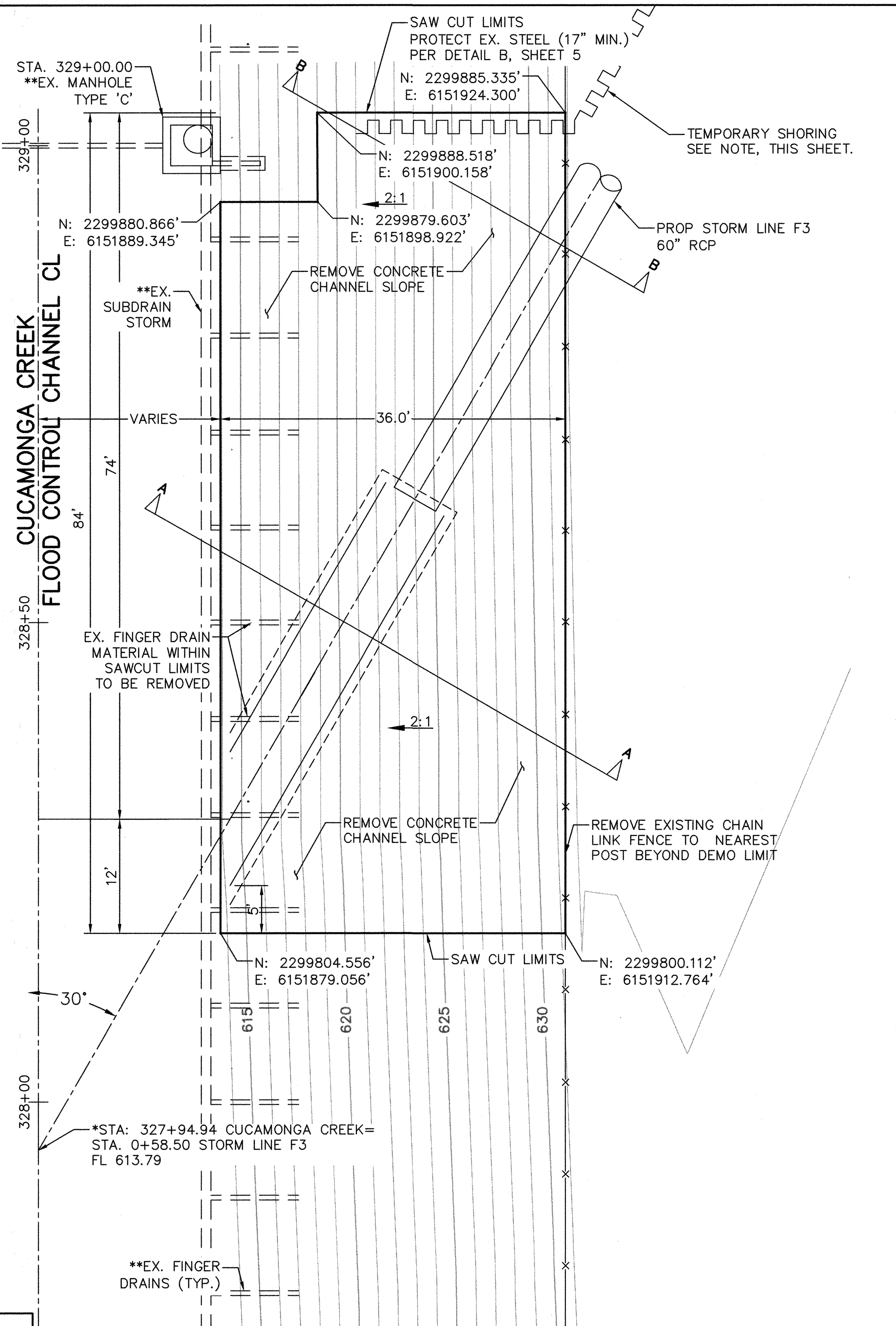
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: Deborah de Chambeau DATE: 6/13/2017
APPROVED BY: Mark H. Wills DATE: 6/19/2017

EASTVALE MDP LINE F-3
LATERAL PROFILE

PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 3 OF 18

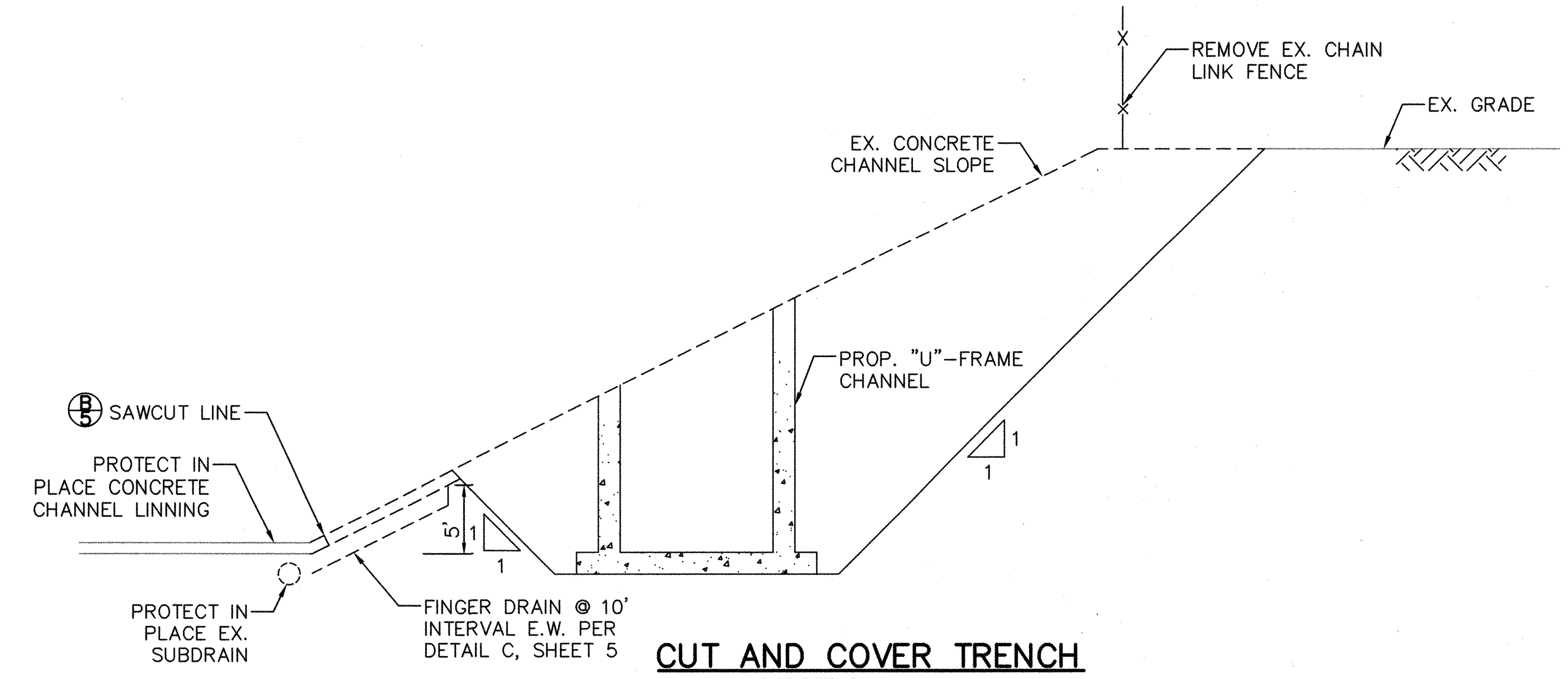
1 STORM LINE F3-3 BASIN OUTFALL STRUCTURES



*CUCAMONGA CREEK CENTERLINE TO BE FIELD VERIFIED AT THE TIME OF CONSTRUCTION
**EXISTING SUB-DRAIN SYSTEM PER 224/198A AND 224/199 TO BE PROTECTED IN PLACE UNLESS OTHERWISE NOTED.

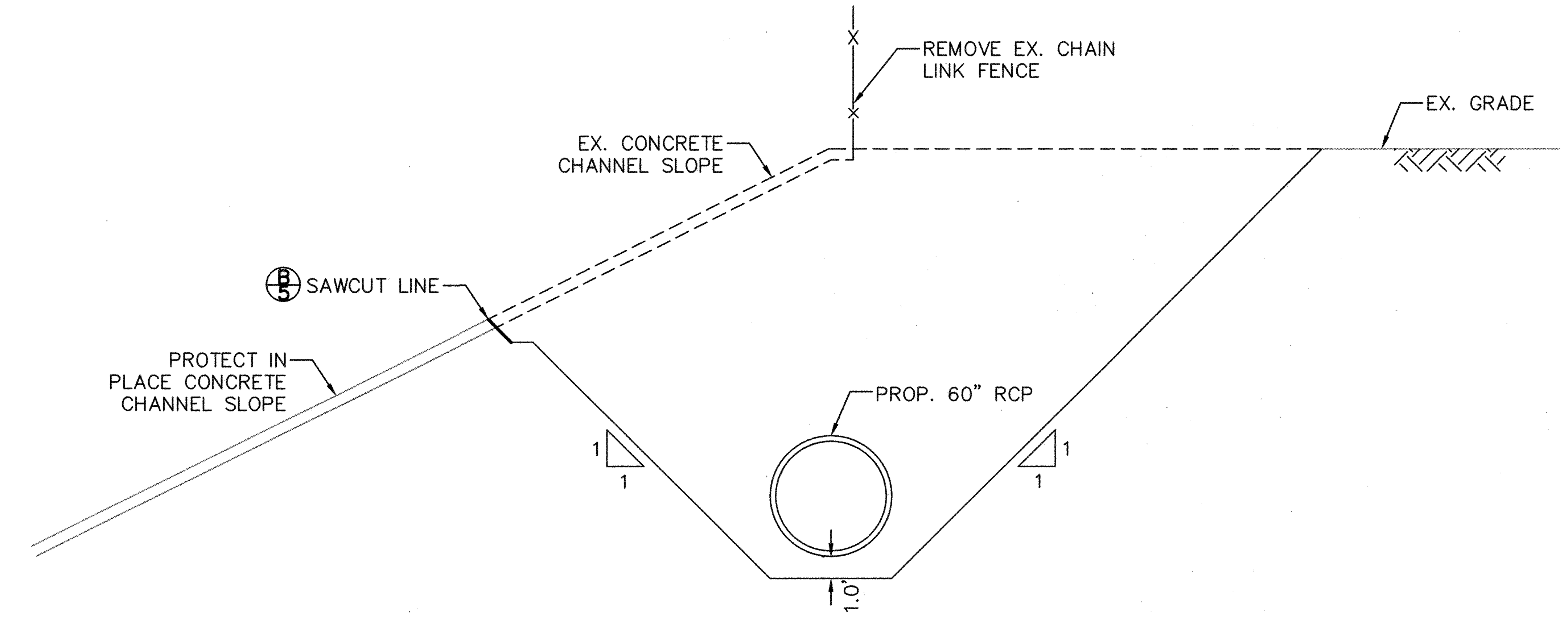
A CUCAMONGA CREEK CONNECTION DEMOLITION LAYOUT

N.T.S.



CUT AND COVER TRENCH SECTION A–A

N.T.S.



CUT AND COVER TRENCH SECTION B–B

N.T.S.

TEMPORARY SHORING NOTE:

TEMPORARY SHORING MAY BE REQUIRED FOR EXCAVATION AND CONSTRUCTION OF STORM LINE F3. THE CONTRACTOR SHALL DETERMINE THE EXACT LIMITS AND TYPES OF NECESSARY SHORING SYSTEMS REQUIRED. THE SHORING DETAILS SHALL BE SEALED BY A PROFESSIONAL ENGINEER REGISTERED IN CALIFORNIA. THE SHORING SYSTEM SHALL BE APPROVED BY THE AGENCY'S PROGRAM/PROJECT MANAGER AND PROJECT GEOTECHNICAL ENGINEER PRIOR TO INSTALLATION.

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER — DATE: 3/7/17

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4238
Tel: (619) 234-948
PREPARED BY:
KATHRYN DANEKER, R.C.E. 81398 — DATE 6/22/2017

REGISTERED PROFESSIONAL ENGINEER — KATHRYN DANEKER — No. 81398 — CIVIL — STATE OF CALIFORNIA

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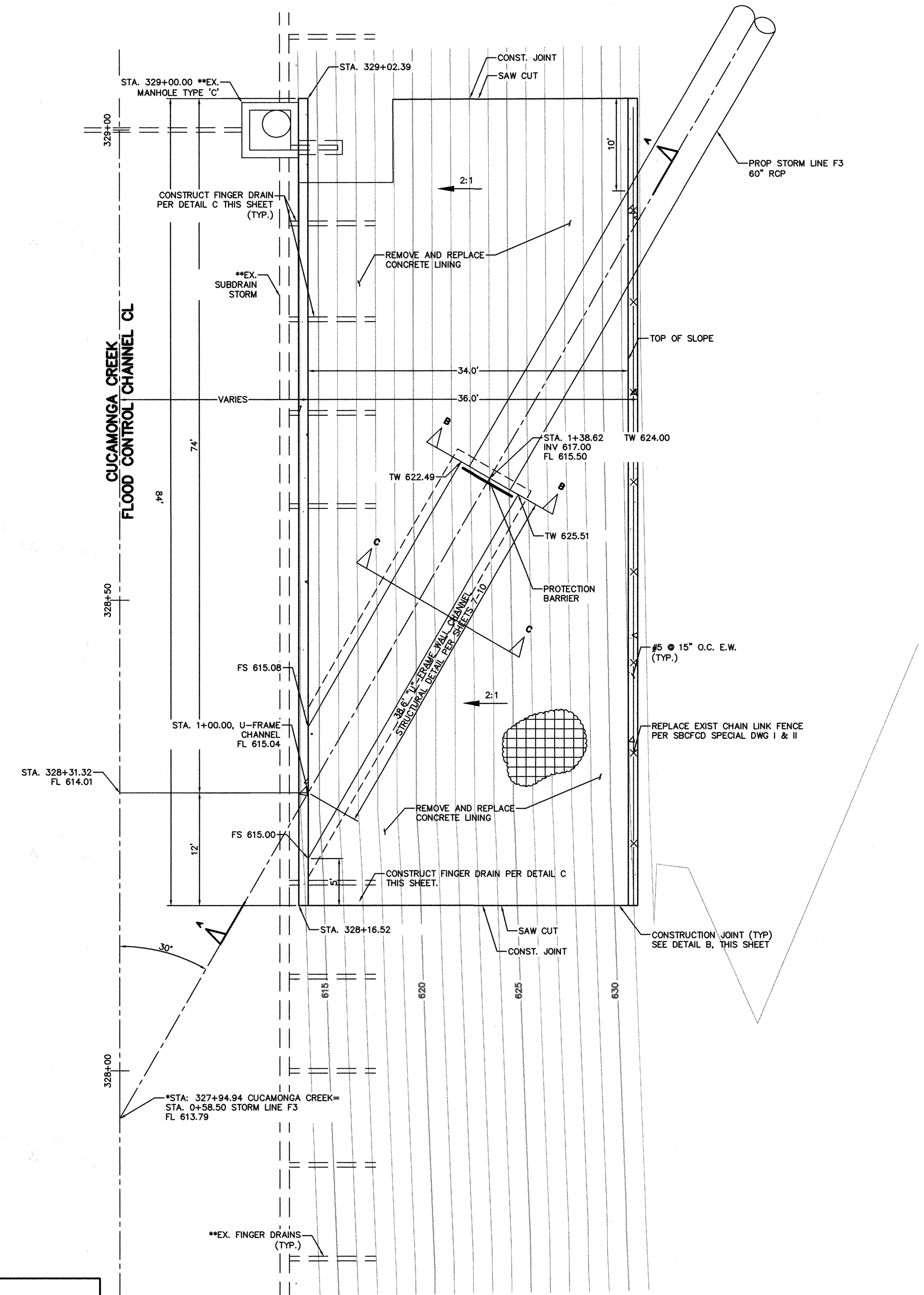
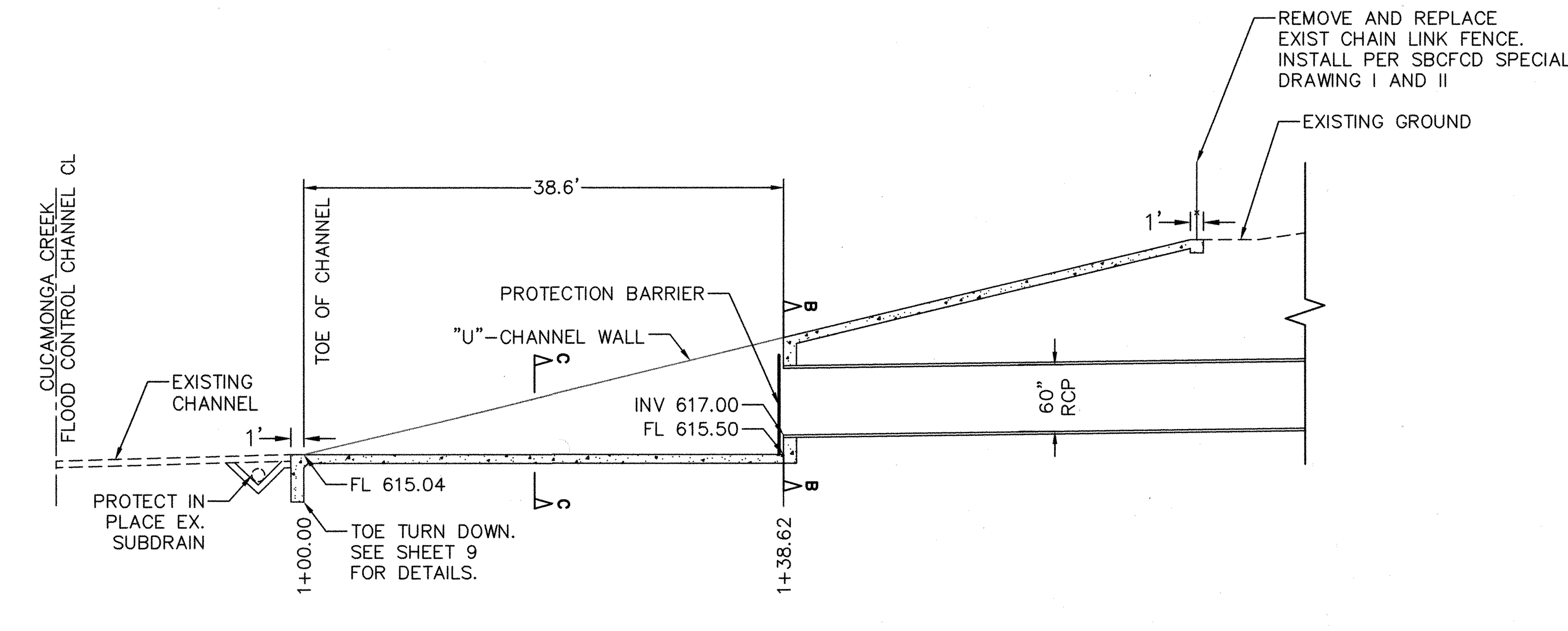
EASTVALE MDP LINE F-3
DEMOLITION SHEET

MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 4 OF 18

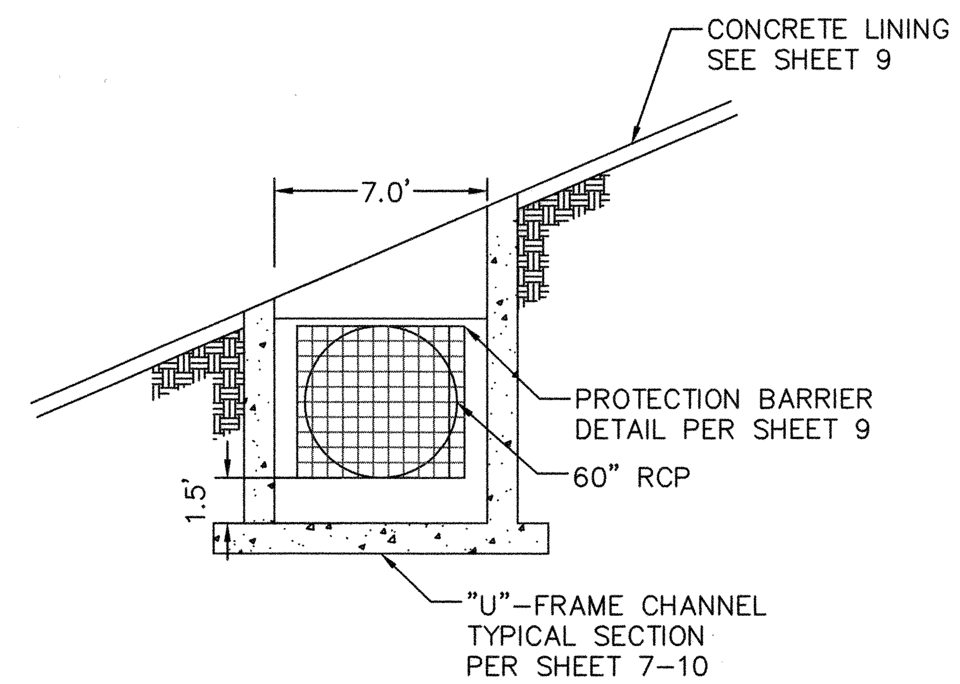


*CUCAMONGA CREEK CENTERLINE TO BE FIELD VERIFIED AT THE TIME OF CONSTRUCTION
**EXISTING SUB-DRAIN SYSTEM PER 224/198A AND 224/199 TO BE PROTECTED IN PLACE.

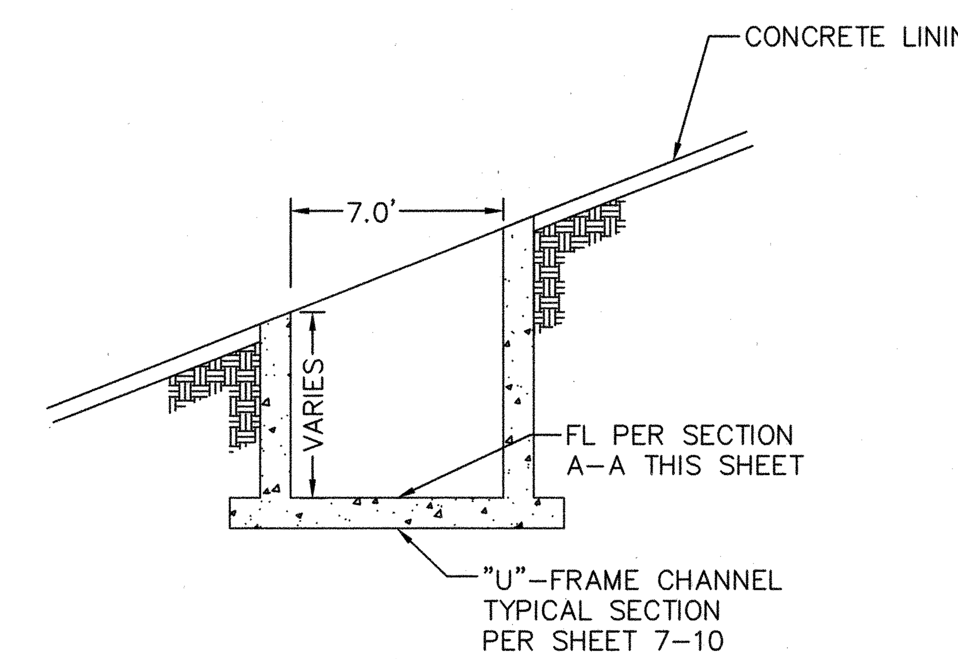
(A) CUCAMONGA CREEK CONNECTION PLAN LAYOUT
N.T.S.



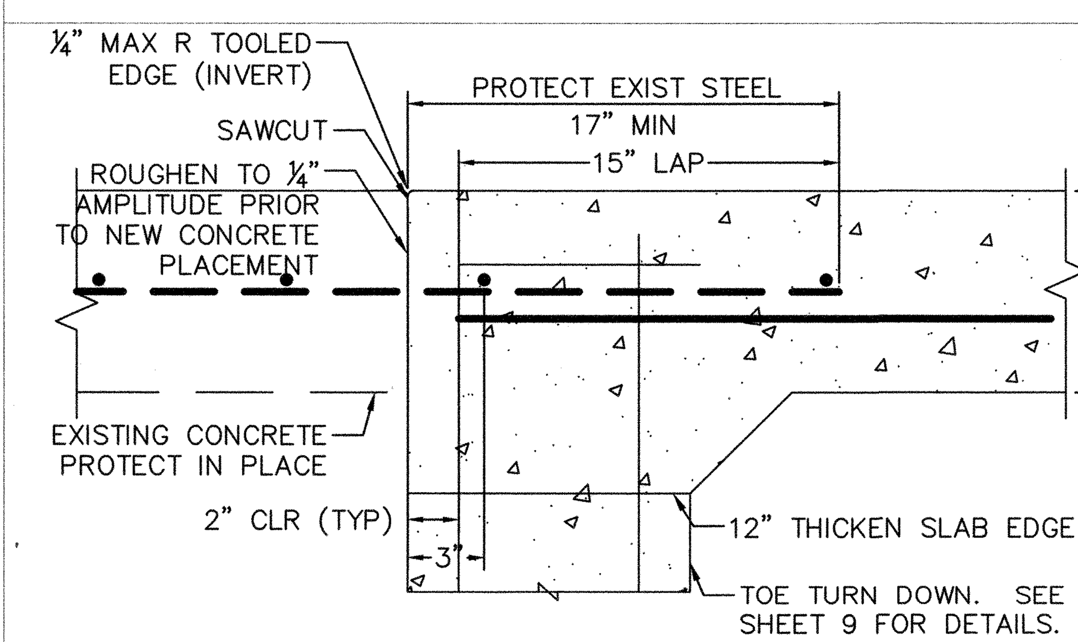
SECTION A–A
N.T.S.



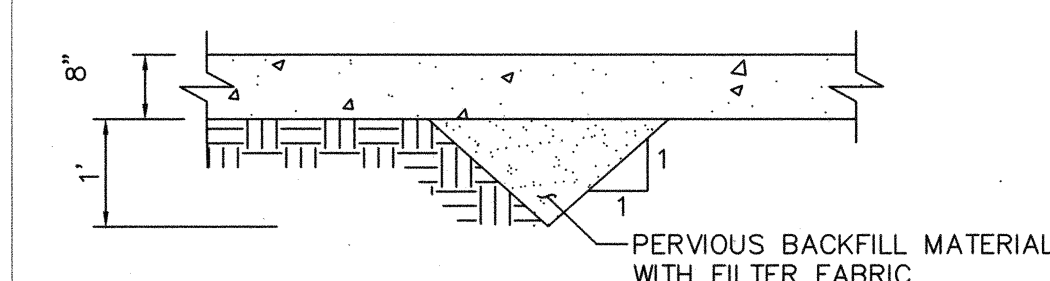
SECTION B–B
N.T.S.



SECTION C–C
N.T.S.



(B) CONST. JOINT DETAIL B
N.T.S.



(C) FINGER DRAIN DETAIL
N.T.S.

CITY OF EASTVALE
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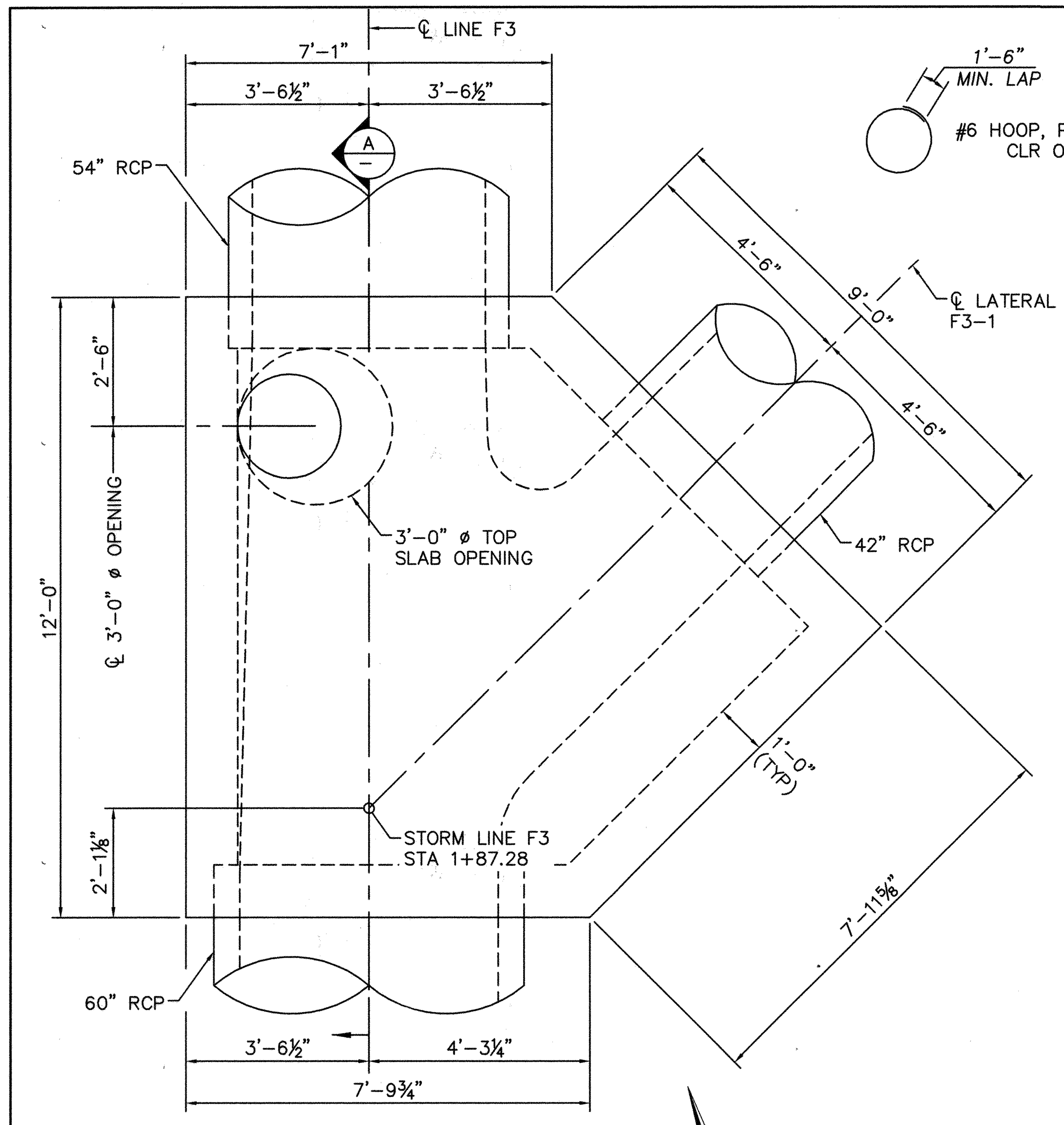
RECOMMENDED FOR APPROVAL BY: Deborah de Chambeau — DATE: 6/13/2017
APPROVED BY: Mark H. Wills — DATE: 6/19/2017

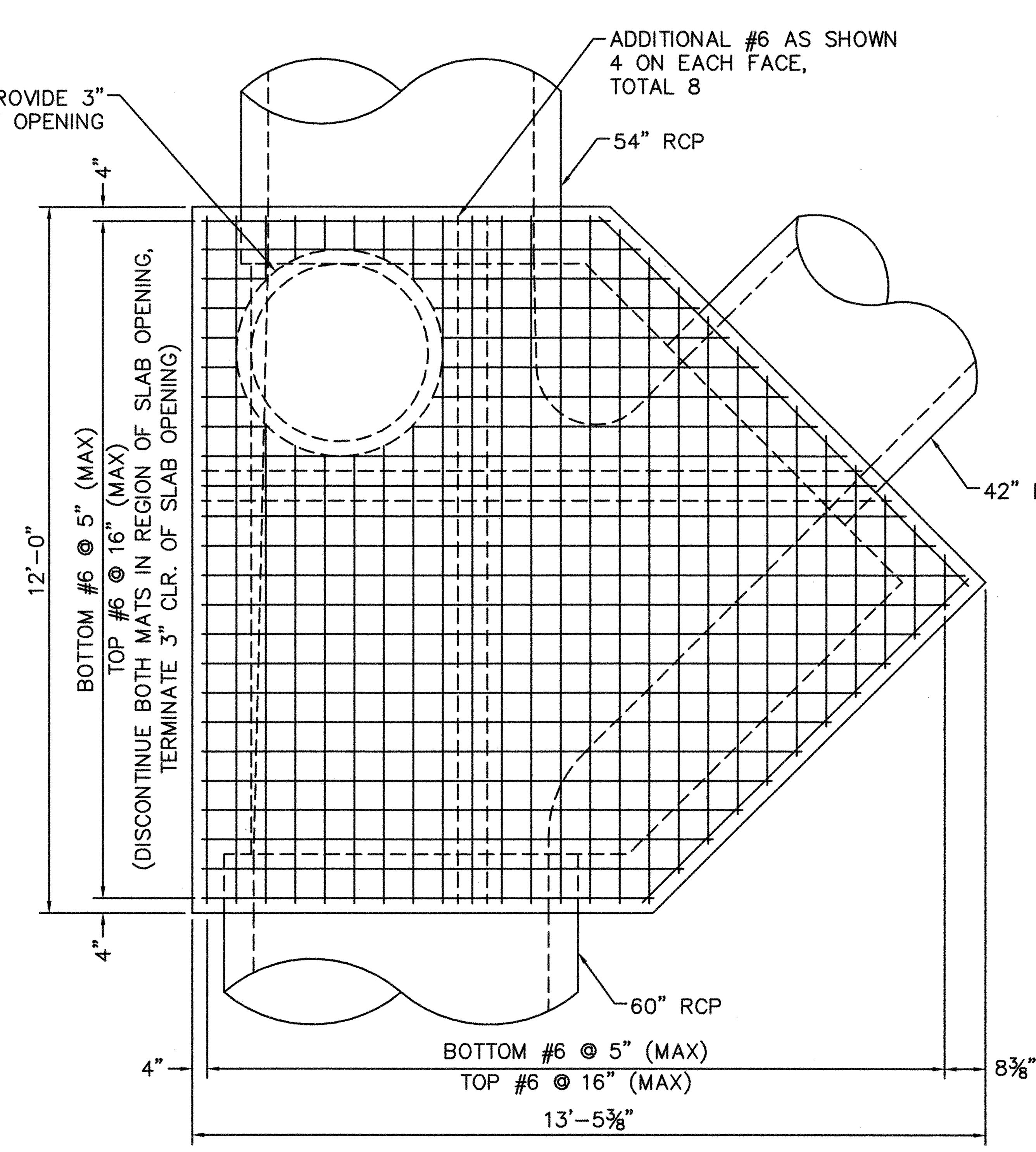
EASTVALE MDP LINE F-3
CREEK CONNECTION DETAIL SHEET

MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 5 OF 18



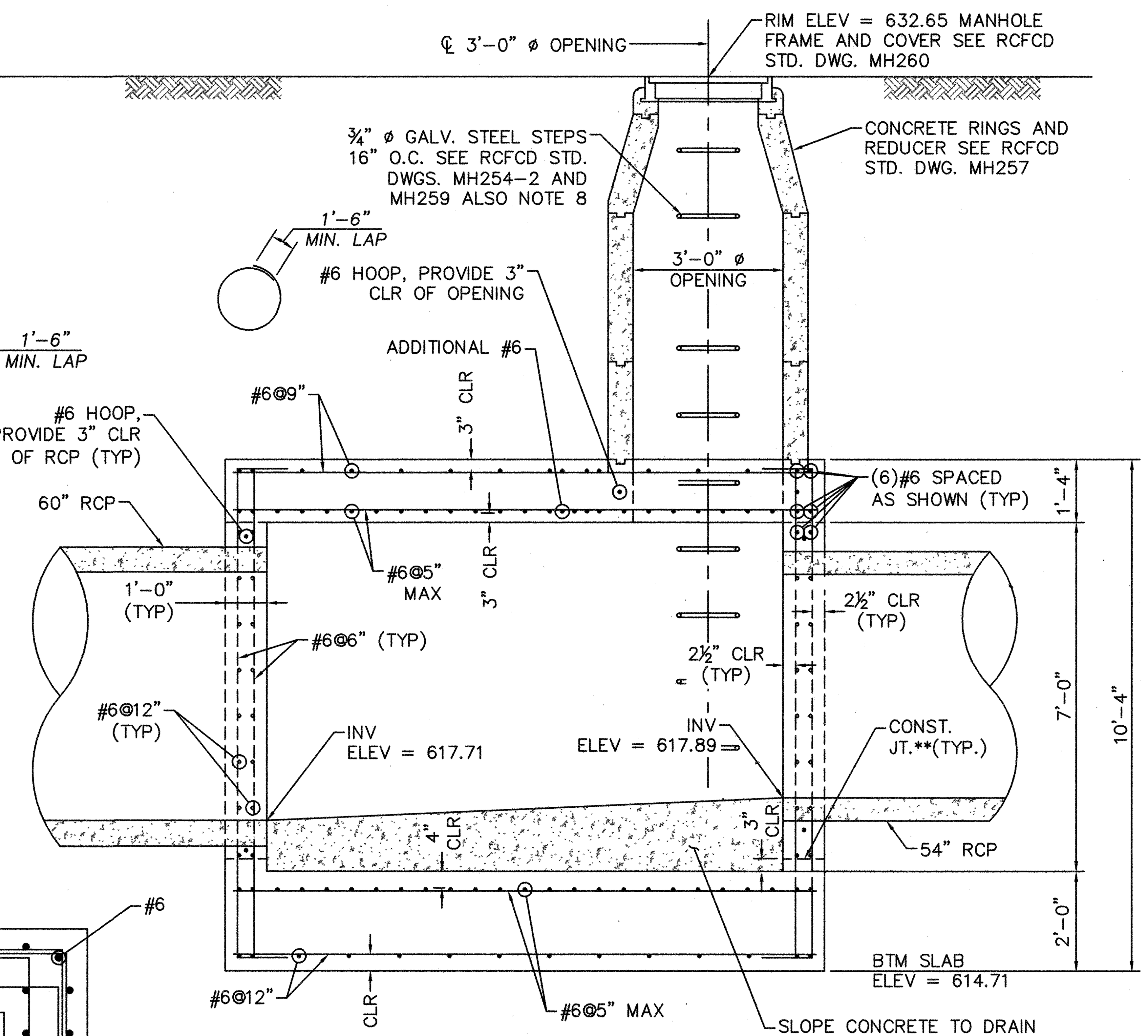
JUNCTION STRUCTURE A PLAN

GRAPHIC SCALE IN FEET



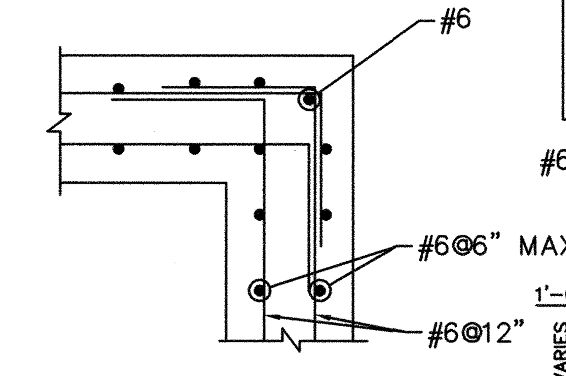
JUNCTION STRUCTURE A TOP SLAB REINFORCING PLAN

GRAPHIC SCALE IN FEET



SECTION A–A

GRAPHIC SCALE IN FEET



CORNER REINF. DETAIL

GRAPHIC SCALE IN FEET

**CONSTRUCTION JOINTS SHALL BE ROUGHENED TO ± ¼" AMPLITUDE PRIOR TO POURING WALL CONCRETE.

JUNCTION STRUCTURE NOTES:

CODE AND DESIGN LOADS

1. DESIGN SPECIFICATION – 2013 CALIFORNIA BUILDING CODE (CBC) AND US ARMY CORPS OF ENGINEERS EM 1110-2-2104.
2. CONSTRUCTION SPECIFICATION – UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION "GREENBOOK", 2012 EDITION.
3. JUNCTION STRUCTURE DESIGN LOADS:
   - A. DEAD LOAD – MORE THAN 2 FEET OF FILL
   - B. LIVE LOAD – 16K WHEEL LOAD (HS20-44)
   - C. LATERAL EARTH PRESSURE:
     - ACTIVE = 36 PCF
     - AT-REST = +20H (H>8.0 FT) PCF
     - PASSIVE = 300 PCF
     - SURCHARGE = 240 PSF

GENERAL STRUCTURAL NOTES:

1. CAST-IN-PLACE CONCRETE SHALL BE F'c = 4000 PSI MIN (650-BW-4000).
2. REINFORCING STEEL SHALL BE ASTM A615, GRADE 60.
3. REINFORCING STEEL SHALL BE TRIMMED AS REQUIRED TO PROVIDE 3" CLEAR UNLESS OTHERWISE NOTED ON THE PLANS.
4. BAR SUPPORTS, DESIGN, DETAILING, FABRICATION, AND PLACING OF REINFORCING BARS SHALL BE IN ACCORDANCE WITH THE LATEST REVISION OF ACI 318 (BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE) AND "DETAILS AND DETAILING OF CONCRETE REINFORCEMENT" (ACI SP-66(04)).
5. BACKFILL SHALL NOT BE PLACED UNTIL CONCRETE HAS REACHED FULL 28-DAY COMPRESSIVE STRENGTH.

SUPPLEMENTARY NOTES:

1. VERIFY ALL DIMENSIONS AND CONDITIONS PRIOR TO STARTING WORK. NOTIFY THE ENGINEER OF ANY DISCREPANCIES OR INCONSISTENCIES
2. VERIFY IN FIELD ALL EXISTING CONDITIONS SHOWN ON DRAWINGS.
3. ESTABLISH AND VERIFY ALL OPENINGS AND INSERTS WITH APPROPRIATE TRADES, DRAWINGS.
4. PROVIDE ALL NECESSARY TEMPORARY BRACING, SHORING OR OTHER MEANS TO AVOID EXCESSIVE STRESSES AND TO HOLD STRUCTURAL ELEMENTS IN PLACE DURING CONSTRUCTION.
5. THE COST OF ADDITIONAL DESIGN WORK DUE TO ERRORS OR OMISSIONS IN CONSTRUCTION SHALL BE PAID FOR BY THE CONTRACTOR
6. ANY ENGINEERING DESIGN PROVIDED BY OTHERS AND SUBMITTED FOR REVIEW SHALL BEAR THE SEAL AND SIGNATURE OF A CIVIL ENGINEER REGISTERED IN CALIFORNIA. IF THIS ENGINEERING DESIGN REQUIRES SPECIAL STRUCTURAL INSPECTION, THEY SHALL BE RESPONSIBLE FOR THE INSPECTION.
7. COMPACT SUBGRADE PER GEOTECHNICAL REQUIREMENTS; MIN. 6" BELOW BOTTOM SLAB TO 95% RELATIVE COMPACTION.
8. STEPS SHALL BE ¾" ROUND, GALVANIZED STEEL ANCHORED NOT LESS THAN 6" IN THE WALLS OF THE STRUCTURE UNLESS OTHERWISE SHOWN. THE SPACING SHALL BE 16" ON CENTER. THE LOWEST STEP SHALL BE NOT MORE THAN 2'-0" ABOVE THE INVERT

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
GLR ACCEPTED FOR CONSTRUCTION
Joe Indrawan 2/7/17
JOE INDRAWAN, CITY ENGINEER DATE:

SPECIAL INSPECTION

1. SPECIAL INSPECTION IS REQUIRED OF MATERIALS, INSTALLATION, FABRICATION, ERECTION OR PLACEMENT OF COMPONENTS AND CONNECTIONS REQUIRING SPECIAL EXPERTISE TO ENSURE COMPLIANCE WITH APPROVED CONSTRUCTION DOCUMENTS.
2. COORDINATE SCHEDULES WITH AGENCY PERFORMING SPECIAL INSPECTION TO INSURE AMPLE TIME IS AVAILABLE TO PERFORM REQUIRED TASKS.
3. THE FOLLOWING ITEMS REQUIRE SPECIAL INSPECTION.

1. INSEPCTION OF CONCRETE CONSTRUCTION (2013 CBC TABLE 1705.3)

INSPECTION ITEM	INSPECTION TASK	FREQUENCY OF INSPECTION	COMMENTS
STRUCTURAL CAST-IN-PLACE CONCRETE	REINFORCING STEEL INCLUDING PLACEMENT	PERIODIC	(1) (3) (4)
	VERIFICATION OF MIX DESIGN	PERIODIC	(1) (3)
	SAMPLES TAKEN FOR STRENGTH, SLUMP, AIR CONTENT, AND CONCRETE TEMPERATURE	CONTINUOUS	(2) (3)
	INSPECTION OF CONCRETE PLACEMENT	CONTINUOUS	(2) (3)
	MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES	PERIODIC	(1) (3)
	FORMWORK FOR SHAPE, LOCATION, AND DIMENSIONS	PERIODIC	(1) (3)
	INSPECT BOLTS TO BE INSTALLED IN CONCRETE PRIOR TO AND DURING PLACEMENT OF CONCRETE	CONTINUOUS	(2) (3)
	INSPECT SAW CUTTING OF CONCRETE WITH REBAR TO BE PRESERVED	PERIODIC	(1) (3)

COMMENTS

1. PERIODIC SPECIAL INSPECTION: THE PART-TIME OR INTERMITTENT OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK HAS BEEN OR IS BEING PERFORMED AND AT THE COMPLETION OF WORK (2013 CBC).
2. CONTINUOUS SPECIAL INSPECTION: THE FULL-TIME OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK IS BEING PERFORMED. (2013 CBC)
3. ITEMS NOT SHOWN MAY REQUIRE CONTINUOUS OR PERIODIC SPECIAL STRUCTURAL INSPECTION AT THE DISCRETION OF THE ENGINEER. ITEMS LISTED MAY REQUIRE ALTERNATE FREQUENCIES OF INSPECTION OTHER THAN SHOWN UNDER DIRECTION OF THE ENGINEER.
4. WELDING OF REINFORCING STEEL NOT ACCEPTABLE UNLESS NOTED OTHERWISE ON THE PLANS OR AS DIRECTED BY THE ENGINEER.

GENERAL NOTES:

1. SEE SHEET 2 FOR STORM LINE F3 PLAN VIEW, PROFILE AND ADDITIONAL LAYOUT DETAILS.
2. SEE SHEET 3 FOR LAT. F3-1 PROFILE.

MDC

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4218
Tel: (619) 234-9411
PREPARED BY:
KEVIN J. KIMM, R.C.E. 75462 9/21/2015 DATE

REGISTERED PROFESSIONAL ENGINEER KEVIN J. KIMM No. C 75462 EXP. 03/31/16 CIVIL STATE OF CALIFORNIA

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY BM NO. M.L. 34-1-64 AT THE N.E. COR OF THE "T" INT. OF ORANGE ST AND SUMNER AVE, 84.0 FEET E'LY AND 22.0 FEET S'LY OF THE CENTERLINE INT. OF SUMNER AVE AND ORANGE ST. TOP OF CURB 10 FEET E'LY OF THE S.E. COR, A 3" ALUMINUM DISK @ TOP OF CURB STAMPED "M.L. 34-1 RESET"
ELEVATION 607.064 FEET
DATUM: NGVD 29

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
DESIGNED BY: BMS
DRAWN BY: CG
DATE DRAWN: 9/21/15
CHECKED BY: KJK
RECOMMENDED FOR APPROVAL BY: Deborah de Chambeau DATE: 6/13/2017
APPROVED BY: Mark H. Wills DATE: 6/19/2017

EASTVALE MDP LINE F-3
JUNCTION STRUCTURE A DETAILS

PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 6 OF 18

K:\PHX_Structure\San Diego\000000000-Providence Business park, Eastvale, CA\Cadd\952000-DETL-JS.dwg

U-FRAME CHANNEL STRUCTURAL NOTES:

DESIGN SPECIFICATIONS

2013 CALIFORNIA BUILDING CODE

CONSTRUCTION SPECIFICATIONS

STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION "GREENBOOK", 2012 EDITION.

DESIGN LOADS

DEAD LOAD – WEIGHT OF BACKFILL = 120pcf

THE FOLLOWING LATERAL EARTH PRESSURES ASSUME LOW EXPANSION POTENTIAL SOILS (WITH AN EI OF 50 OR LESS) PER PROJECT GEOTECHNICAL INVESTIGATION.

EQUIVALENT FLUID PRESSURE FOR ACTIVE SOIL PRESSURE = 36pcf (LEVEL BACKFILL)
EQUIVALENT FLUID PRESSURE FOR ACTIVE SOIL PRESSURE = 55pcf (2:1 SLOPING BACKFILL)

EQUIVALENT FLUID PRESSURE FOR AT-REST SOIL PRESSURE = 56pcf (LEVEL BACKFILL)

EQUIVALENT FLUID PRESSURE FOR PASSIVE SOIL PRESSURE = 300pcf

COEFFICIENT OF FRICTION = 0.35

ALLOWABLE SOIL BEARING PRESSURE = 2500 psf (4000 psf MAX)

FOUNDATIONS

FOUNDATION DATA BASED ON SUPPLEMENTAL GEOTECHNICAL INVESTIGATION AND PERCOLATION TESTING FOR PROVIDENCE BUSINESS PARK PROJECT, (CITY OF EASTVALE, CA), PREPARED BY GEOCON WEST INC., PROJECT NO. T2586-22-01, DATED MARCH 13, 2014, REVISED JUNE 13, 2014.

FOUNDATION PREPARATION: IN ACCORDANCE WITH THE RECOMMENDATIONS OF THE PROJECT GEOTECHNICAL INVESTIGATION.

U-FRAME CHANNEL EXCAVATION AND BACKFILL SHALL BE APPROVED BY THE GEOTECHNICAL ENGINEER OF RECORD. U-FRAME CHANNEL WALLS SHALL BE BACKFILLED SIMULTANEOUSLY.

CONCRETE AND REINFORCEMENT

f'c = 4000 psi – WALLS AND FOOTINGS (650-BW-4000)
fy = 60,000 psi – REINFORCING STEEL (GRADE 60)

CONCRETE MIX DESIGN SHALL BE SUBMITTED TO THE DISTRICT AT LEAST 72 HOURS PRIOR TO CONCRETE PLACEMENT WITHIN DISTRICT RIGHT-OF-WAY.

REINFORCING SHALL CONFORM TO ASTM A615, EXCEPT REINFORCING BARS WHICH ARE TO BE WELDED SHALL CONFORM TO A706.

DETAIL, FABRICATE AND ERECT REINFORCEMENT BARS, INCLUDING BAR SUPPORTS, SPACERS, ETC. IN ACCORDANCE WITH "DETAILS AND DETAILING OF CONCRETE REINFORCEMENT." (A.C.I. SP-66(04)).

ALL BEND DIMENSIONS FOR REINFORCING STEEL SHALL BE OUT-TO-OUT OF BARS. ALL PLACEMENT DIMENSIONS FOR REINFORCING STEEL SHALL BE TO CENTER OF BARS UNLESS NOTED OTHERWISE.

ALL REINFORCING SHALL HAVE 3" CLEAR COVER UNLESS NOTED OTHERWISE.

ALL EXPOSED CONCRETE CORNERS SHALL BE CHAMFERED 3/4".

JOINT NOTES:

WALLS AND BOTTOM SLAB SHALL BE CONTINUOUS WITH NO JOINTS.

VIBRATE ALL CONCRETE IMMEDIATELY AFTER PLACEMENT.

U-FRAME CHANNEL GEOMETRY

SEE STORM LINE F3 DETAIL SHEETS FOR U-FRAME CHANNEL LAYOUT, FLOWLINE AND TOP OF WALL ELEVATIONS. HEIGHT OF WALL MAY VARY + 2 INCHES.

U-FRAME CHANNEL WALL REINFORCING AND DIMENSIONS SHALL BE PER "SECTION" INDICATED IN THE U-FRAME CHANNEL ELEVATION. TOP OF WALL (TW) AND FLOW LINE (FL) SHALL BE AS SHOWN ON THE U-FRAME CHANNEL ELEVATION, REGARDLESS OF THE VALUE OF "DESIGN H".

DIMENSIONS

DIMENSIONS SHALL NOT BE SCALED FROM DRAWINGS.

U-FRAME CHANNEL FINISH REQUIREMENTS

U-FRAME CHANNEL SHALL RECEIVE A CLASS I SURFACE FINISH.

STRUCTURAL STEEL

PLATES, BARS, AND ANGLES SHALL CONFORM TO ASTM A36 UNLESS NOTED OTHERWISE.

DESIGN, FABRICATION AND ERECTION OF STRUCTURAL STEEL SHALL CONFORM TO THE LATEST AISC CODES AND SPECIFICATIONS. INCLUDING THE AISC CODE OF STANDARD PRACTICE FOR STEEL BUILDINGS.

SHOP CONNECTIONS SHALL BE MADE WITH HIGH-STRENGTH BOLTS OR BY WELDING. FIELD CONNECTIONS SHALL BE MADE WITH HIGH-STRENGTH BOLTS, EXCEPT WHERE WELDING IS INDICATED ON THE DRAWINGS. HIGH-STRENGTH BOLTS SHALL CONFORM TO ASTM A325 BEARING TYPE CONNECTION WITH THREADS INCLUDED IN SHEAR PLANE UNLESS NOTED OTHERWISE. ALL BOTLS SHALL BE 3/4 INCH DIAMETER UNLESS NOTED OTHERWISE.

ALL WELD SIZES, NOT INDICATED ON THE PLANS, SHALL COMPLY WITH THE LATEST AWS D1.1 BUT IN NO CASE SHALL WELD SIZE BE LESS THAN 3/16 INCH.

ALL STEEL AND HARDWARE SHALL BE HOT-DIPPED GALVANIZED CONFORMING TO ASTM A123 AND ASTM A153.

FIELD CUTTING OR BURNING OF STEEL IS NOT ALLOWED WITHOUT WRITTEN APPROVAL OF THE ENGINEER.

STEEL FABRICATOR SHALL FABRICATE, SUPPLY, FURNISH AND DELIVER ALL BOLTS. ALL BOLTS AND NUTS CONNECTING STEEL TO STEEL SHALL BE INSTALLED WITH A WASHER UNDER EACH BOLT HEAD AND NUT. HOLES FOR BOLTS –PUNCHED OR DRILLED– SHALL BE 1/16 INCH LARGER THAN THE BOLT SHAFT WHERE THE CONNECTION IS A SHEAR TYPE LOADING, AND 1/8 INCH LARGER THAN THE BOLT SHAFT WHEN THE CONNECTION IS BEARING TYPE.

STEEL MANUFACTURER'S CERTIFICATION, FURNISH TO THE CONTRACTOR AND STRUCTURAL ENGINEER, SHALL CONSTITUTE SUFFICIENT EVIDENCE OF CONFORMITY WITH THE AISC AND PROJECT SPECIFICATIONS. USE AISC GAGES FOR BOLT HOLES, UNLESS SHOWN OTHERWISE.

THE ALIGNMENT OF ALL STEEL MEMBERS SHALL BE INSTALLED IN A PLUMB VERTICAL AND HORIZONTAL POSITION.

APPLY A SINGLE COAT OF ORGANIC OXIDE PAINT TO ALL NON-GALVANIZED, EXPOSED METAL SURFACES AFTER CLEANING OF STEEL; DRY FILM THICKNESS SHALL BE 8 MIL, MINIMUM. DO NOT PAINT STEEL EMBEDDED AND IN CONTACT WITH CONCRETE.

BOLTS MAY BE DRILLED AND ANCHORED WITH HILTI HIT-HY 200 SAFE SET SYSTEM OR APPROVED EQUIVALENT.

COORDINATION

CONTRACTOR SHALL COORDINATE ALL EXISTING CONDITIONS DURING CONSTRUCTION OF PROJECT. UTILITY INFORMATION SHOWN ON THE PLANS MAY NOT BE COMPLETE OR ACCURATELY DEPICT THE LOCATION OF THE FACILITIES SHOWN. THE CONTRACTOR SHALL COORDINATE THE LOCATION OF ALL EXISTING, NEW, RELOCATED AND ABANDONED UTILITIES WITH THE PROJECT PLANS AND NOTIFY RESPECTIVE OWNERS BEFORE COMMENCING THE WORK OF EXCAVATION, INCLUDING ANY DRILLING OR PILING REQUIRED FOR TEMPORARY SHORING. CONFLICTS SHALL BE BROUGHT TO THE ATTENTION OF THE ENGINEER AND RESOLVED PRIOR TO PROCEEDING WITH THE WORK. SEE CIVIL AND UTILITY DRAWINGS FOR ADDITIONAL INFORMATION.

VERIFY ALL DIMENSIONS AND ELEVATIONS PRIOR TO STARTING WORK. NOTIFY THE ENGINEER OF ANY DISCREPANCIES.

PROTECT UTILITY WITHIN THE USACE RIGHT OF WAY.

PROVISIONS HALL BE MADE TO PREVENT DEBRIS FROM FALLING INTO THE CHANNEL DURING CONSTRUCTION. COMPACTION EQUIPMENT USED TO PLACE BACKFILL BEHIND CHANNEL WALL MUST NOT EXCEED 35,000 POUNDS INCLUDING DYNAMIC FORCES FROM VIBRATOR COMPACTOR.

NO EQUIPMENT IN EXCESS OF H-10 HIGHWAY LOADING (AASHTO), AND NO STOCKPILING OF MATERIAL WILL BE PERMITTED ALONG THE CHANNEL WITHIN A DISTANCE OF ONE-HALF WALL HEIGHT.

NO EQUIPMENT IN EXCESS OF H-20 HIGHWAY LOADING WILL BE PERMITTED TO OPERATE ON THE INVERT OF THE CHANNEL. ONLY RUBBER-TIRED, LEGALLY LOADED EQUIPMENT SHALL BE OPERATED ON THE EXPOSED CHANNEL INVERT. IF STEEL CRAWLER TYPE EQUIPMENT IS USED, WOODEN MATTING SHALL BE PROVIDED OVER THE INVERT IN THE OPERATING AREA. LOADS FROM TRACK VEHICLES SHALL NOT EXCEED 3000 PSF ON A SURFACE AT THE BOTTOM OF THE INVERT SLAB.

ABBREVIATIONS

ACI	AMERICAN CONCRETE INSTITUTE
ASTM	AMERICAN SOCIETY FOR TESTING AND MATERIALS
CLR	CLEAR
EA	EACH
FL	FLOW LINE
FS	FINISHED SURFACE
INV	INVERT
PCF	POUNDS PER CUBIC FEET
PSF	POUNDS PER SQUARE FEET
PSI	POUNDS PER SQUARE INCH
RCP	REINFORCED CONCRETE PIPE
STA	STATION
TW	TOP OF WALL
TYP	TYPICAL

SPECIAL INSPECTIONS

1. SPECIAL INSPECTION IS REQUIRED OF MATERIALS, INSTALLATION, FABRICATION, ERECTION OR PLACEMENT OF COMPONENTS AND CONNECTIONS REQUIRING SPECIAL EXPERTISE TO ENSURE COMPLIANCE WITH APPROVED CONSTRUCTION DOCUMENTS.
2. THE FOLLOWING ITEMS REQUIRE SPECIAL INSPECTION:

INSPECTION OF CONCRETE CONSTRUCTION (2013 CBC TABLE 1705.3)			
INSPECTION ITEMS	INSPECTION TASK	FREQUENCY OF INSPECTION	COMMENTS
STRUCTURAL CAST-IN-PLACE CONCRETE	REINFORCING STEEL INCLUDING PLACEMENT	PERIODIC	(1) (3) (4)
	VERIFICATION OF MIX DESIGN	PERIODIC	(1) (3)
	SAMPLES TAKEN FOR STRENGTH, SLUMP, AIR CONTENT, AND CONCRETE TERMPERATURE	CONTINUOUS	(2) (3)
	INSPECTION OF CONCRETE PLACEMENT	CONTINUOUS	(2) (3)
	MAINTENANCE OF SPECIFIED CURING TEMPERATURE AND TECHNIQUES	PERIODIC	(1) (3)
	FORMWORK FOR SHAPE, LOCATION, AND DIMENSIONS	PERIODIC	(1) (3)
	INSPECT BOLTS TO BE INSTALLED IN CONCRETE PRIOR TO AND DURING PLACEMENT OF CONCRETE	CONTINUOUS	(2) (3)

INSPECTION OF SOILS (2013 CBC TABLE 1705.6)			
INSPECTION ITEMS	INSPECTION TASK	FREQUENCY OF INSPECTION	COMMENTS
SOIL PREPARATIONS AND EXCAVATIONS	---------	----------	(3) (5)

COMMENTS

1. PERIODIC SPECIAL INSPECTION: THE PART-TIME OR INTERMITTENT OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK HAS BEEN OR IS BEING PERFORMED AND AT THE COMPLETION OF WORK. (2013 CBC 1702).
2. CONTINUOUS SPECIAL INSPECTION: THE FULL-TIME OBSERVATION OF WORK REQUIRING SPECIAL INSPECTION BY AN APPROVED SPECIAL INSPECTOR WHO IS PRESENT IN THE AREA WHERE THE WORK IS BEING PERFORMED. (2013 CBC 1702).
3. ITEMS NOT SHOWN MAY REQUIRE CONTINUOUS OR PERIODIC SPECIAL STRUCTURAL INSPECTION AT THE DISCRETION OF THE ENGINEER. ITEMS LISTED MAY REQUIRE ALTERNATE FREQUENCIES OF INSPECTION OTHER THAN SHOWN UNDER DIRECTION OF THE ENGINEER.
4. WELDING OF REINFORCING STEEL NOT ACCEPTABLE UNLESS DIRECTED BY THE PROGRAM/PROJECT MANAGER OF RECORD.
5. SOILS INSPECTION REQUIREMENT SHALL CONFORM WITH PROJECT SOILS ENGINEER/CONSULTANT AS OUTLINED IN SOILS REPORT, THESE PLANS AND PROJECT SPECIFICATIONS.

MDc

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
GLB ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER — DATE: 3/7/17

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4218
Tel: (619) 234-9411
PREPARED BY:
KVEIN J. KIMM, R.C.E. 75462 — 9/21/2015 DATE

REGISTERED PROFESSIONAL ENGINEER — KEVIN J. KIMM — No. C 75462 — EXP: 03/31/16 — CIVIL — STATE OF CALIFORNIA

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ELEVATION 607.064 FEET
DATUM: NGVD 29

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

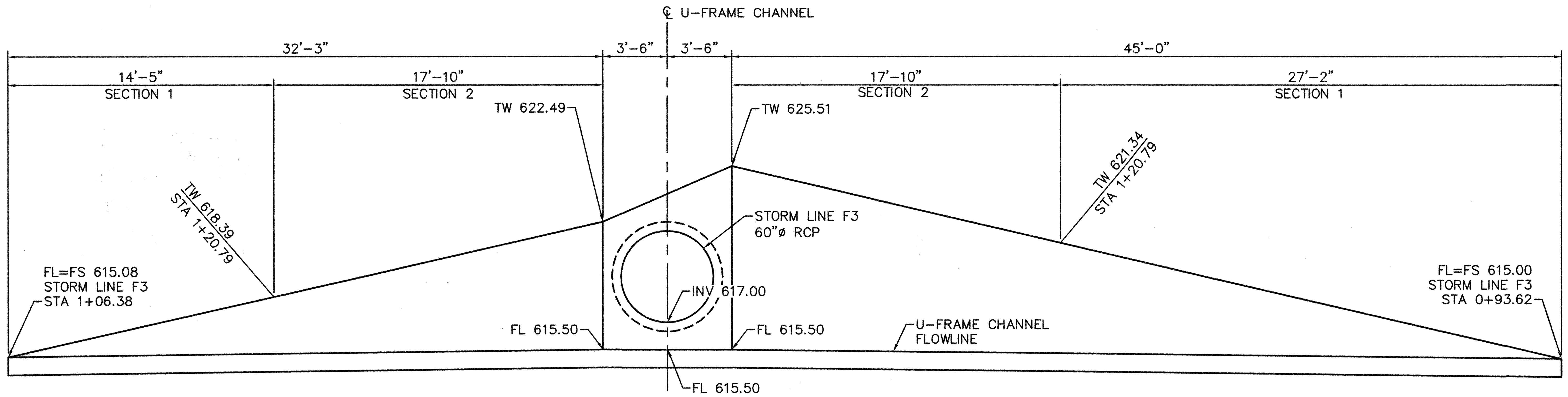
DESIGNED BY: BMS
DRAWN BY: CG
DATE DRAWN: 9/21/15
CHECKED BY: KJK

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: Deborah de Chambeau — DATE: 6/13/2017
APPROVED BY: Mark H. Wills — DATE: 6/19/2017

EASTVALE MDP LINE F-3
STORM LINE F3 CHANNEL
GENERAL STRUCTURAL NOTES

PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 7 OF 18

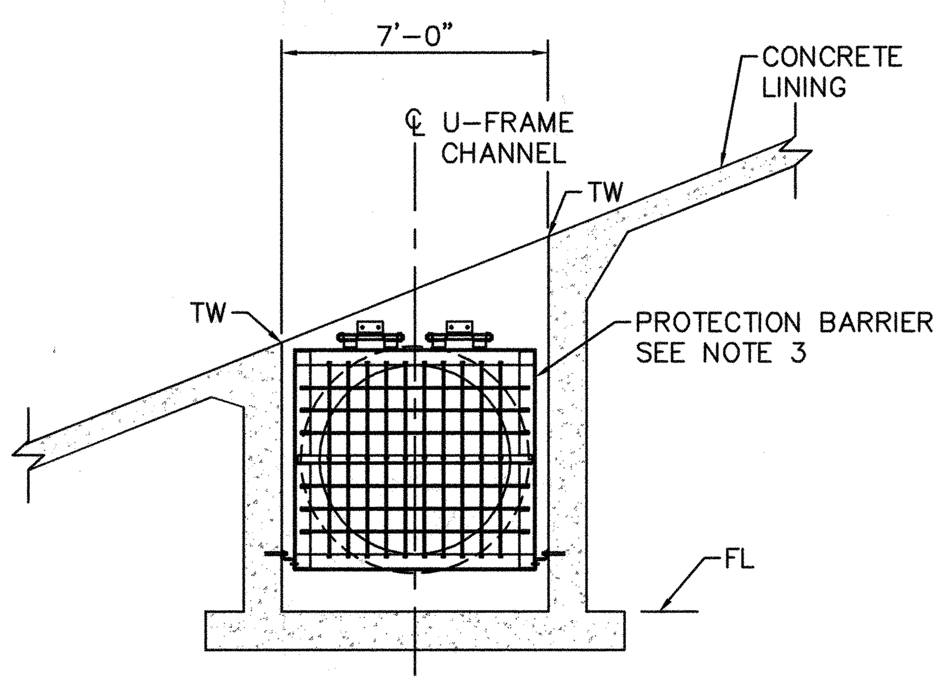
K:\PHX_Structure\San Diego\000000000-Providence Business park, Eastvale, CA\Cadd\952000-DETL-F4.dwg



U-FRAME CHANNEL ELEVATION

(PROTECTION BARRIER NOT SHOWN FOR CLARITY)

GRAPHIC SCALE IN FEET
0 2 4 8



U-FRAME CHANNEL SECTION

GRAPHIC SCALE IN FEET
0 2 4 8

GENERAL NOTES:

1. SEE SHEET 5 FOR U-FRAME CHANNEL PLAN VIEW AND ADDITIONAL LAYOUT DETAILS.
2. SEE SHEET 7 FOR U-FRAME CHANNEL STRUCTURAL NOTES.
3. SEE SHEET 9 AND 10 FOR U-FRAME CHANNEL TYPICAL SECTION AND REINFORCING REQUIREMENTS.
4. SEE SHEETS 9, 10 AND 11 FOR U-FRAME PROTECTION BARRIER DETAILS.

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
GLB ACCEPTED FOR CONSTRUCTION
Joe Indrawan 3/7/17
JOE INDRAWAN, CITY ENGINEER DATE:

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4218
Tel: (619) 234-9411
PREPARED BY:
KEVIN J. KIMM, R.C.E. 75462 9/21/2015 DATE

REGISTERED PROFESSIONAL ENGINEER KEVIN J. KIMM No. C 75462 EXP. 03/31/16 CIVIL STATE OF CALIFORNIA

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DATUM: NGVD 29

REF.	REVISIONS DESCRIPTION	APPR.	DATE

DESIGNED BY: BMS
DRAWN BY: CG
DATE DRAWN: 9/21/15
CHECKED BY: KJK

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: Deborah deChambeau DATE: 6/13/2017
APPROVED BY: Mark H. Wills DATE: 6/19/2017

EASTVALE MDP LINE F-3
STORM LINE F3 CHANNEL
DETAILS 1 OF 4

MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 8 OF 18

K:\PHX_Structure\San Diego\000000000-Providence Business park, Eastvale, CA\Cadd\952000-DETL-F3.dwg

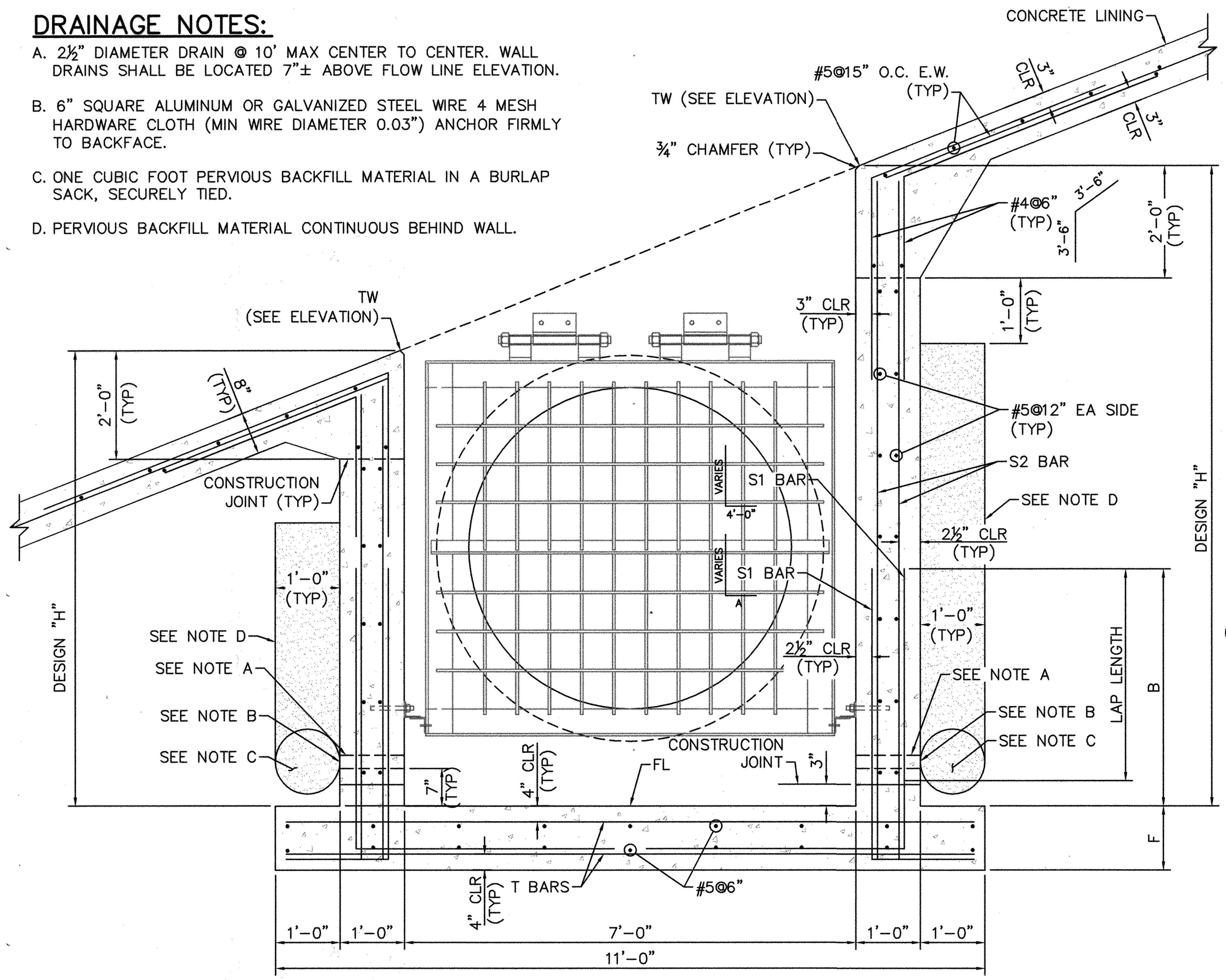
DRAINAGE NOTES:

A. 2½" DIAMETER DRAIN @ 10' MAX CENTER TO CENTER. WALL DRAINS SHALL BE LOCATED 7"± ABOVE FLOW LINE ELEVATION.

B. 6" SQUARE ALUMINUM OR GALVANIZED STEEL WIRE 4 MESH HARDWARE CLOTH (MIN WIRE DIAMETER 0.03") ANCHOR FIRMLY TO BACKFACE.

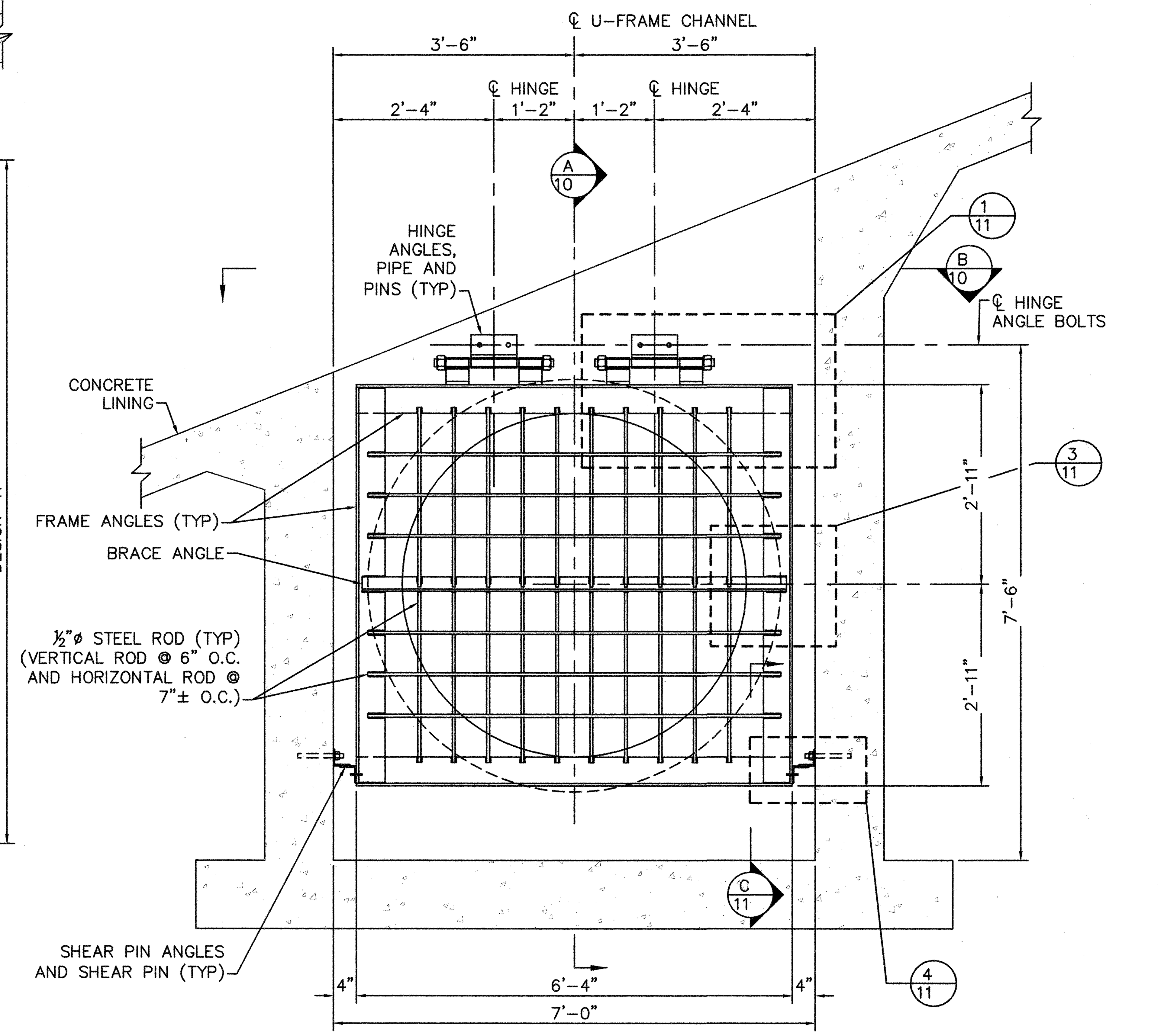
C. ONE CUBIC FOOT PERVIOUS BACKFILL MATERIAL IN A BURLAP SACK, SECURELY TIED.

D. PERVIOUS BACKFILL MATERIAL CONTINUOUS BEHIND WALL.



U-FRAME CHANNEL TYPICAL SECTION

GRAPHIC SCALE IN FEET
0 0.67 1.33 2.67



PROTECTION BARRIER ELEVATION

GRAPHIC SCALE IN FEET
0 0.67 1.33 2.67

U-FRAME CHANNEL DIMENSIONS AND REINFORCING

DIMENSIONS				REINFORCING STEEL LIST									AVG. BEARING PRESSURE (LBS/SQ FT)
				S1			S2			T			
DESIGN SECTION	DESIGN H	F	B	BAR SIZE	SPACING	LENGTH	BAR SIZE	SPACING	LENGTH	BAR SIZE	SPACING	LENGTH	
SECTION 1	6'-0"	1'-10"	--	#5	8"	SEE NOTE 1	--	--	--	#6	8"	10'-6"	700
SECTION 2	10'-0"	1'-10"	4'-0"	#6	8"	5'-9"	#5	8"	SEE NOTE 2	#6	8"	10'-6"	1650

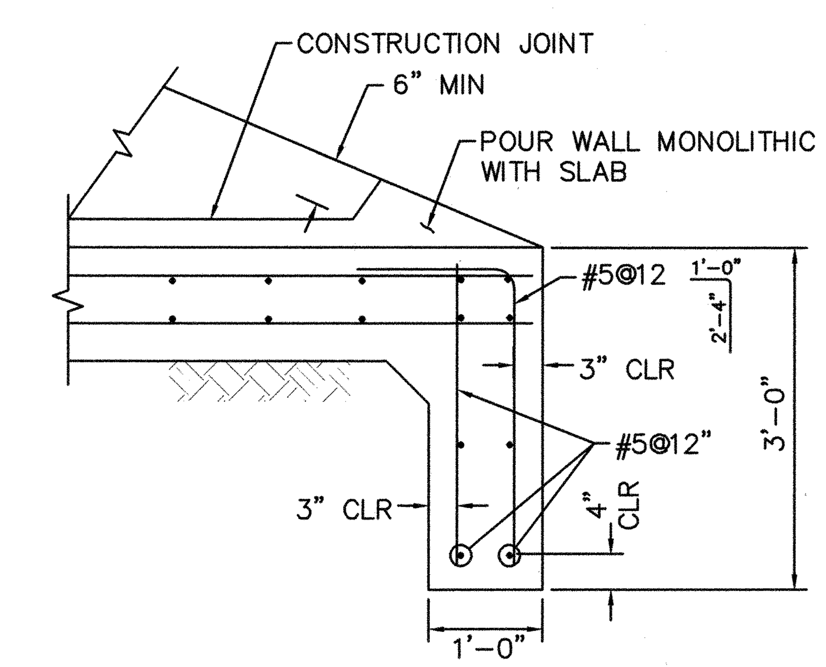
LAP SPLICE AND HOOK LENGTH TABLE–REINFORCED CONCRETE

BAR SIZE	LAP LENGTH SPLICE	A
#4	1'-8"	1'-0"
#5	2'-1"	1'-0"
#6	2'-6"	1'-0"
#7	2'-11"	1'-2"
#8	3'-4"	1'-4"

REINFORCING NOTES:

1. S1 BAR LENGTH SHALL BE AS REQUIRED TO PLACE BAR TO TOP OF WALL.

2. S2 BAR LENGTH SHALL BE AS REQUIRED TO PLACE BAR TO TOP OF WALL AND PROVIDE THE NECESSARY LAP LENGTH WITH S1 BARS.



U-FRAME CHANNEL TOE TURN DOWN DETAIL

GRAPHIC SCALE IN FEET
0 0.67 1.33 2.67

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER
DATE: 3/7/17

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ELEVATION 607.064 FEET
DATUM: NGVD 29

REF.	REVISIONS DESCRIPTION	APPR.	DATE

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RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: Deborah de Chambeau
DATE: 6/13/2017
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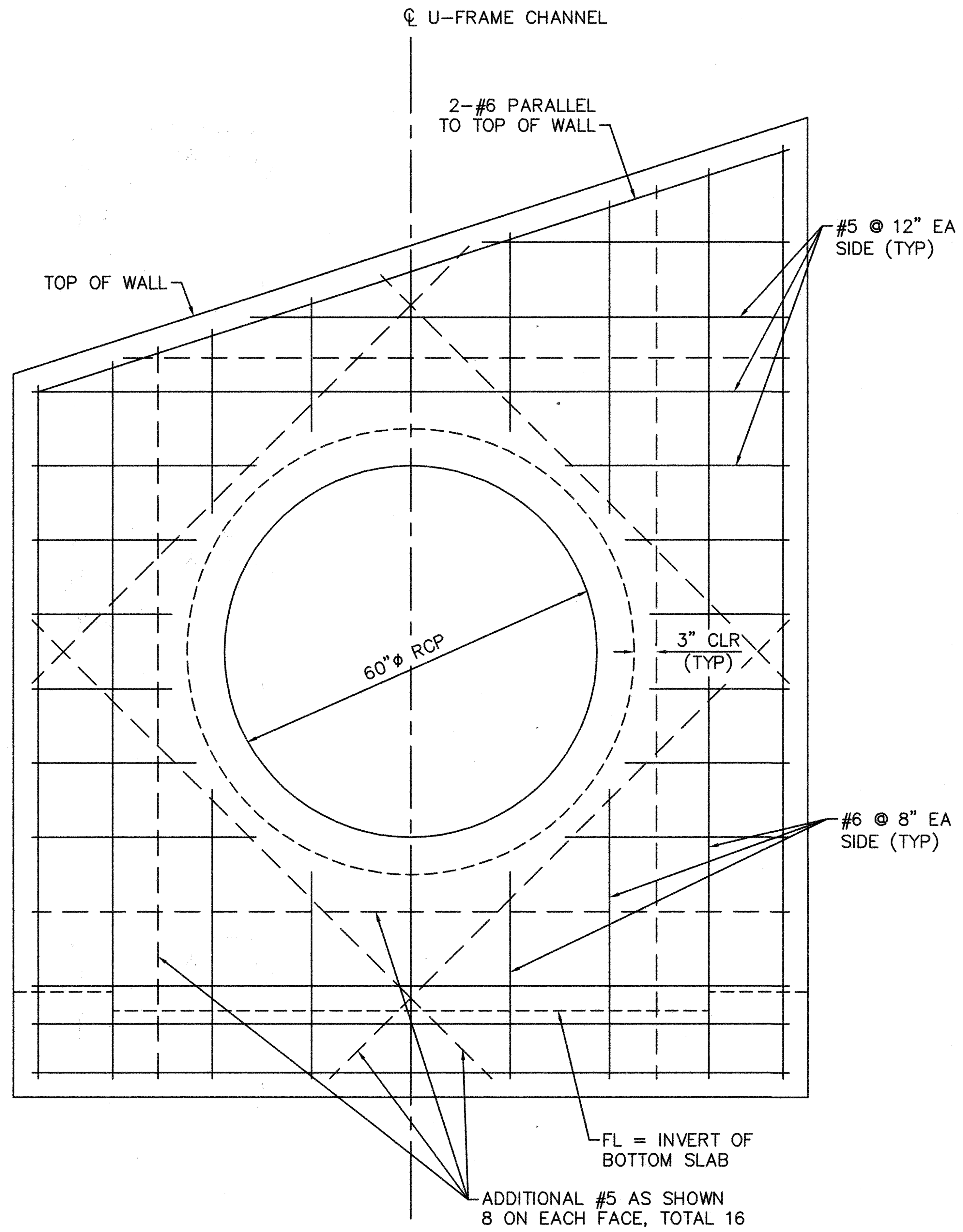
DATE: 6/19/2017

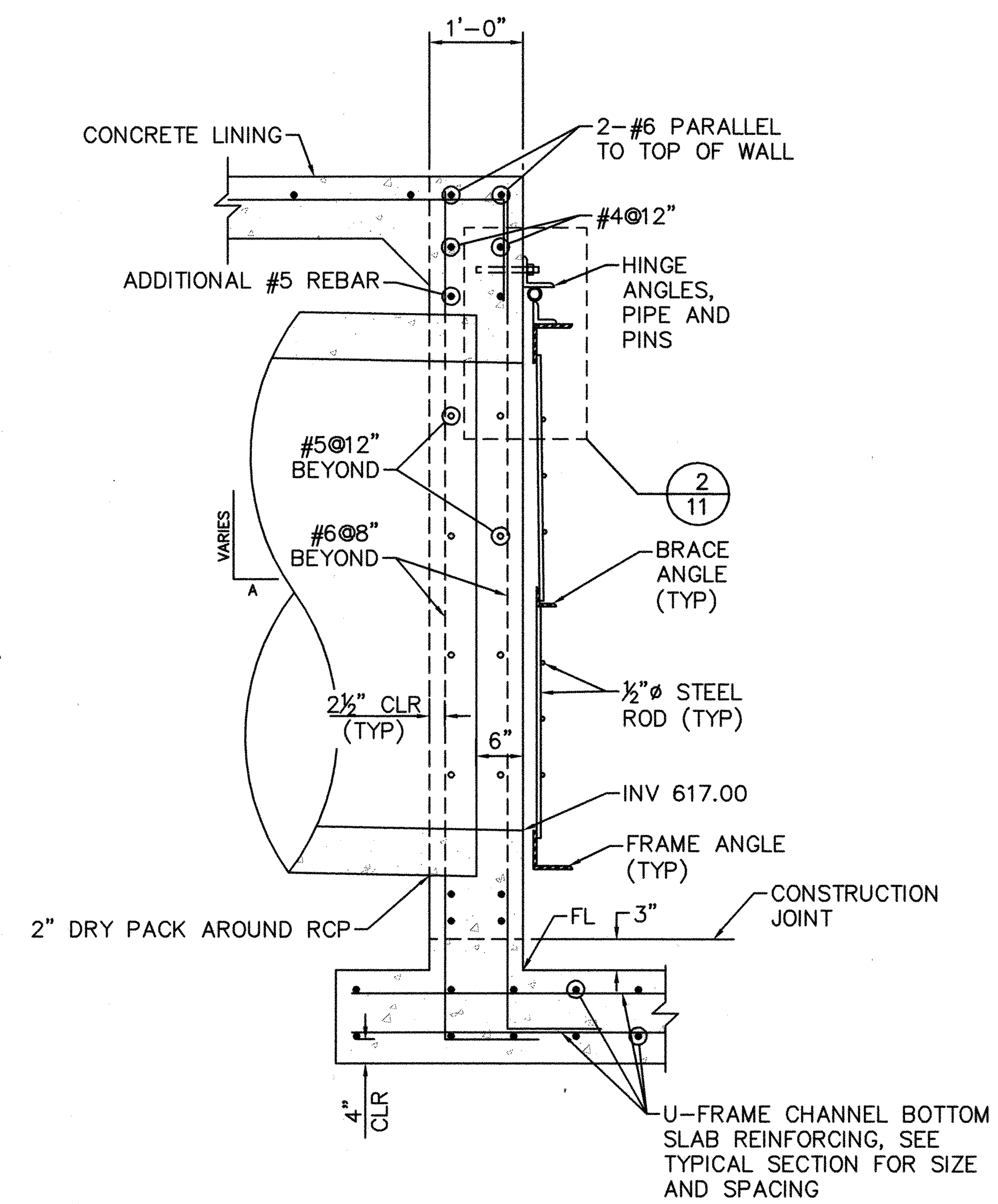
EASTVALE MDP LINE F-3
STORM LINE F3 CHANNEL
DETAILS 2 OF 4

MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 9 OF 18



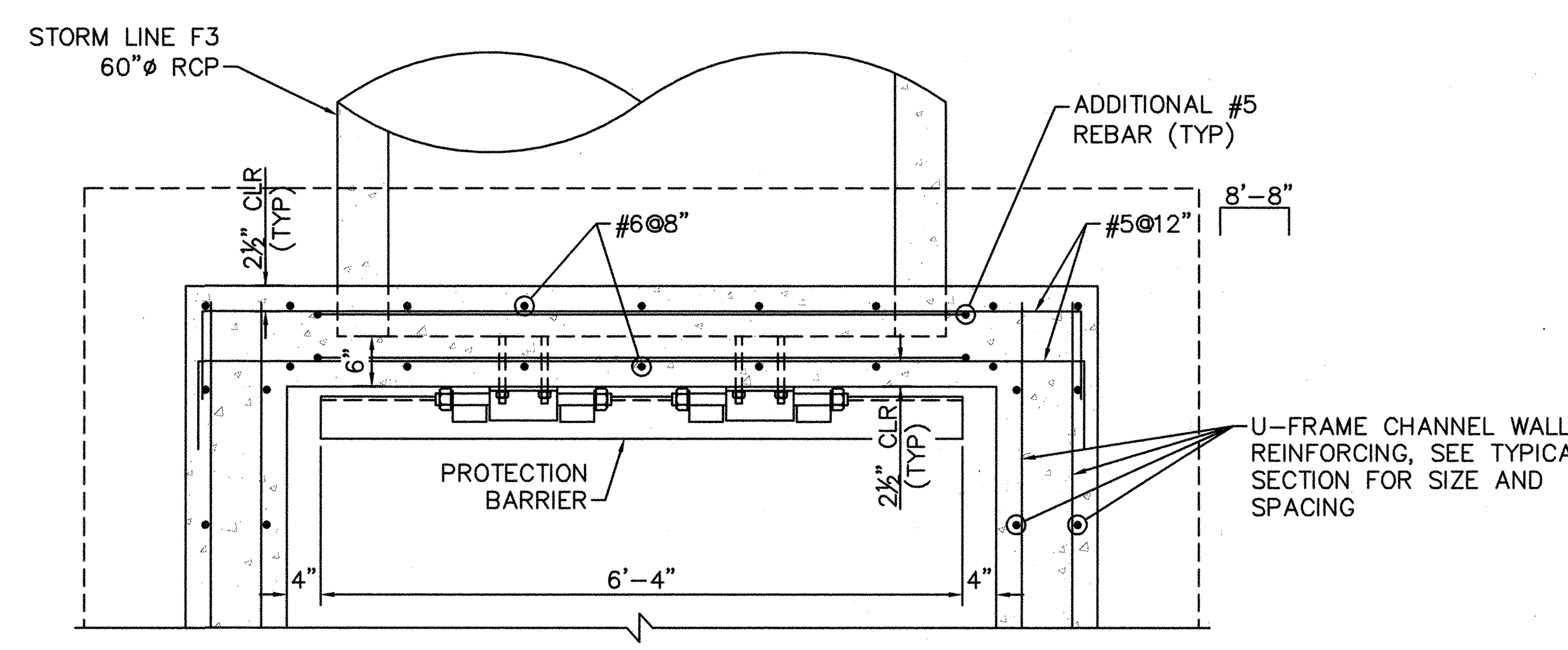
OUTLET WALL REINFORCING ELEVATION

GRAPHIC SCALE IN FEET
0 0.67 1.33 2.67



SECTION A-A (A / 9)

GRAPHIC SCALE IN FEET
0 0.67 1.33 2.67



SECTION B-B (B / 9)

GRAPHIC SCALE IN FEET
0 0.67 1.33 2.67

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
616 ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER — DATE: 3/7/17

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TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY BM NO. M.L. 34-1-64 AT THE N.E. COR OF THE "T" INT. OF ORANGE ST AND SUMNER AVE, 84.0 FEET E'LY AND 22.0 FEET S'LY OF THE CENTERLINE INT. OF SUMNER AVE AND ORANGE ST. TOP OF CURB 10 FEET E'LY OF THE S.E. ECR, A 3" ALUMINUM DISK @ TOP OF CURB STAMPED "M.L. 34-1 RESET"
ELEVATION 607.064 FEET
DATUM: NGVD 29

REVISIONS			
REF.	DESCRIPTION	APPR.	DATE

DESIGNED BY: BMS
DRAWN BY: CG
DATE DRAWN: 9/21/15
CHECKED BY: KJK

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: Deborah de Chambeau — DATE: 6/13/2017
APPROVED BY: Mark H. Wills — DATE: 6/19/2017

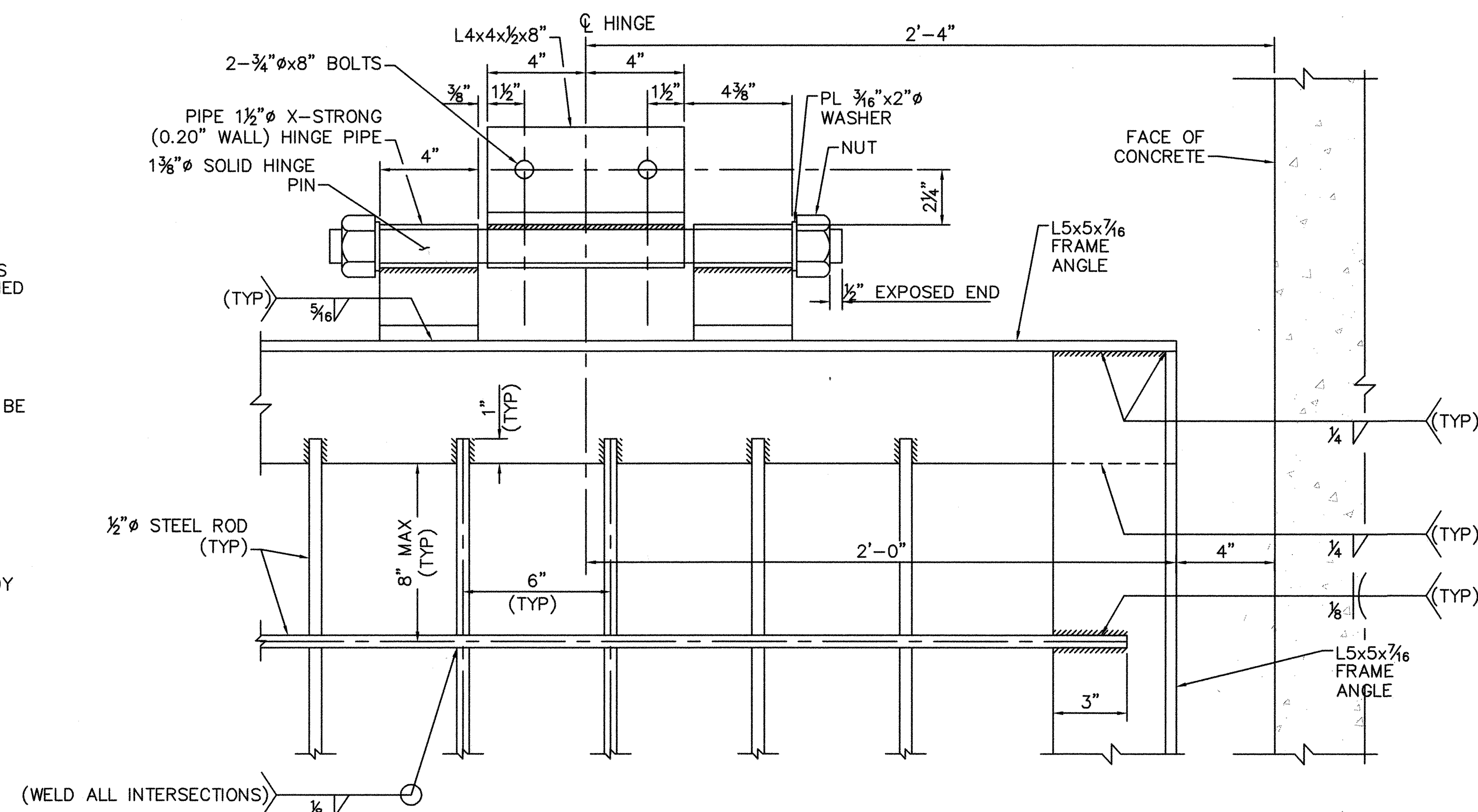
EASTVALE MDP LINE F-3

STORM LINE F3 CHANNEL DETAILS 3 OF 4

MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 10 OF 18

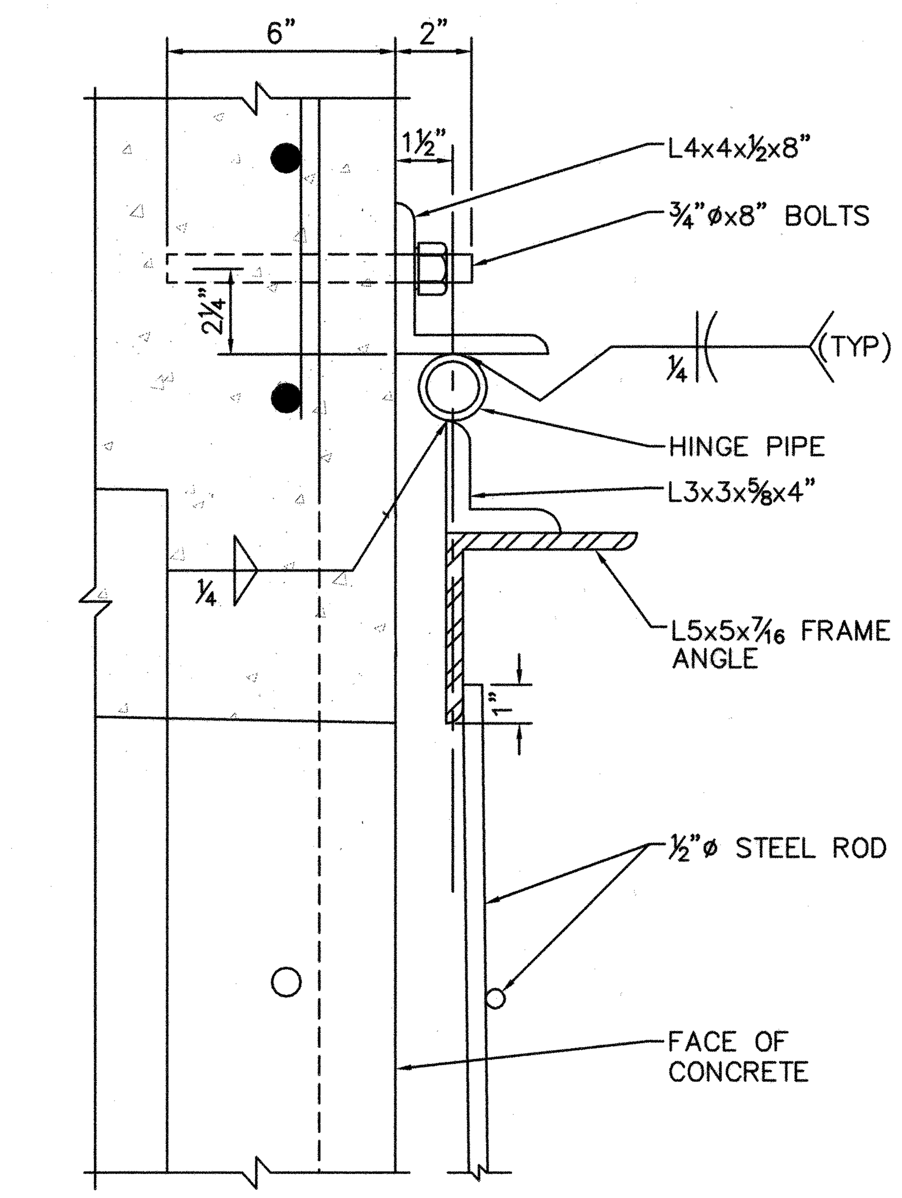
STRUCTURAL STEEL

1. ANGLES CONNECTED WITH SHEAR PINS SHALL FIT SNUGLY AND TRULY FACE TO FACE.
2. THE SHEAR PIN HOLES SHALL BE DRILLED SO AS TO PROVIDE A TIGHT FIT WITH THE SHEAR PINS IN PLACE.
3. THE ALUMINUM SHEAR PIN SHALL BE PEENED ON BOTH SIDES AFTER INSTALLATION.
4. ALL ¾ INCH DIAMETER BOLT HOLES SHALL BE DRILLED ON THE GAGE LINES OF THE ANGLES, UNLESS NOTED OTHERWISE.
5. ALL BOLTS SHALL BE ¾ INCH DIAMETER EMBEDDED A MINIMUM OF 6 INCHES INTO CONCRETE OR EQUIVALENT EXPANSION BOLTS, AND SHALL BE FURNISHED WITH HEX NUTS AND METALLIC WASHERS AT LEAST 3/32 INCH THICK.
6. FRAME, BRACE, AND HINGE ANGLES SHALL HAVE THE OUTSTANDING LEGS FACING IN THE DIRECTION OF BOTH THE BOLT HINGES AND ANGLES.
7. THREAD ENDS OF THE HINGE PIN SO THAT NUTS AND LOCK WASHERS WILL BE FLUSH WITH THE HINGE ANGLE. DAMAGE THREADS BEYOND THE NUT FACE. USE BOLT STOCK FOR PIN.
8. GALVANIZE ALL FERROUS PARTS AFTER FABRICATION.
9. COVER ALL MOVABLE CONTACT SURFACES WITH COAT OF WATERPROOF GREASE PRIOR TO INSTALLATION.
10. SHEAR PIN MATERIAL SHALL BE COMMERCIALLY PURE ALUMINUM WIRE, ALLOY 1100, TEMPER 0, FEDERAL SPECIFICATION 00-A-411.
11. REFER TO SHEET NO. 7 FOR ADDITIONAL REQUIREMENTS AND MATERIAL SPECIFICATIONS.



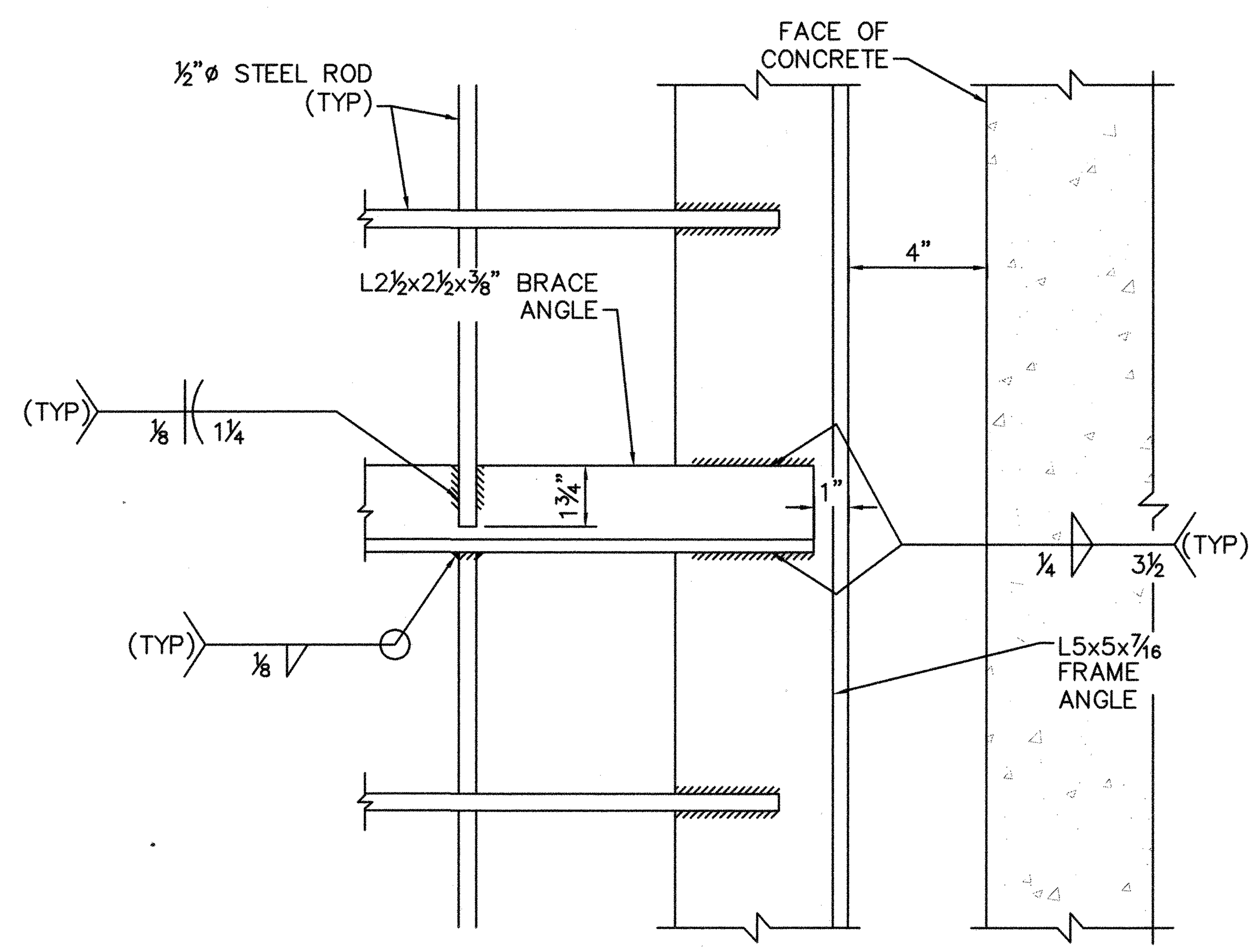
DETAIL 1 (1/-)

GRAPHIC SCALE IN FEET 0 0.16 0.33 0.67



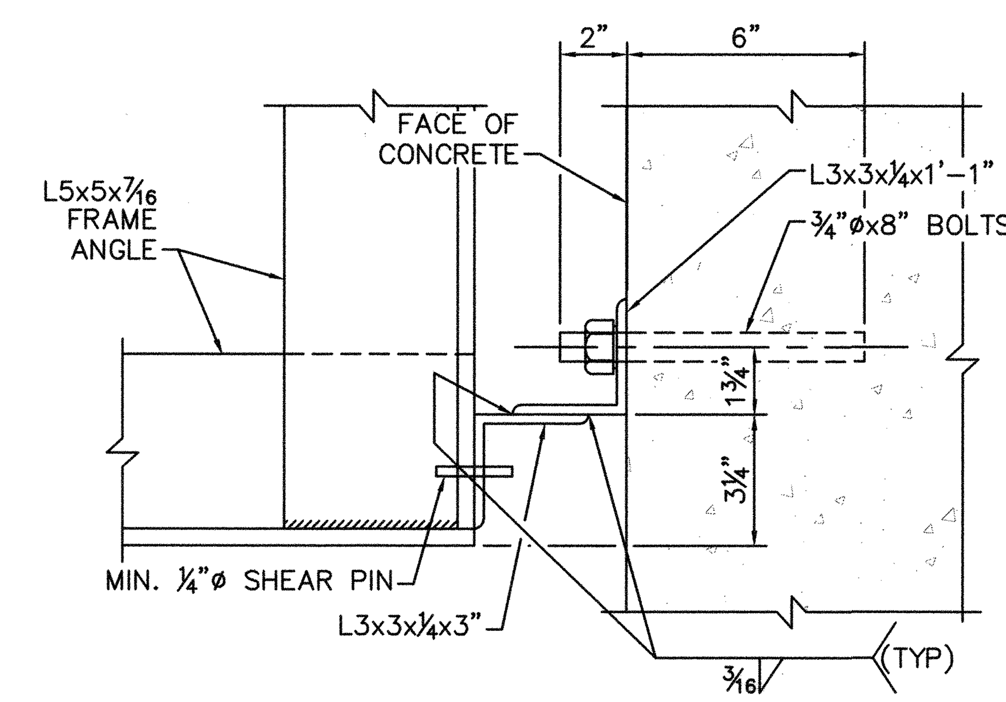
DETAIL 2 (2/10)

GRAPHIC SCALE IN FEET 0 0.16 0.33 0.67



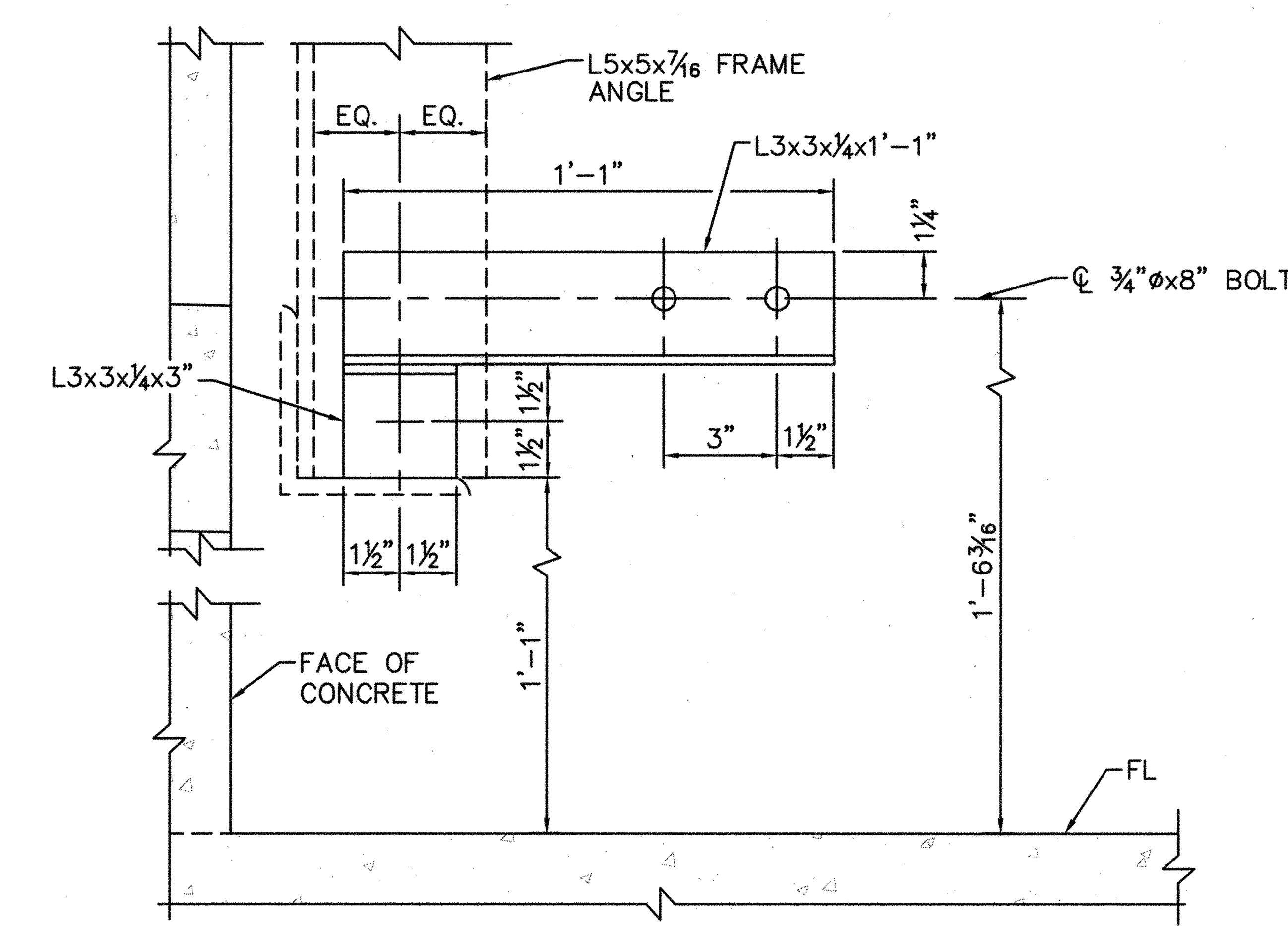
DETAIL 3 (3/9)

GRAPHIC SCALE IN FEET 0 0.16 0.33 0.67



DETAIL 4 (4/9)

GRAPHIC SCALE IN FEET 0 0.16 0.33 0.67



SECTION C-C (C/9)

GRAPHIC SCALE IN FEET 0 0.16 0.33 0.67

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER DATE: 3/7/17

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4218
Tel: (619) 234-9411
PREPARED BY:
KEVIN J. KIMM, R.C.E. 75462 9/21/2015 DATE

REGISTERED PROFESSIONAL ENGINEER KEVIN J. KIMM No. C 75462 EXP: 03/31/16 CIVIL STATE OF CALIFORNIA

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
RIVERSIDE COUNTY BM NO. M.L. 34-1-64 AT THE N.E. COR OF THE "T" INT. OF ORANGE ST AND SUMNER AVE, 84.0 FEET E'LY AND 22.0 FEET S'LY OF THE CENTERLINE INT. OF SUMNER AVE AND ORANGE ST. TOP OF CURB 10 FEET E'LY OF THE S.E. COR, A 3" ALUMINUM DISK @ TOP OF CURB STAMPED "M.L. 34-1 RESET"
ELEVATION 607.064 FEET
DATUM: NGVD 29

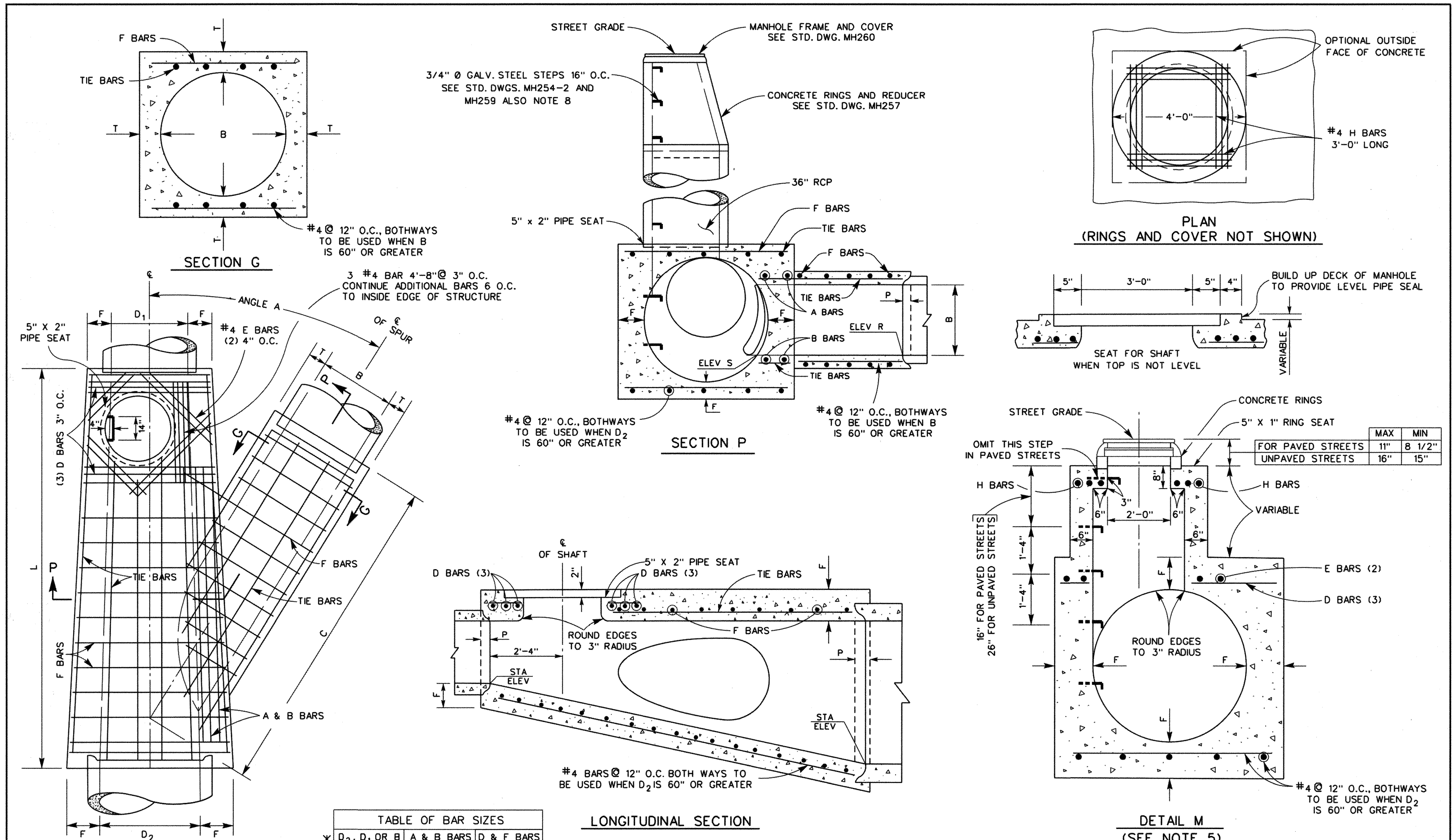
REF.	REVISIONS DESCRIPTION	APPR.	DATE

DESIGNED BY: BMS
DRAWN BY: CG
DATE DRAWN: 9/21/15
CHECKED BY: KJK

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: Deborah deChambeau DATE: 6/13/2017
APPROVED BY: Mark H. Wills DATE: 6/19/2017

EASTVALE MDP LINE F-3
STORM LINE F3 CHANNEL DETAILS 4 OF 4

MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 11 OF 18



	MAX	MIN
FOR PAVED STREETS	11"	8 1/2"
UNPAVED STREETS	16"	15"

TABLE OF BAR SIZES

✱ D_2, D_1 OR B	A & B BARS	D & F BARS
12" – 39"	#5 @ 3"	#4 @ 6"
42" – 84"	#6 @ 3"	#5 @ 6"
90" – 144"	#7 @ 3"	#6 @ 6"

✱ USE D_2, OR D_1, WHICHEVER IS GREATER, OR B

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: CHIEF, DESIGN & CONSTRUCTION DATE: JANUARY 2011 R.E. No. 44684
APPROVED BY: CHIEF ENGINEER DATE: JANUARY 2011 R.C.E. NO. 32336

MANHOLE NO. 4
STANDARD DRAWING NUMBER MH254
SHEET 1 OF 2

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER DATE: 3/7/17

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4216
Tel. (619) 234-948
PREPARED BY:
KATHRYN DANEKER, R.C.E. 81398 DATE 12/16/2016

REGISTERED PROFESSIONAL ENGINEER KATHRYN DANEKER No. 81398 CIVIL STATE OF CALIFORNIA

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
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ELEVATION 607.064 FEET
DATUM: NGVD 29 (NAVD88=NGVD29+2.42')

REF.	REVISIONS DESCRIPTION	APPR.	DATE

DESIGNED BY: KFD
DRAWN BY: WP
DATE DRAWN: 05/28/2014
CHECKED BY: JH

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: DATE: 6/13/2017
APPROVED BY: DATE: 6/19/2017

EASTVALE MDP LINE F-3
STANDARD DETAILS

MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 12 OF 18

NOTES

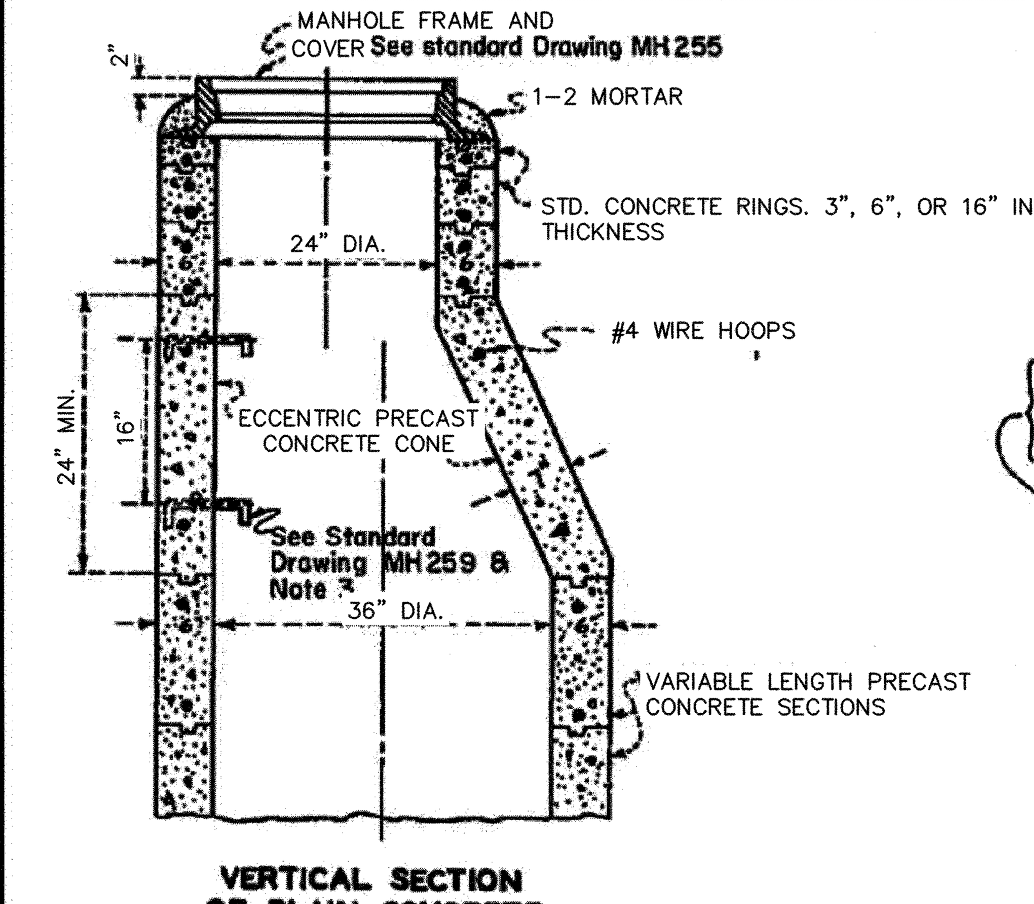
1. VALUES FOR A, B, C, D_1, D_2, ELEVATION R AND ELEVATION S ARE SHOWN ON THE IMPROVEMENT PLAN TABLE OF VALUES FOR F AND T HEREON.
2. LATERALS: IF LATERALS ENTER ON BOTH SIDES OF MANHOLE, ACCESS SHAFT SHALL BE LOCATED ON SIDE RECEIVING THE SMALLER LATERAL.
3. CENTER OF MANHOLE SHAFT SHALL BE LOCATED OVER CENTER LINE OF STORM DRAIN WHEN D_1 IS 48" OR LESS, IN WHICH CASE PLACE 8 E BARS SYMMETRICALLY AROUND SHAFT AT 45° WITH CENTER LINE
4. LENGTH L MAY BE INCREASED AT OPTION OF CONTRACTOR TO MEET PIPE ENDS, BUT ANY CHANGE IN LOCATION OF SPUR MUST BE APPROVED BY THE ENGINEER.
5. DETAIL M: WHEN DEPTH OF MANHOLE FROM STREET GRADE TO TOP OF BOX IS LESS THAN 2'-10 1/2" FOR PAVED STREETS OR 3'-6" FOR UNPAVED STREETS, CONSTRUCT MONOLITHIC SHAFT AS PER DETAIL M. THE CONTRACTOR SHALL HAVE THE OPTION OF CONSTRUCTING SHAFT AS PER DETAIL M FOR ANY DEPTH OF MANHOLE WHEN DIAMETER D_1 IS 48" OR LESS, CENTER OF SHAFT SHALL BE LOCATED AS PER NOTE 3.
6. REINFORCING STEEL SHALL BE ROUND, DEFORMED, STRAIGHT BARS, 1 1/2" CLEAR FROM INSIDE FACE UNLESS OTHERWISE SHOWN. TIE BARS SHALL BE NO. 4 AND SPACED 18" ON CENTERS OR CLOSER.
7. CONCRETE SHALL BE CLASS A, 1 1/2" AGGREGATE.
8. STEPS SHALL BE 3/4" ROUND, GALVANIZED STEEL AND ANCHORED NOT LESS THAN 6" IN THE WALLS OF STRUCTURE UNLESS OTHERWISE SHOWN THE SPACING SHALL BE 16" ON CENTERS. THE LOWEST STEP SHALL BE NOT MORE THAN 2' ABOVE THE INVERT.
9. RINGS, REDUCER AND PIPE FOR ACCESS SHAFT SHALL BE SEATED IN CEMENT MORTAR AND NEATLY POINTED OR WIPED INSIDE SHAFT.
10. FLOOR OF MANHOLE SHALL BE STEEL TROWELED TO SPRINGLINE.
11. BODY OF MANHOLE, INCLUDING SPUR, SHALL BE POURED IN ONE CONTINUOUS OPERATION, EXCEPT THAT THE CONTRACTOR SHALL HAVE THE OPTION OF PLACING AT THE SPRINGLINE A CONSTRUCTION JOINT WITH LONGITUDINAL KEYWAY AND REBAR DOWELS.
12. THE MAXIMUM COVER ABOVE THIS STRUCTURE SHALL BE 25'. IF THE COVER EXCEEDS 25' A SPECIAL STRUCTURE SHALL BE DESIGNED FOR THE COVER AND DETAILED ON THE PROJECT DRAWING.
13. P SHALL BE 5" UNLESS DIAMETER EXCEEDS 96" THEN P= 8".
14. WHERE PRESSURE MANHOLE NO. 4 IS SPECIFIED ON PLANS SEE STD DWG MH256 AND MH258.

** TABLE OF VALUES FOR F AND T

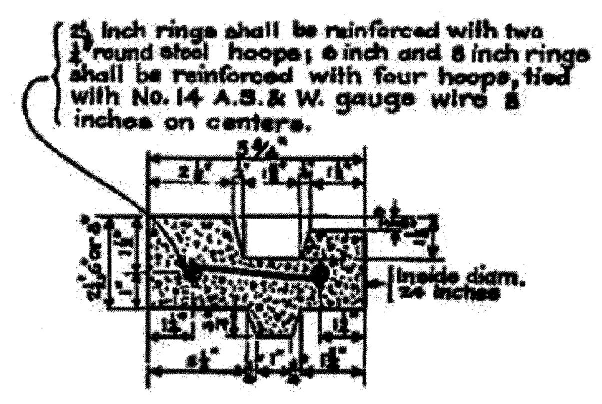
* D_2, D_1	F	* D_2, D_1	F		B	T	B	T
12"	4"	63"	10"		12"	4"	63"	10"
15"	4 1/4"	66"	10 1/4"		15"	4 1/4"	66"	10 1/4"
18"	4 1/2"	69"	10 3/4"		18"	4 1/2"	69"	10 3/4"
21"	5"	72"	11"		21"	5"	72"	11"
24"	5 1/4"	78"	11 3/4"		24"	5 1/4"	78"	11 3/4"
27"	5 1/2"	84"	12 1/2"		27"	5 1/2"	84"	12 1/2"
30"	6"	90"	13 1/4		30"	6"	90"	13 1/4
33"	6 1/4"	96"	14"		33"	6 1/4"	96"	14"
36"	6 1/2"	102"	15 1/2"		36"	6 1/2"	102"	15 1/2"
39"	7"	108"	16"		39"	7"	108"	16"
42"	7 1/2"	114"	16 1/2"		42"	7 1/2"	114"	16 1/2"
45"	7 3/4"	120"	17"		45"	7 3/4"	120"	17"
48"	8"	126"	17"		48"	8"	126"	17"
51"	8 1/2"	132"	17 1/2"		51"	8 1/2"	132"	17 1/2"
54"	9"	138"	17 1/2"		54"	9"	138"	17 1/2"
57"	9 1/4"	144"	18"		57"	9 1/4"	144"	18"
60"	9 1/2"				60"	9 1/2"		

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: CHIEF, DESIGN & CONSTRUCTION DATE: JANUARY 2011 R.E. No. 44684
APPROVED BY: CHIEF ENGINEER DATE: JANUARY 2011 R.C.E. NO. 32336

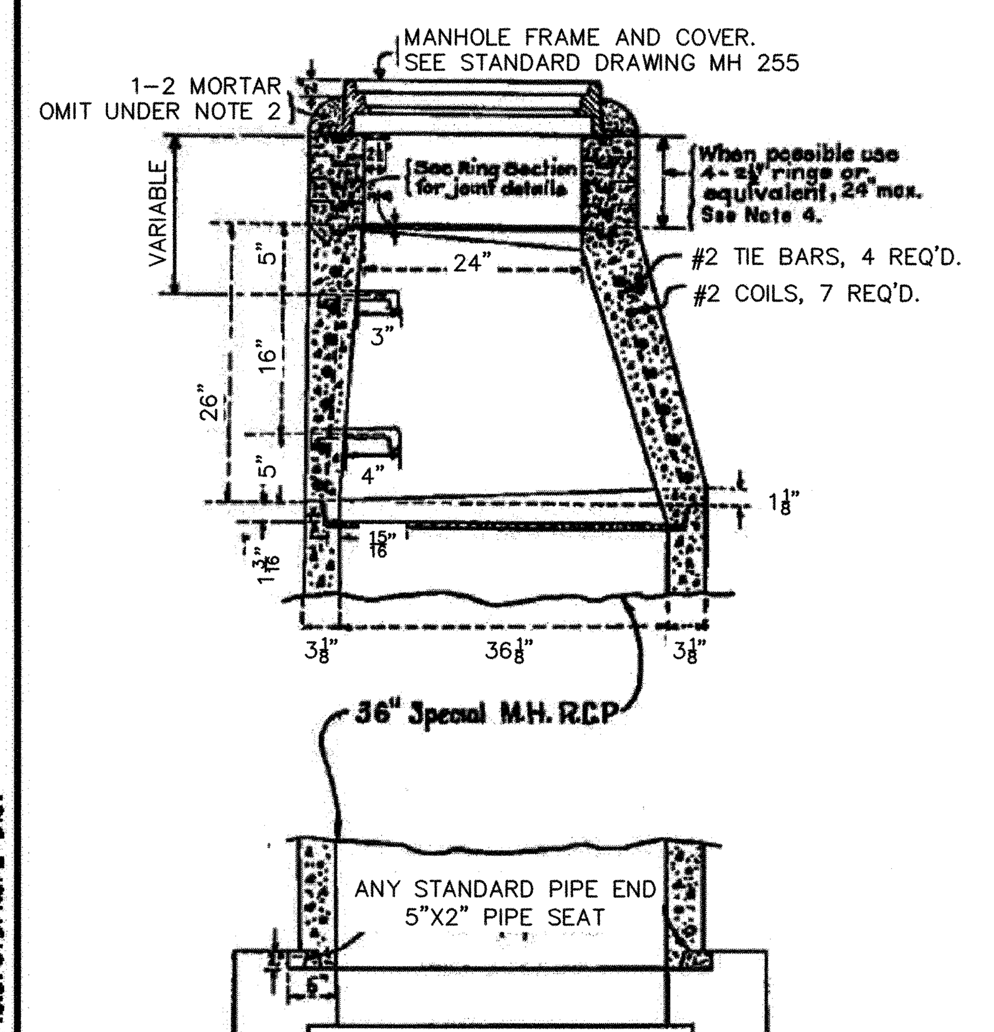
MANHOLE NO. 4
STANDARD DRAWING NUMBER MH254
SHEET 2 OF 2



VERTICAL SECTION OF PLAIN CONCRETE ECCENTRIC MANHOLE SHAFT



CROSS SECTION OF REINFORCED CONCRETE RING



VERTICAL SECTION OF REINFORCED CONCRETE ECCENTRIC MANHOLE SHAFT

L.A.C.F.C.D. STD. No. 2-D107

NOTES

1. ALL JOINTS SHALL BE FILLED WITH 1-2 MORTAR AND NEATLY PAINTED OR WIPED ON INSIDE OF SHAFT.
2. COLLAR OF 1-2 MORTAR AROUND COVER FRAME SHALL BE OMITTED IN ROCK AND OIL STREETS AND IN PAVED STREETS.
3. STEPS SHALL BE 3/4 INCH ROUND GALVANIZED STEEL. TOP STEP SHALL BE PLACED DIRECTLY BENEATH THE MANHOLE COVER FRAME.

   WIDTH OF ALL STEPS SHALL BE 14 INCHES BETWEEN LEG CENTERS. EXCEPT WHERE SHOWN OTHERWISE, SPACING OF STEPS IN SHAFT SHALL BE 16" INCHES ON CENTER.
4. ECCENTRIC MANHOLE SHAFT, REDUCER, AND RINGS MAY BE PLAIN CONCRETE. FOR UNREINFORCED SECTIONS, THE MINIMUM THICKNESS SHALL BE 6 INCHES. THE CONCRETE USED SHALL BE CLASS "A".

REGISTERED PROFESSIONAL ENGINEER WARREN D. WILLIAMS No. 32336 Exp. 12-31-04 CIVIL STATE OF CALIFORNIA

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY: CHIEF ENGINEER DATE: April 5, 2004 R.C.E. NO. 32336

MANHOLE SHAFT FOR CAST PIPE
STANDARD DRAWING NUMBER MH257

STANDARD DETAIL SHOWN FOR REFERENCE ONLY. IF DISCREPANCY EXISTS BETWEEN WHAT IS REFLECTED IN THIS PLAN AND RCFCD STANDARD DRAWING, RIVERSIDE COUNTY FLOOD CONTROL STANDARD SHALL GOVERN.

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER DATE: 3/7/17

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4238
Tel. (619) 234-9411
PREPARED BY:
KATHRYN DANEKER, R.C.E. 81398 DATE: 12/16/2016

REGISTERED PROFESSIONAL ENGINEER KATHRYN DANEKER No. 81398 CIVIL STATE OF CALIFORNIA

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

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DATUM: NGVD 29 (NAVD88=NGVD29+2.42')

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DRAWN BY: WP
DATE DRAWN: 05/28/2014
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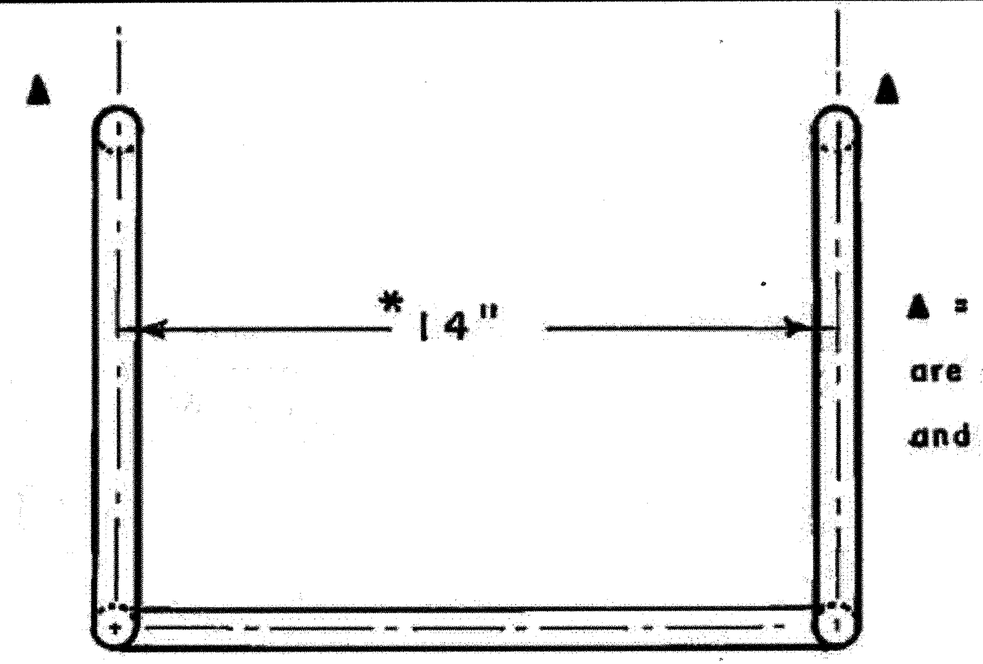
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: Deborah de Chambeau DATE: 6/13/2017
APPROVED BY: Mark H. Wills DATE: 6/19/2017

EASTVALE MDP LINE F-3
STANDARD DETAILS

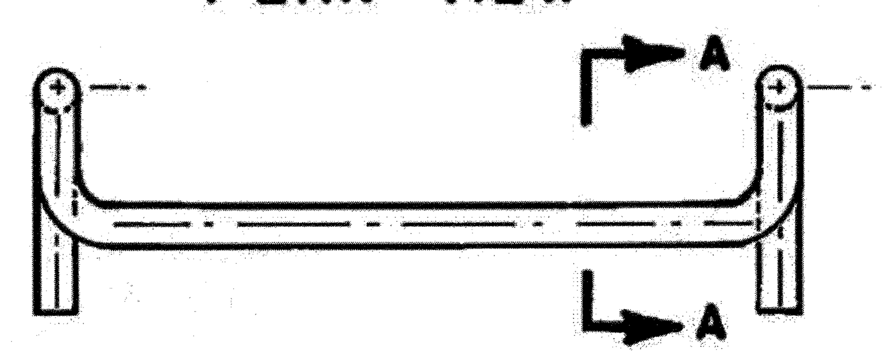
MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 13 OF 18



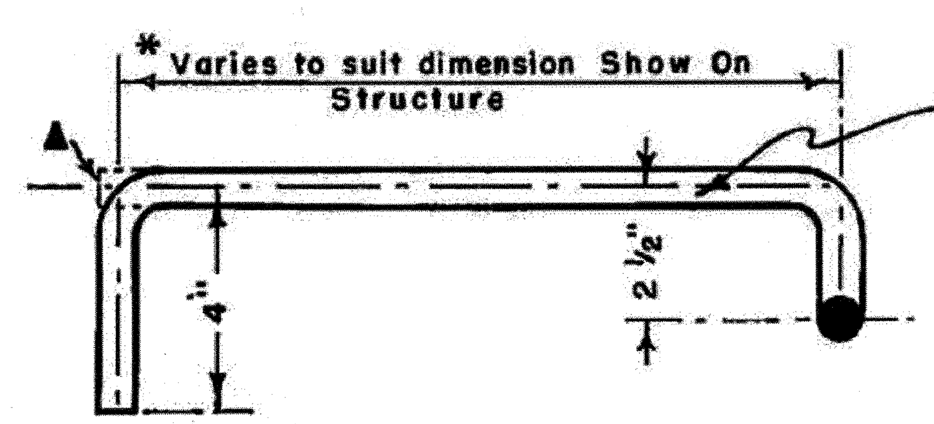
Note

▲ = When steel forms are used eliminate hook and use upset end.

PLAN VIEW



FRONT ELEVATION



SECTION A-A
GALVANIZE AFTER BENDING

NOTE:

THIS DETAIL SHALL BE USED WHEREVER STEPS ARE REQUIRED.

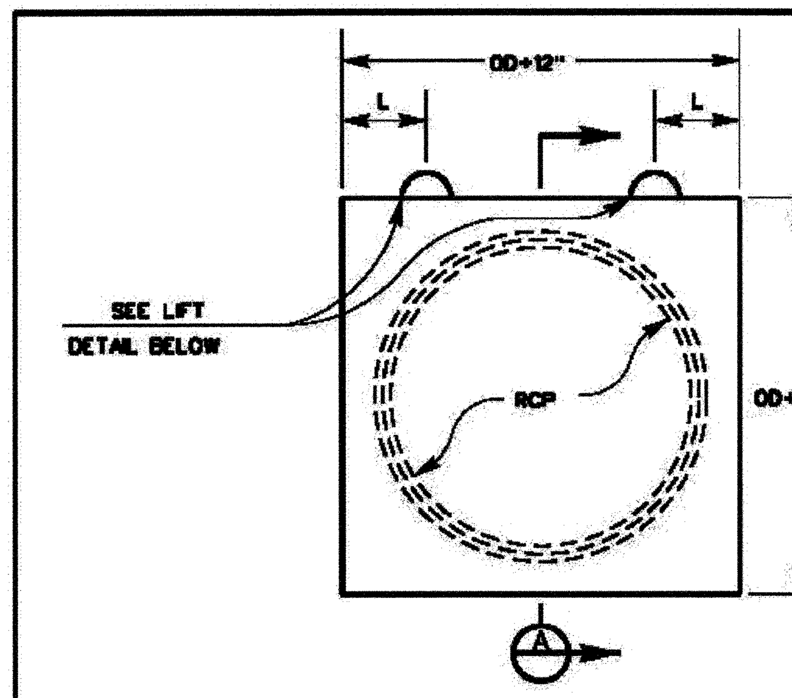
L.A.C.F.C.D. STD. NO. 2-D66

REGISTERED PROFESSIONAL ENGINEER WARREN D. WILLIAMS No. 32336 Exp. 12-31-04 CIVIL STATE OF CALIFORNIA

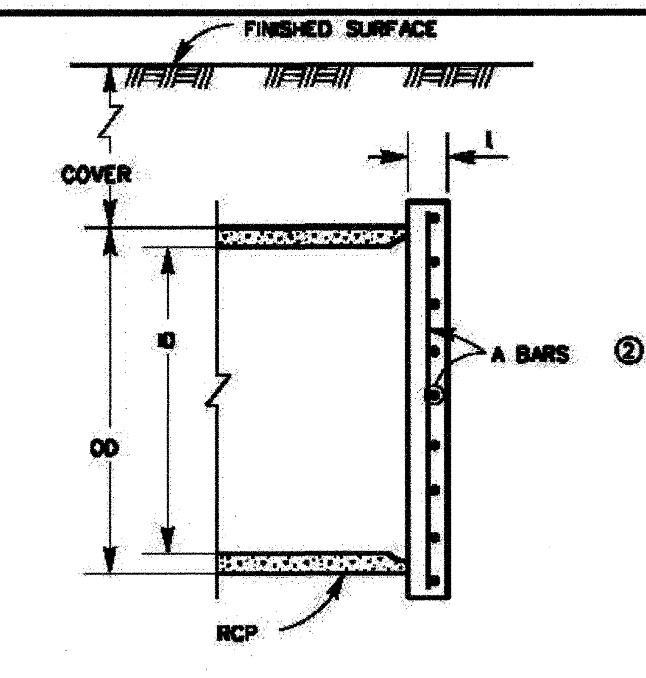
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE: April 5, 2004 R.C.E. NO. 32336

STANDARD DROP STEP

STANDARD DRAWING NUMBER MH259

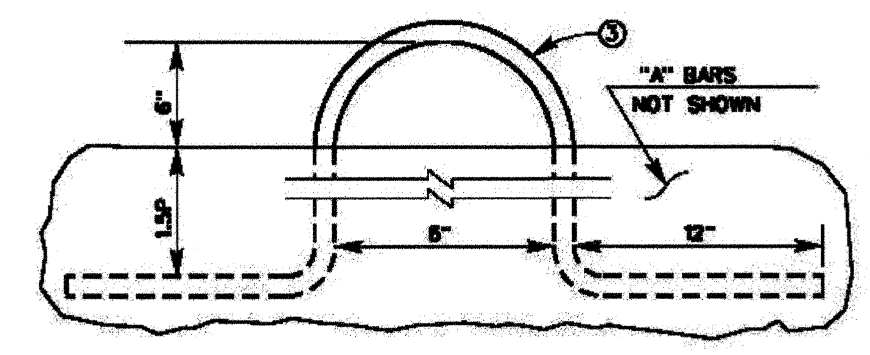


FRONT VIEW

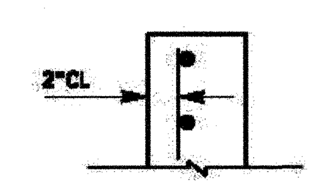


SECTION A

ID (IN)	MAX COVER (FT)	t (IN)	A BARS	L, P
48	5	4	4 @ 9	1'-6"
	10	4	4 @ 6	
	15	5	4 @ 6	
60	5	4	4 @ 6	1'-8"
	10	5	4 @ 6	
	15	5	5 @ 6	
66	5	5	4 @ 6	1'-10"
	10	5	5 @ 6	
	15	5	5 @ 6	
72	5	5	4 @ 6	2'-0"
	10	5	5 @ 6	
	15	5	6 @ 6	
78	5	5	5 @ 6	2'-2"
	10	5	6 @ 6	
	15	6	6 @ 6	
84	5	5	5 @ 6	2'-4"
	10	5	6 @ 6	
	15	6	6 @ 5	
90	5	5	6 @ 6	2'-5"
	10	6	6 @ 6	
	15	6	6 @ 5	
96	5	5	6 @ 6	2'-7"
	10	6	6 @ 5	
	15	6	7 @ 6	



LIFT DETAIL



DETAIL

NOTES

1. CONCRETE SHALL BE CLASS 'A'.
2. ② ALL REINFORCING STEEL SHALL BE CENTERED IN BULKHEAD EXCEPT FOR PIPE DIAMETER GREATER THAN 96", VERTICAL "A" BARS SHALL BE PLACED AT 2" CLEAR FROM THE INSIDE FACE OF THE BULKHEAD. HORIZONTAL "A" BARS SHALL BE PLACED TOWARDS OUTSIDE FACE OF BULKHEAD PER DETAIL.
3. ③ LIFTS SHALL BE WOVEN STEEL CABLE WITH SAME MINIMUM DIAMETER (d) AS "A" BARS. WEAVE CABLE THROUGH HORIZONTAL "A" BARS. COAT EXPOSED PORTION OF CABLE LIFTS WITH AN APPROVED BITUMINOUS PAINT PRIOR TO BACKFILLING TRENCH.

REGISTERED PROFESSIONAL ENGINEER WARREN D. WILLIAMS No. 32336 Exp. 12-31-04 CIVIL STATE OF CALIFORNIA

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
APPROVED BY:
CHIEF ENGINEER
DATE: April 5, 2004 R.C.E. NO. 32336

CONCRETE BULKHEAD

STANDARD DRAWING NUMBER M816

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
61b ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER — DATE: 3/7/17

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4238
Tel: (619) 234-9411
PREPARED BY:
KATHRYN DANEKER, R.C.E. 81398 — DATE 12/16/2016

REGISTERED PROFESSIONAL ENGINEER KATHRYN DANEKER No. 81398 CIVIL STATE OF CALIFORNIA

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ELEVATION 607.064 FEET
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DRAWN BY: WP
DATE DRAWN: 05/28/2014
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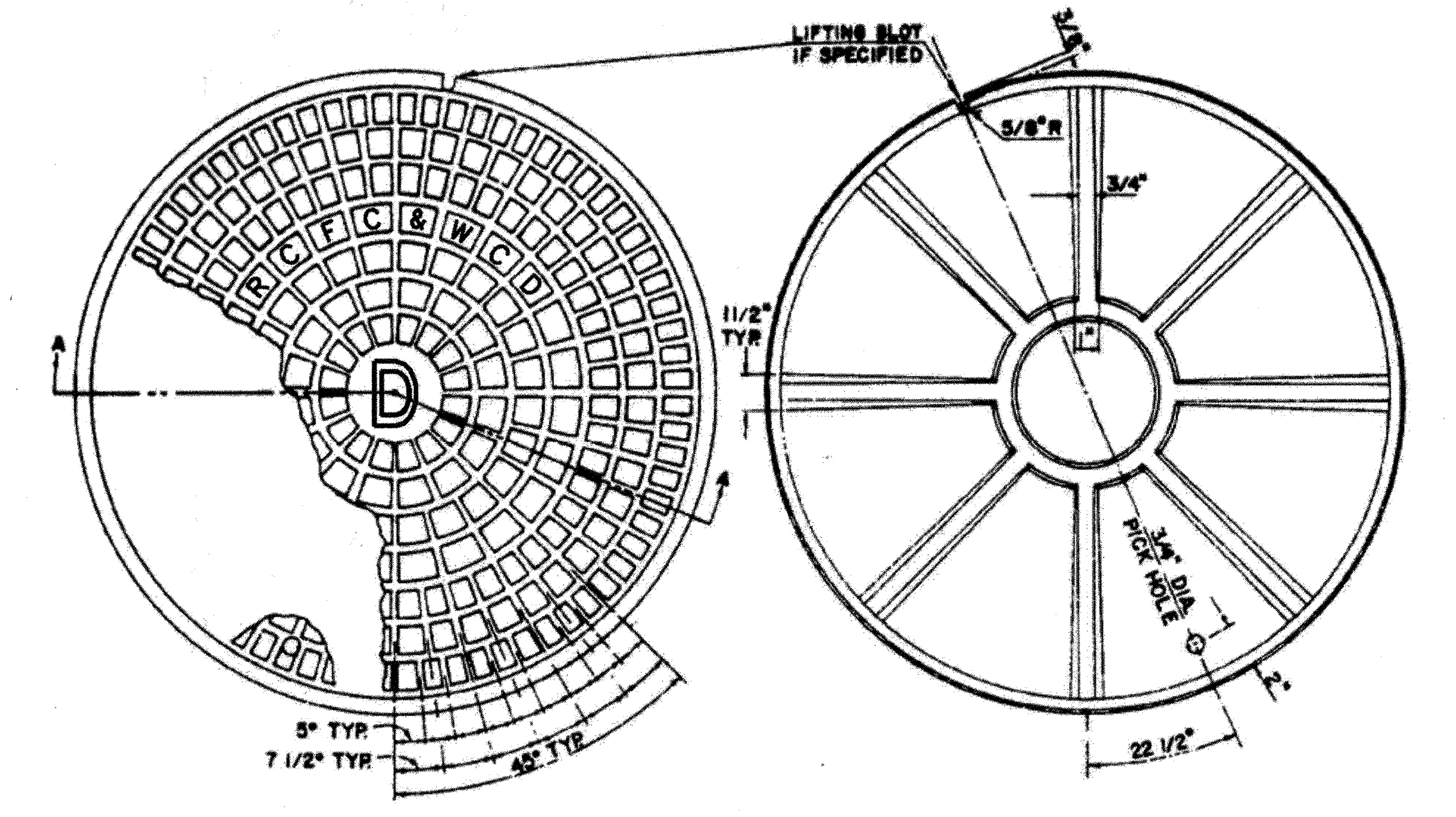
RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
RECOMMENDED FOR APPROVAL BY: Deborah de Chambeau — DATE: 6/13/2017
APPROVED BY: Mark H. Wills — DATE: 6/19/2017

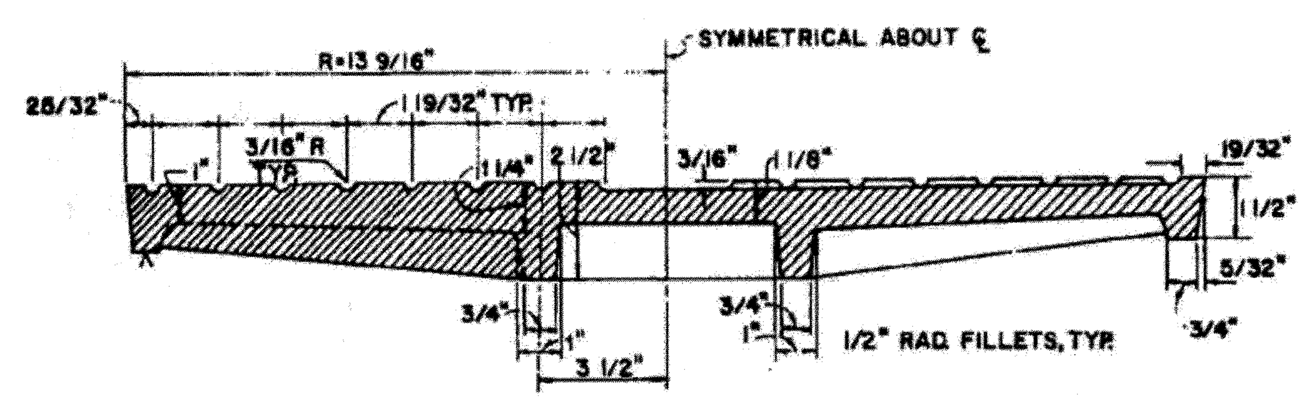
EASTVALE MDP LINE F-3
STANDARD DETAILS

MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 14 OF 18

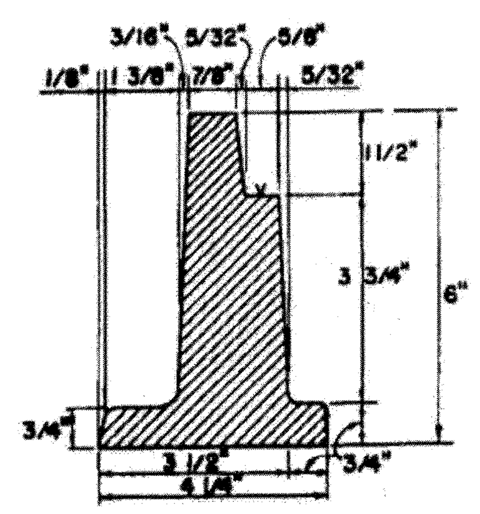


COVER FOR 24" CLEAR OPENING FRAME

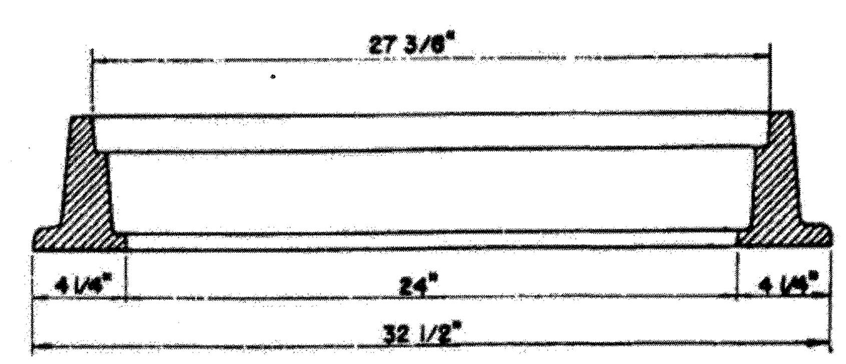
BOTTOM PLAN OF COVER



SECTION A-A



DETAIL OF FRAME



SECTION THRU FRAME

APWA STD PLAN 630-1

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

APPROVED BY:

CHIEF ENGINEER

DATE: April 5, 2004 R.C.E. NO. 32336

24-INCH MANHOLE FRAME AND COVER

STANDARD DRAWING NUMBER MH260
SHEET 1 OF 2

NOTES:

1. THE CAST IRON USED SHALL CONFORM WITH ASTM A-48 CLASS 35B.
2. THE FRAME AND COVER SHALL BE COATED WITH ASPHALTUM OR BITUMINOUS PAINT AFTER TESTING AND INSPECTION.
3. COVERS SHALL BE CAST WITH THE LETTERS "D" AND "RCFC&WCD". THE LETTER "D" SHALL BE APPROXIMATELY 2 1/2 INCHES HIGH WITH 1/2-INCH LINE WIDTH AND PLACED IN THE CENTER OF THE COVER. ALL LETTERS SHALL BE FLUSH WITH THE FINISHED SURFACE OF THE COVER.
4. FOUNDRY IDENTIFYING MARK, HEAT AND DATE SHALL BE CAST ON THE BOTTOM OF THE COVER AND ON THE INSIDE OF THE FRAME.
5. IMPORTED COVERS AND FRAMES SHALL HAVE THE COUNTRY OF ORIGIN MARKING IN COMPLIANCE WITH FEDERAL REGULATIONS.
6. WEIGHT OF FRAME SHALL BE 265 POUNDS. WEIGHT OF COVER SHALL BE 175 POUNDS. ACTUAL WEIGHTS SHALL BE WITHIN A RANGE OF 95% TO 110%.
7. THE MANHOLE FRAME AND COVER SHALL BE INSPECTED BY THE ENGINEER PRIOR TO SHIPMENT TO THE JOB SITE. ACCEPTANCE WILL BE INDICATED BY THE AGENCY'S MARK.
8. THE PROOF-LOAD FOR TEST METHOD B OF THE STANDARD SPECIFICATIONS IS 40,700 POUNDS.
9. COVERS FOR MANHOLES LOCATED IN EASEMENTS, ALLEYS, PARKWAYS AND ALL OTHER PLACES EXCEPT PAVED STREETS SHALL BE PROVIDED WITH SOCKET SET SCREW LOCKING DEVICES. DRILL AND TAP TWO HOLES TO A DEPTH OF ONE INCH AT 90 DEGREES TO PICK HOLE AND INSTALL ¾-INCH X ¾-INCH STAINLESS STEEL SOCKET SET SCREWS WITH ⅜-INCH RECESSED HEX HEAD. ALL THREADS SHALL BE N.C.

APWA STD PLAN 630-1

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

APPROVED BY:

CHIEF ENGINEER

DATE: April 5, 2004 R.C.E. NO. 32336

24-INCH MANHOLE FRAME AND COVER

STANDARD DRAWING NUMBER MH260
SHEET 2 OF 2

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION

JOE INDRAWAN, CITY ENGINEER DATE: 3/7/17

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4216
Tel: (619) 234-9411
PREPARED BY:

KATHRYN DANEKER, R.C.E. 81398 DATE: 12/16/2016

Don't Dig...Until You Call U.S.A. Toll Free 1-800-227-2600 for the location of buried utility lines. Don't disrupt vital services. TWO WORKING DAYS BEFORE YOU DIG

BENCHMARK:
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ELEVATION 607.064 FEET
DATUM: NGVD 29 (NAVD88=NGVD29+2.42')

REF.	REVISIONS DESCRIPTION	APPR.	DATE

DESIGNED BY: KFD
DRAWN BY: WP
DATE DRAWN: 05/28/2014
CHECKED BY: JH

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY: Deborah de Chambeau DATE: 6/13/2017

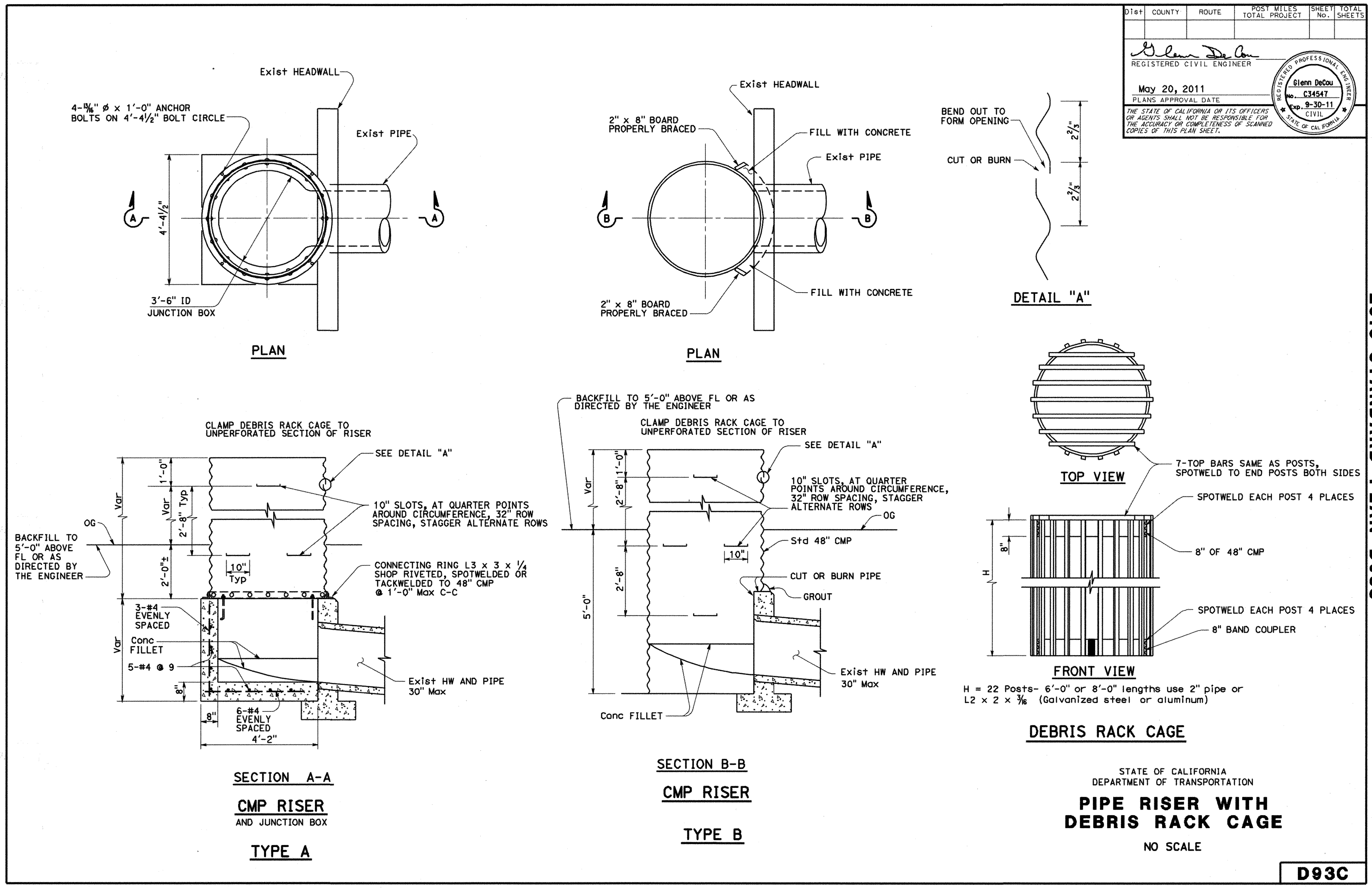
APPROVED BY: Mark H. Wills DATE: 6/19/2017

EASTVALE MDP LINE F-3

STANDARD DETAILS

MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 15 OF 18

194



6-9-09

Return to Table of Contents

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER — DATE: 3/7/17

Kimley»Horn
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Tel: (619) 234-948
PREPARED BY:
KATHRYN DANEKER, R.C.E. 81398 — DATE 12/16/2014

REGISTERED PROFESSIONAL ENGINEER — KATHRYN DANEKER — No. 81398 — CIVIL — STATE OF CALIFORNIA

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APPROVED BY: Mark H. Wills — DATE: 6/19/2017

EASTVALE MDP LINE F-3
STANDARD DETAILS

MDC
PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 16 OF 18

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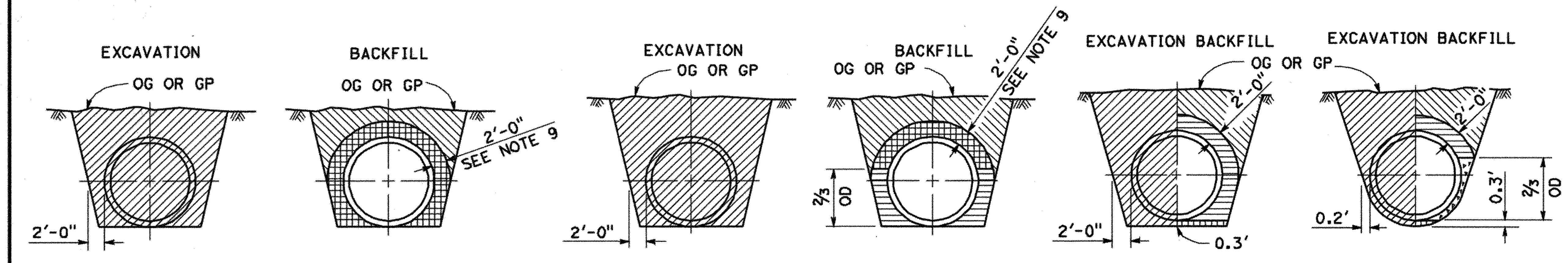
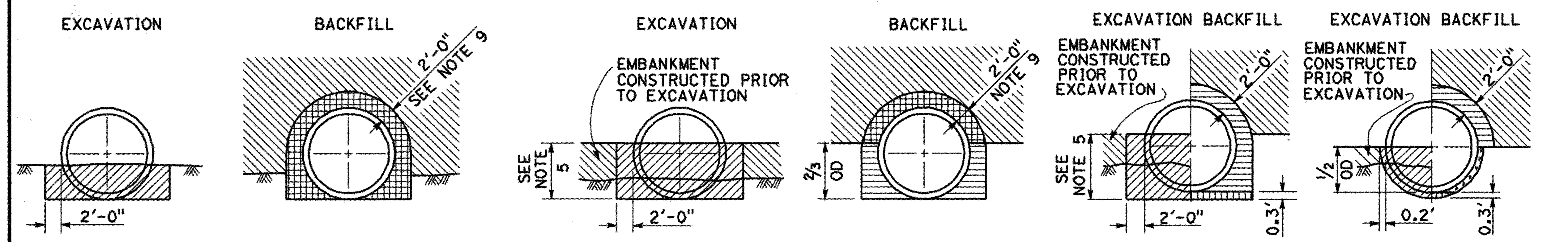


IN TRENCH

IN TRENCH

SAND BEDDING SOIL CEMENT BEDDING

IN TRENCH



IN EMBANKMENT

IN EMBANKMENT

SAND BEDDING SOIL CEMENT BEDDING
A B

IN EMBANKMENT

MINIMUM ALLOWABLE CLASSES OF RCP FOR METHOD 1

COVER	MINIMUM CLASS AND D-LOAD
5.9'	CLASS II 1000D
6.0' - 7.9'	CLASS III 1350D
8.0' - 9.9'	CLASS III SPECIAL 1700D
10.0' - 11.9'	CLASS IV 2000D
12.0' - 13.9'	CLASS IV SPECIAL 2500D
14.0' - 16.9'	CLASS V 3000D
17.0' - 20.0'	CLASS V SPECIAL 3600D

See Notes 6 and 9

METHOD 1

MINIMUM ALLOWABLE CLASSES OF RCP FOR METHOD 2

COVER	MINIMUM CLASS AND D-LOAD
15.9'	CLASS II 1000D
16.0' - 19.9'	CLASS III 1350D
20.0' - 24.9'	CLASS III SPECIAL 1700D
25.0' - 27.9'	CLASS IV 2000D
28.0' - 34.9'	CLASS IV SPECIAL 2500D
35.0' - 41.9'	CLASS V 3000D
42.0' - 50.0'	CLASS V SPECIAL 3600D

See Notes 8 and 9

METHOD 2

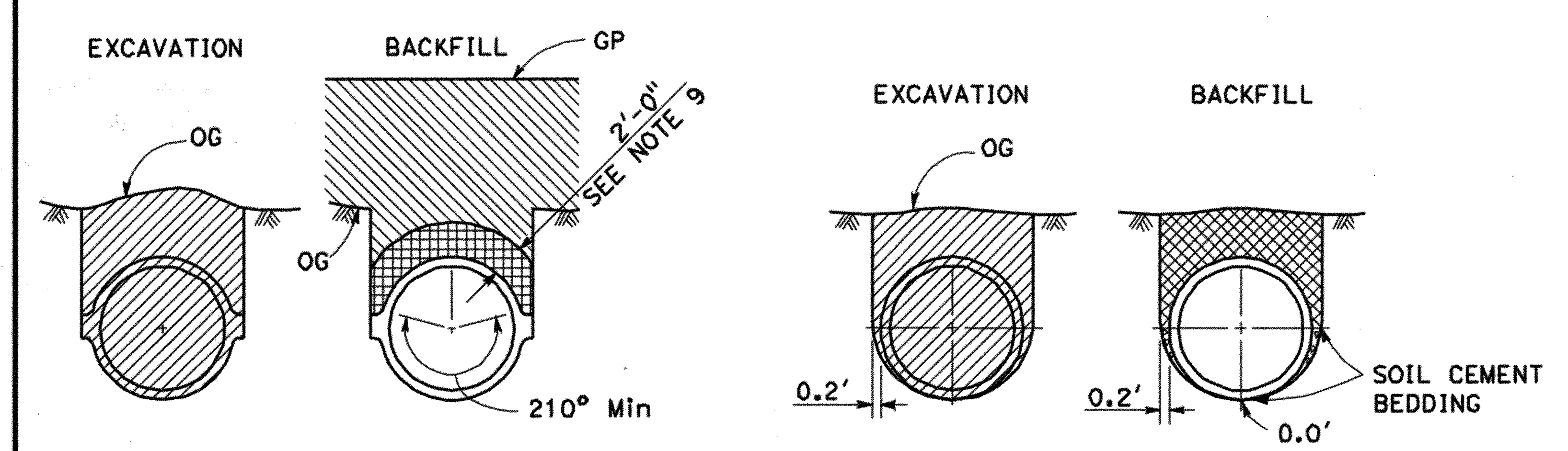
MINIMUM ALLOWABLE CLASSES OF RCP FOR METHOD 3

COVER	MINIMUM CLASS AND D-LOAD
25.9'	Class II 1000D
26.0' - 31.9'	Class III 1350D
32.0' - 37.9'	Class III Special 1700D
38.0' - 44.9'	Class IV 2000D
45.0' - 55.9'	Class IV Special 2500D
56.0' - 67.9'	Class V 3000D
68.0' - 80.0'	Class V Special 3600D

METHOD 3

REINFORCED CONCRETE PIPE

See Notes 1, 2, 7 and 10



IN TRENCH ONLY
CAST-IN-PLACE

IN TRENCH ONLY
PRECAST
See Notes 7 and 11

NON-REINFORCED CONCRETE PIPE

LEGEND

- STRUCTURE EXCAVATION (CULVERT)
- STRUCTURE BACKFILL (CULVERT) 95% RELATIVE COMPACTION
- STRUCTURE BACKFILL (CULVERT) 90% RELATIVE COMPACTION
- LOOSE BACKFILL
- SAND BEDDING
- SOIL CEMENT BEDDING
- ROADWAY EMBANKMENT
- ORIGINAL GROUND

OD = OUTSIDE DIAMETER FOR CIRCULAR PIPES AND MAXIMUM VERTICAL DIMENSION FOR OTHER SHAPES

ID = INSIDE DIAMETER FOR CIRCULAR PIPES AND MINIMUM VERTICAL DIMENSION FOR OTHER SHAPES

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

Dallas J. Forester
REGISTERED CIVIL ENGINEER

May 20, 2011
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER Dallas Forester No. C37765 Exp. 12-31-12 CIVIL STATE OF CALIFORNIA

THE STATE OF CALIFORNIA OR ITS OFFICERS OR AGENTS SHALL NOT BE RESPONSIBLE FOR THE ACCURACY OR COMPLETENESS OF SCANNED COPIES OF THIS PLAN SHEET.

NOTES:

1. Unless otherwise shown on the plans or specified in the special provisions, the Contractor shall have the option of selecting the class of RCP and the method of backfill to be used, provided the height of cover does not exceed the value shown for the RCP selected.
   Example:
   2'-0" RCP culvert with maximum cover of 19'-0" the options are:
   a) Class V Special or stronger with Method 1.
   b) Class III or stronger with Method 2.
   c) Class II or stronger with Method 3.
   Cover is defined as the maximum vertical distance from top of pipe to finished grade within the length of any given culvert.
2. The class of RCP, method of backfill and bedding selected shall be the same throughout the length of any given culvert.
3. The "length of any culvert" is defined as the culvert between:
   a) Successive drainage structures (inlets, junction boxes, headwalls, etc.).
   b) A drainage structure and the inlet or outlet end of the culvert.
   c) The inlet and outlet end of the culvert when there are no intervening drainage structures.
4. Slope or shore excavation sides as necessary.
5. Embankment height prior to excavation for installation of all classes of RCP under Methods 2 and 3A shall be as follows:
   Pipe sizes 1'-0" to 3'-6", I D = 2'-6"
   Pipe sizes 4'-0" to 7'-0", I D = ⅔ OD
   Pipe sizes larger than 7'-0", I D = 5'-0"
6. The maximum size for all classes of RCP placed under Method 1 is 78" ID.
7. Non-reinforced precast pipe sizes 3'-0" or smaller may also be placed under Methods 1, 2 or 3.
8. Oval or arch shaped RCP shall be placed under Method 2 only.
9. Embankment compaction requirements govern over the 90% relative compaction backfill requirement within 2'-6" of finished grade.
10. Backfill shall be placed full width of excavation except where dimensions are shown for backfill width or thickness. Dimensions shown are minimums.
11. Where the precast non-reinforced concrete pipe is used as a substitute for the cast-in-place pipe, both the wall thickness and the concrete strength shall be at least as great as that specified for the cast-in-place pipe. The fill height allowed shall not exceed that shown for the cast-in-place pipe.

2010 STANDARD PLAN A62D

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

EXCAVATION AND BACKFILL CONCRETE PIPE CULVERTS

NO SCALE

A62D

4-28-09

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION
3/7/17
JOE INDRAWAN, CITY ENGINEER DATE:

Return to Table of Contents

MDC

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4218
Tel: (619) 234-9411
PREPARED BY:
12/16/2016
KATHRYN DANEKER, R.C.E. 81398 DATE

REGISTERED PROFESSIONAL ENGINEER KATHRYN DANEKER No. 81398 CIVIL STATE OF CALIFORNIA

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DESIGNED BY: KFD
DRAWN BY: WP
DATE DRAWN: 05/28/2014
CHECKED BY: JH

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
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APPROVED BY: Mark H. Wills DATE: 6/19/2017

EASTVALE MDP LINE F-3
STANDARD DETAILS

PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 17 OF 18

Dist	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS

REGISTERED CIVIL ENGINEER
May 20, 2011
PLANS APPROVAL DATE

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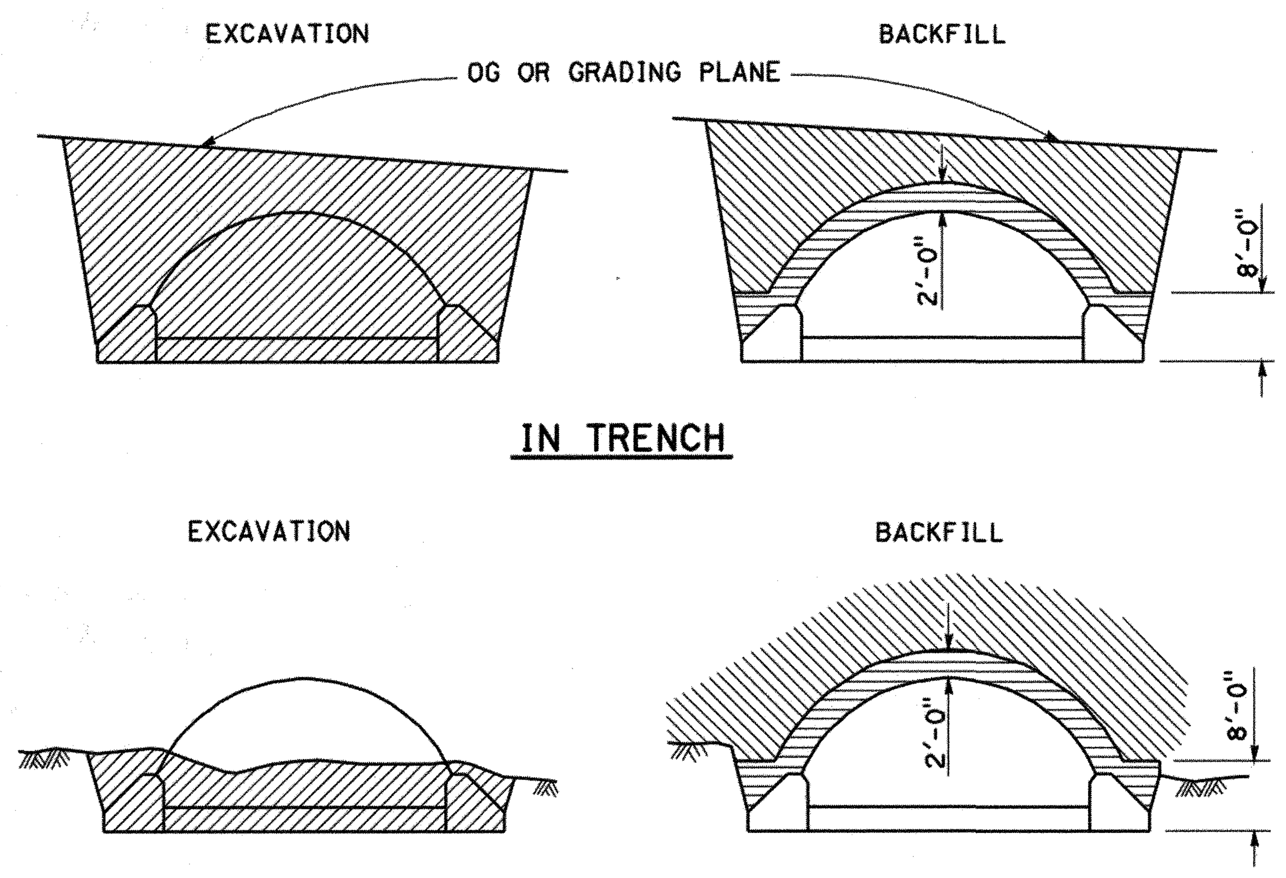
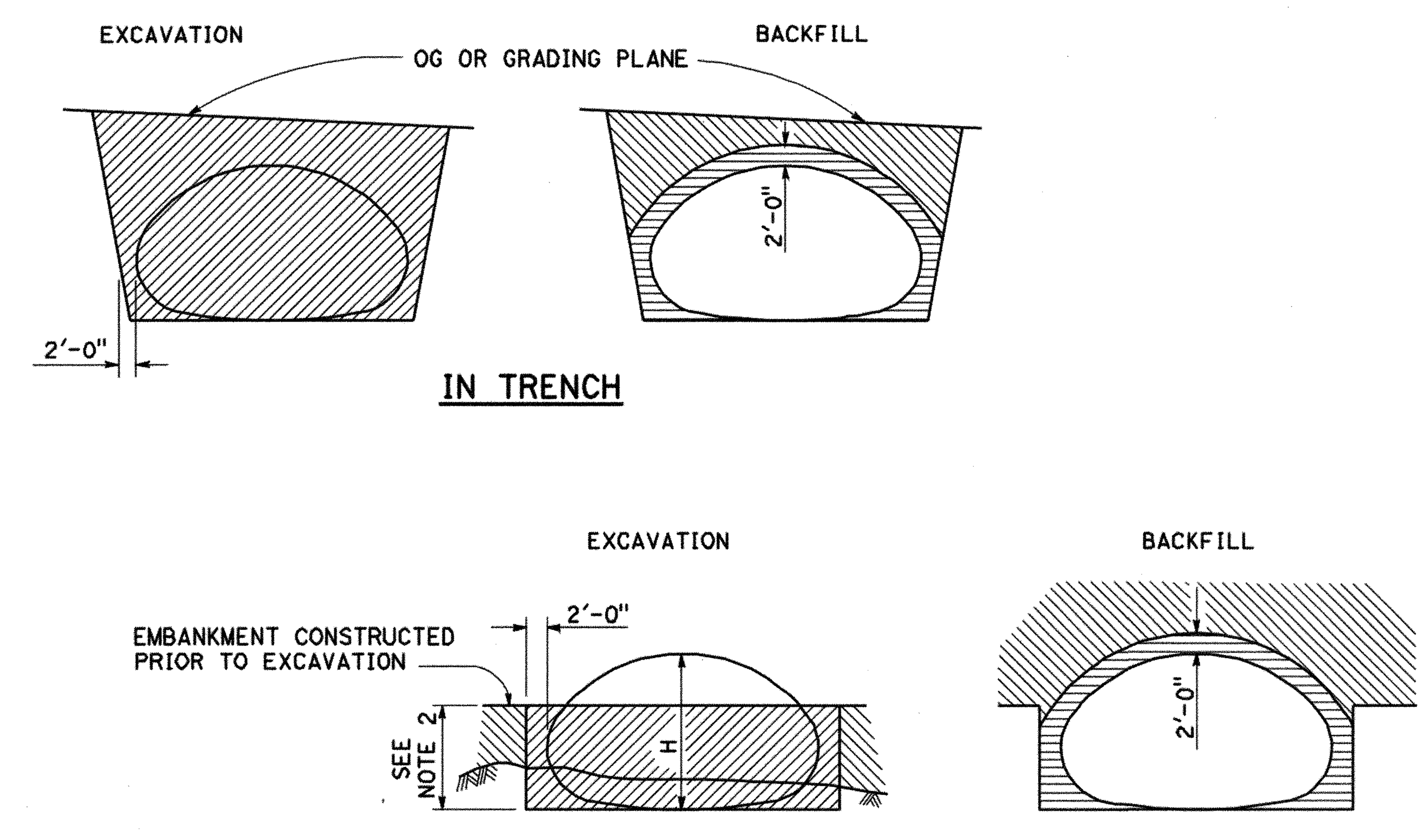
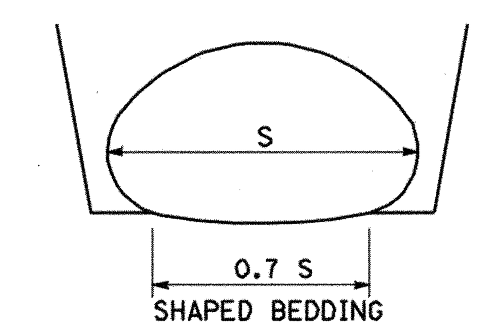
REGISTERED PROFESSIONAL ENGINEER Dallas Forester No. C37765 Exp. 12-31-12 CIVIL STATE OF CALIFORNIA



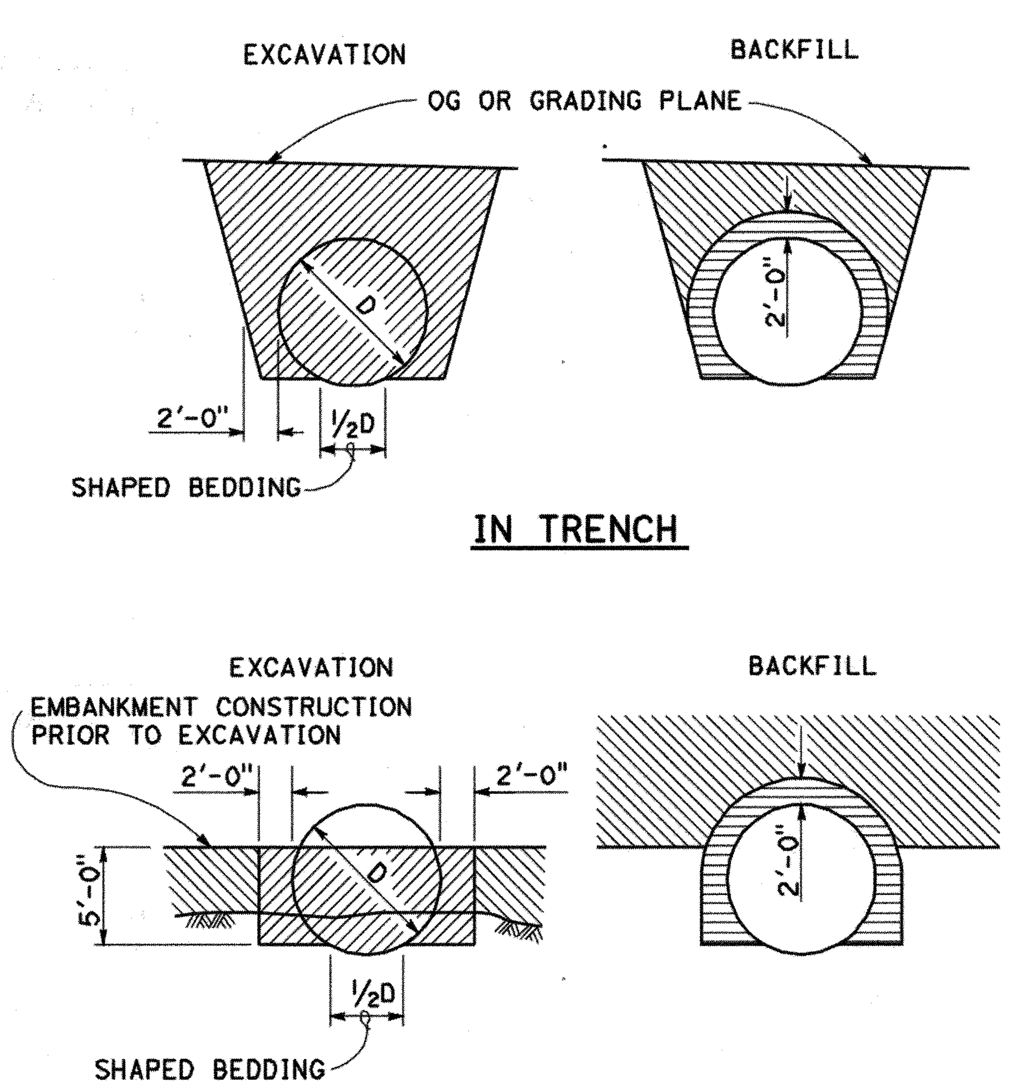
STRUCTURAL STEEL PLATE ARCHES



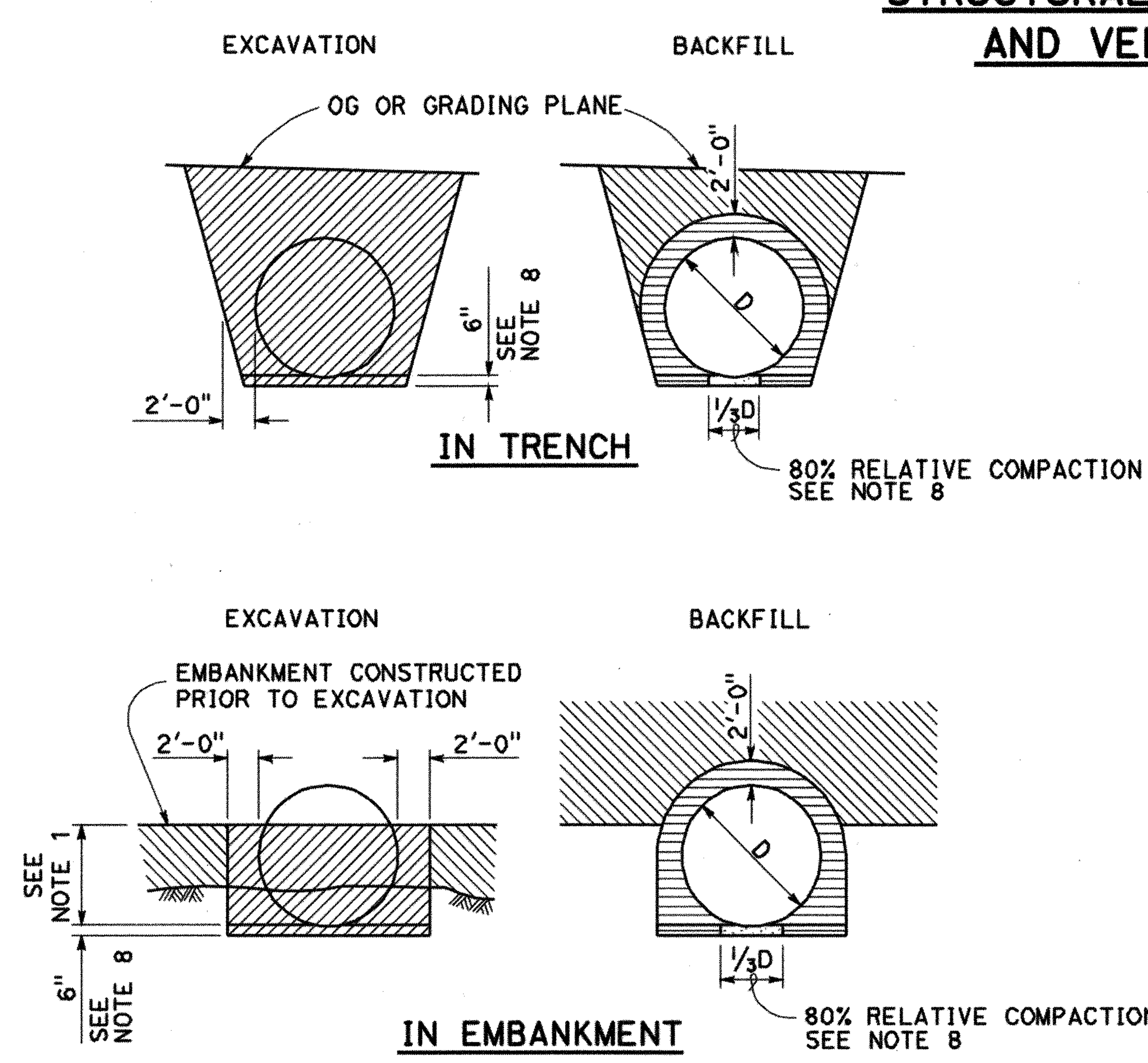
STRUCTURAL STEEL PLATE PIPE ARCHES AND VEHICULAR UNDERCROSSING



SHAPED BEDDING
S = Larger than 84"



PIPES
Larger than 84"



METAL AND PLASTIC PIPES AND CORRUGATED METAL PIPE ARCHES
84" or Smaller

NOTES:

1. PIPES: 30" minimum for diameters up to and including 42" then ⅔ diameter but no more than 60" required. CORRUGATED METAL PIPE ARCHES: 30" maximum.
2. ⅔ H up to 60" maximum.
3. Slope or shore excavation sides as necessary.
4. Backfill shall be placed full width of excavation except as noted.
5. Diagrams do not apply to overside drains.
6. Dimensions shown are minimum.
7. Construction strutting of structural steel plate pipe, arches and vehicular undercrossing to be used when shown on the project plans. When shown, see Standard Plan D88A for strutting requirements.
8. Excavation below pipe and 80% relative compaction requirements for plastic pipes only.

LEGEND

- STRUCTURE EXCAVATION (CULVERT)
- ROADWAY EMBANKMENT
- STRUCTURE BACKFILL (CULVERT) 95% RELATIVE COMPACTION
- ORIGINAL GROUND
- STRUCTURE BACKFILL (CULVERT) 80% RELATIVE COMPACTION

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

EXCAVATION AND BACKFILL METAL AND PLASTIC CULVERTS

NO SCALE

A62F

2010 STANDARD PLAN A62F

26

2-7-11

CITY OF EASTVALE
PUBLIC WORKS DEPARTMENT
ACCEPTED FOR CONSTRUCTION
JOE INDRAWAN, CITY ENGINEER — DATE: 3/7/17

Return to Table of Contents

MDC

Kimley»Horn
401 B Street - Suite 600 - San Diego, Ca. - 92101-4218
Tel. (619) 234-9411
PREPARED BY:
KATHRYN DANEKER, R.C.E. 81398 — 12/16/2016 DATE

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EASTVALE MDP LINE F-3
STANDARD DETAILS

PROJECT NO. 2-0-00356
DRAWING NO. 2-0475
SHEET NO. 18 OF 18

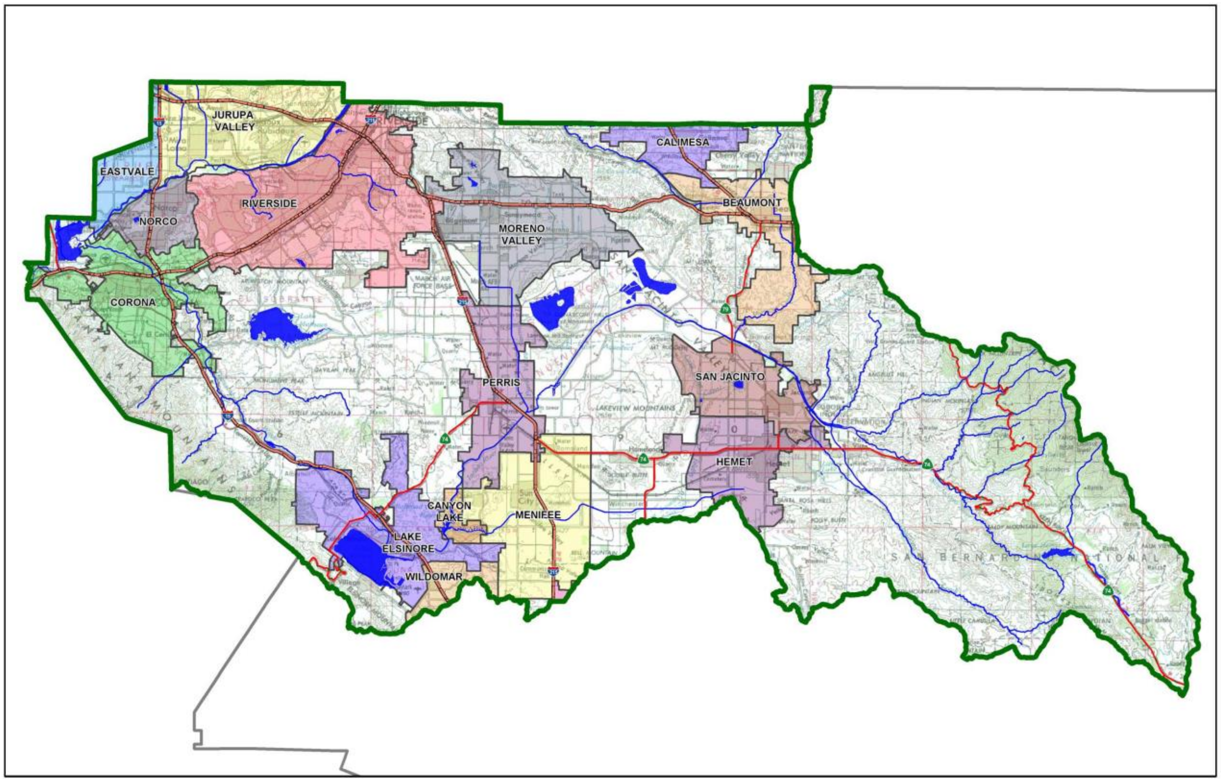
Project Specific Water Quality Management Plan

*A Template for Projects located within the **Santa Ana Watershed** Region of Riverside County*

Project Title: The Homestead

Development No: Tentative Map: XXXXX

Design Review/Case No: Preliminary



Contact Information:

Prepared for: Ray Polverini
The Homestead, LLC
280 Newport Center Drive, Suite 240
Newport Beach, CA 92660

Prepared by: Brian Gillis, P.E.
Kimley-Horn and Associates, Inc.
765 The City Drive, Suite 200
Orange, CA 92868

☒ **Preliminary**
☐ **Final**

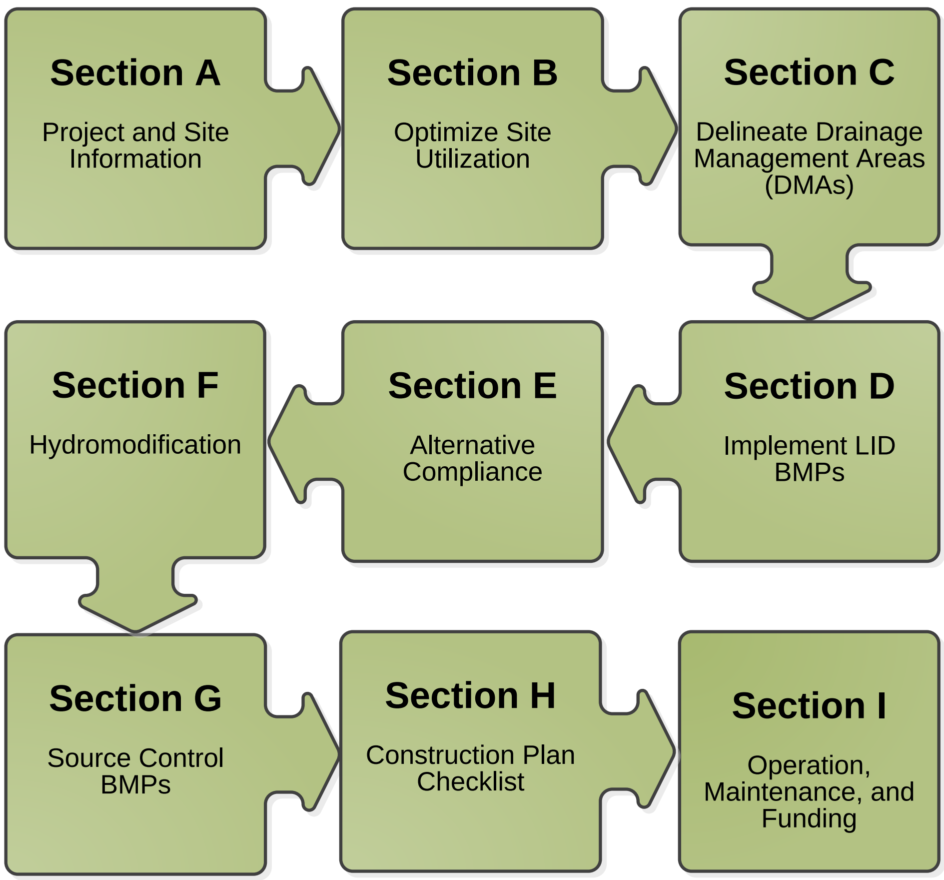
Original Date Prepared: June 2019

Revision Date(s):

Prepared for Compliance with
Regional Board Order No. **R8-2010-0033**
Template revised June 30, 2016

A Brief Introduction

This Project-Specific WQMP Template for the **Santa Ana Region** has been prepared to help guide you in documenting compliance for your project. Because this document has been designed to specifically document compliance, you will need to utilize the WQMP Guidance Document as your "how-to" manual to help guide you through this process. Both the Template and Guidance Document go hand-in-hand, and will help facilitate a well prepared Project-Specific WQMP. Below is a flowchart for the layout of this Template that will provide the steps required to document compliance.



OWNER'S CERTIFICATION

This Project-Specific Water Quality Management Plan (WQMP) has been prepared for The Homestead, LLC by Kimley-Horn and Associates for the Homestead project.

This WQMP is intended to comply with the requirements of Riverside County for 754.2 which includes the requirement for the preparation and implementation of a Project-Specific WQMP.

The undersigned, while owning the property/project described in the preceding paragraph, shall be responsible for the implementation and funding of this WQMP and will ensure that this WQMP is amended as appropriate to reflect up-to-date conditions on the site. In addition, the property owner accepts responsibility for interim operation and maintenance of Stormwater BMPs until such time as this responsibility is formally transferred to a subsequent owner. This WQMP will be reviewed with the facility operator, facility supervisors, employees, tenants, maintenance and service contractors, or any other party (or parties) having responsibility for implementing portions of this WQMP. At least one copy of this WQMP will be maintained at the project site or project office in perpetuity. The undersigned is authorized to certify and to approve implementation of this WQMP. The undersigned is aware that implementation of this WQMP is enforceable under Riverside County Water Quality Ordinance (Municipal Code Section 754.2).

"I, the undersigned, certify under penalty of law that the provisions of this WQMP have been reviewed and accepted and that the WQMP will be transferred to future successors in interest."

Owner's Signature	Date
Owner's Printed Name	Owner's Title/Position

PREPARER'S CERTIFICATION

"The selection, sizing and design of stormwater treatment and other stormwater quality and quantity control measures in this plan meet the requirements of Regional Water Quality Control Board Order No. **R8-2010-0033** and any subsequent amendments thereto."

Preparer's Signature	Date
Preparer's Printed Name	Preparer's Title/Position

Preparer's Licensure:

Table of Contents

List of Tables

List of Appendices

Section A: Project and Site Information

PROJECT INFORMATION		
Type of Project:	Industrial	
Planning Area:	A2	
Community Name:	Heavy Agriculture	
Development Name:	The Homestead	
PROJECT LOCATION		
Latitude & Longitude (DMS): 33.974800. -117.596561		
Project Watershed and Sub-Watershed: Chino Creek Watershed and Lower Cucamonga Creek Sub-Watershed		
Gross Acres: 55.86 AC		
APN(s): 144-010-015, 144-010-018, 144-010-020, 144-010-023, 114-010-024, 144-010-032		
Map Book and Page No.: 683-A5		
PROJECT CHARACTERISTICS		
Proposed or Potential Land Use(s)		Industrial I-P
Proposed or Potential SIC Code(s)		TBD
Area of Impervious Project Footprint (SF)		2,190,000
Total Area of proposed Impervious Surfaces within the Project Footprint (SF)/or Replacement		2,190,000
Does the project consist of offsite road improvements?		☒ Y ☐ N
Does the project propose to construct unpaved roads?		☐ Y ☒ N
Is the project part of a larger common plan of development (phased project)?		☐ Y ☒ N
EXISTING SITE CHARACTERISTICS		
Total area of existing Impervious Surfaces within the Project limits Footprint (SF)		142,000
Is the project located within any MSHCP Criteria Cell?		☐ Y ☒ N
If so, identify the Cell number:		N/A
Are there any natural hydrologic features on the project site?		☐ Y ☐ N
Is a Geotechnical Report attached?		☒ Y ☐ N
If no Geotech. Report, list the NRCS soils type(s) present on the site (A, B, C and/or D)		C
What is the Water Quality Design Storm Depth for the project?		0.9 inches

A.1 Maps and Site Plans

When completing your Project-Specific WQMP, include a map of the local vicinity and existing site. In addition, include all grading, drainage, landscape/plant palette and other pertinent construction plans in Appendix 2. At a **minimum**, your WQMP Site Plan should include the following:

- Drainage Management Areas
- Proposed Structural BMPs
- Drainage Path
- Drainage Infrastructure, Inlets, Overflows
- Source Control BMPs
- Buildings, Roof Lines, Downspouts
- Impervious Surfaces
- Standard Labeling
- BMP Locations (Lat/Long)

Use your discretion on whether or not you may need to create multiple sheets or can appropriately accommodate these features on one or two sheets. Keep in mind that the Co-Permittee plan reviewer must be able to easily analyze your project utilizing this template and its associated site plans and maps.

Site Description: The proposed project is located on an approximately 56-acre site located on the northwest and southwest corners of Archibald Avenue and Limonite Avenue in the City of Eastvale, Riverside County, California. For reference, see Appendix 1, Location Map.

The proposed project consists of an industrial development with a Limonite Avenue road extension running through the middle of the site. The proposed development will include the construction of seven industrial buildings of varying sizes consisting of approximately 1,981,000 square feet. Improvements within the site will provide parking facilities, driveway entrances connecting to existing roads, site utilities, bio filtration units, storm drain system and underground detention.

There is an existing 54 in. storm drain pipe (Lateral F-3) that is part of Riverside County's Master Drainage Plan (MDP) that stubs into the site at the southwest corner and runs southwest, ultimately discharging into Cucamonga Creek. As part of the Limonite Avenue roadway extension project, this storm drain will be extended easterly within the new road right-of-way. Storm water from the developed site and new road would be discharged to this existing 54 in. storm drain pipe.

A.2 Identify Receiving Waters

Using Table A.1 below, list in order of upstream to downstream, the receiving waters that the project site is tributary to. Continue to fill each row with the Receiving Water's 303(d) listed impairments (if any), designated beneficial uses, and proximity, if any, to a RARE beneficial use. Include a map of the receiving waters in Appendix 1.

Table A.1 Identification of Receiving Waters

Receiving Waters	EPA Approved 303(d) List Impairments	Designated Beneficial Uses	Proximity to RARE Beneficial Use
Unidentified Water (390)	Cucamonga creek reach 1 (Valley Reach) (Cadmium, coliform Bacteria, copper, lead and zinc.) TMDL Name: Middle Santa Ana River watershed bacterial indicator TMDL Pollutant: Pathogens	Limited warm water, Municipal and Domestic Supply, warm Freshwater Habitat	N/A
Santa Ana Reach 2	Santa Ana Reach 2 (Indicator Bacteria) Escherichia coli (E.coli)	Water Contact Recreation	

A.3 Additional Permits/Approvals required for the Project:

Table A.2 Other Applicable Permits

Agency	Permit Required	
State Department of Fish and Game, 1602 Streambed Alteration Agreement	☐ Y	☒ N
State Water Resources Control Board, Clean Water Act (CWA) Section 401 Water Quality Cert.	☐ Y	☒ N
US Army Corps of Engineers, CWA Section 404 Permit	☐ Y	☒ N
US Fish and Wildlife, Endangered Species Act Section 7 Biological Opinion	☐ Y	☒ N
Statewide Construction General Permit Coverage	☐ Y	☒ N
Statewide Industrial General Permit Coverage	☐ Y	☒ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
Other *(please list in the space below as required)*	☐ Y	☒ N

If yes is answered to any of the questions above, the Co-Permittee may require proof of approval/coverage from those agencies as applicable including documentation of any associated requirements that may affect this Project-Specific WQMP.

Section B: Optimize Site Utilization (LID Principles)

Review of the information collected in Section 'A' will aid in identifying the principal constraints on site design and selection of LID BMPs as well as opportunities to reduce imperviousness and incorporate LID Principles into the site and landscape design. For example, **constraints** might include impermeable soils, high groundwater, groundwater pollution or contaminated soils, steep slopes, geotechnical instability, high-intensity land use, heavy pedestrian or vehicular traffic, utility locations or safety concerns. **Opportunities** might include existing natural areas, low areas, oddly configured or otherwise unbuildable parcels, easements and landscape amenities including open space and buffers (which can double as locations for bioretention BMPs), and differences in elevation (which can provide hydraulic head). Prepare a brief narrative for each of the site optimization strategies described below. This narrative will help you as you proceed with your LID design and explain your design decisions to others.

The 2010 Santa Ana MS4 Permit further requires that LID Retention BMPs (Infiltration Only or Harvest and Use) be used unless it can be shown that those BMPs are infeasible. Therefore, it is important that your narrative identify and justify if there are any constraints that would prevent the use of those categories of LID BMPs. Similarly, you should also note opportunities that exist which will be utilized during project design. Upon completion of identifying Constraints and Opportunities, include these on your WQMP Site plan in Appendix 1.

Consideration of "highest and best use" of the discharge should also be considered. For example, Lake Elsinore is evaporating faster than runoff from natural precipitation can recharge it. Requiring infiltration of 85% of runoff events for projects tributary to Lake Elsinore would only exacerbate current water quality problems associated with Pollutant concentration due to lake water evaporation. In cases where rainfall events have low potential to recharge Lake Elsinore (i.e. no hydraulic connection between groundwater to Lake Elsinore, or other factors), requiring infiltration of Urban Runoff from projects is counterproductive to the overall watershed goals. Project proponents, in these cases, would be allowed to discharge Urban Runoff, provided they used equally effective filtration-based BMPs.

Site Optimization

The following questions are based upon Section 3.2 of the WQMP Guidance Document. Review of the WQMP Guidance Document will help you determine how best to optimize your site and subsequently identify opportunities and/or constraints, and document compliance.

Did you identify and preserve existing drainage patterns? If so, how? If not, why?

The project will largely preserve existing drainage patters with approximately 2 acers draining toward Archibald and approximately 54 acers discharging into the existing 54" F-3 County Lateral.

Did you identify and protect existing vegetation? If so, how? If not, why?

The existing vegetation is non-native and used for dairy farming. It is not being preserved since it is non-native.

Did you identify and preserve natural infiltration capacity? If so, how? If not, why?

The underlying infiltration rates are not sufficient for infiltration BMPs.

Did you identify and minimize impervious area? If so, how? If not, why?

Impervious areas were minimized wherever practical. The existing site has a minimal amount of impervious area.

Did you identify and disperse runoff to adjacent pervious areas? If so, how? If not, why?

Roof runoff and other impervious surfaces will discharge into adjacent bioretention BMPs that will be located throughout the project site before discharging into the proposed storm drain system.

Section C: Delineate Drainage Management Areas (DMAs)

Utilizing the procedure in Section 3.3 of the WQMP Guidance Document which discusses the methods of delineating and mapping your project site into individual DMAs, complete Table C.1 below to appropriately categorize the types of classification (e.g., Type A, Type B, etc.) per DMA for your project site. Upon completion of this table, this information will then be used to populate and tabulate the corresponding tables for their respective DMA classifications.

Due to the preliminary nature of this report individual DMAs will not be delineated. It is not feasible at this time to precisely define all drainage areas for the project. A wholistic approach will be taken to determine the total required treatment for the proposed project subareas. The final WQMP will delineate each DMA area and size each Modular Wetland Treatment System.

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1][2]	Area (AC)	DMA Type
DA-1	Multiple surfaces	12.63	D
DA-2	Multiple surfaces	26.39	D
DA-3	Multiple surfaces	8.60	D
DA-1R	Multiple surfaces	10.46[3]	D

[1]*Reference Table 2-1 in the WQMP Guidance Document to populate this column*
[2]*If multi-surface provide back-up*
[3]*DA-1R includes offsite future tributary area.*

Table C.2 Type 'A', Self-Treating Areas

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
TBD on Final WQMP			

Table C.3 Type 'B', Self-Retaining Areas

Self-Retaining Area				**Type 'C' DMAs that are draining to the Self-Retaining Area**		
DMA Name/ ID	Post-project surface type	Area (square feet) [A]	Storm Depth (inches) [B]	DMA Name / ID	[C] from Table C.4 = [C]	Required Retention Depth (inches) [D]
TBD on Final WQMP						

$$[D] = [B] + \frac{[B] \cdot [C]}{[A]}$$

Table C.4 Type 'C', Areas that Drain to Self-Retaining Areas

DMA					**Receiving Self-Retaining DMA**		
DMA Name/ ID	Area (square feet) [A]	Post-project surface type	Impervious fraction [B]	Product [C] = [A] x [B]	DMA name /ID	Area (square feet) [D]	Ratio [C]/[D]
TBD on Final WQMP							

Table C.5 Type 'D', Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
DA-1	Modular Wetland to be individually sized on Final WQMP
DA-2	Modular Wetland to be individually sized on Final WQMP
DA-3	Modular Wetland to be individually sized on Final WQMP
DA-1R	Floguard Catch Basin Filter Inserts

<u>Note</u>: More than one drainage management area can drain to a single LID BMP, however, one drainage management area may not drain to more than one BMP.

Section D: Implement LID BMPs

D.1 Infiltration Applicability

Is there an approved downstream 'Highest and Best Use' for stormwater runoff (see discussion in Chapter 2.4.4 of the WQMP Guidance Document for further details)? ☐ Y ☒ N

If yes has been checked, Infiltration BMPs shall not be used for the site; proceed to section D.3

If no, continue working through this section to implement your LID BMPs. It is recommended that you contact your Co-Permittee to verify whether or not your project discharges to an approved downstream 'Highest and Best Use' feature.

Geotechnical Report

A Geotechnical Report or Phase I Environmental Site Assessment may be required by the Copermittee to confirm present and past site characteristics that may affect the use of Infiltration BMPs. In addition, the Co-Permittee, at their discretion, may not require a geotechnical report for small projects as described in Chapter 2 of the WQMP Guidance Document. If a geotechnical report has been prepared, include it in Appendix 3. In addition, if a Phase I Environmental Site Assessment has been prepared, include it in Appendix 4.

Is this project classified as a small project consistent with the requirements of Chapter 2 of the WQMP Guidance Document? ☐ Y ☒ N

Infiltration Feasibility

Table D.1 below is meant to provide a simple means of assessing which DMAs on your site support Infiltration BMPs and is discussed in the WQMP Guidance Document in Chapter 2.4.5. Check the appropriate box for each question and then list affected DMAs as applicable. If additional space is needed, add a row below the corresponding answer.

Table D.1 Infiltration Feasibility

Does the project site…	YES	NO
…have any DMAs with a seasonal high groundwater mark shallower than 10 feet?		X
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		X
If Yes, list affected DMAs:		
…have any areas identified by the geotechnical report as posing a public safety risk where infiltration of stormwater could have a negative impact?		X
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?	X	
If Yes, list affected DMAs:	All	
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		X
If Yes, list affected DMAs:		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?	X	
Describe here: Low infiltration rates		

If you answered "Yes" to any of the questions above for any DMA, Infiltration BMPs should not be used for those DMAs and you should proceed to the assessment for Harvest and Use below.

D.2 Harvest and Use Assessment

Please check what applies*:*

☐ Reclaimed water will be used for the non-potable water demands for the project.

☐Downstream water rights may be impacted by Harvest and Use as approved by the Regional Board (verify with the Copermittee).

☐The Design Capture Volume will be addressed using Infiltration Only BMPs. In such a case, Harvest and Use BMPs are still encouraged, but it would not be required if the Design Capture Volume will be infiltrated or evapotranspired.

If any of the above boxes have been checked, Harvest and Use BMPs need not be assessed for the site. If none of the above criteria applies, follow the steps below to assess the feasibility of irrigation use, toilet use and other non-potable uses (e.g., industrial use).

Irrigation Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for Irrigation Use BMPs on your site:

Step 1: Identify the total area of irrigated landscape on the site, and the type of landscaping used.

Total Area of Irrigated Landscape: 5.59 AC

Type of Landscaping (Conservation Design or Active Turf): Conservative design.

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for irrigation use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 50.27 AC

Step 3: Cross reference the Design Storm depth for the project site (see Exhibit A of the WQMP Guidance Document) with the left column of Table 2-3 in Chapter 2 to determine the minimum area of Effective Irrigated Area per Tributary Impervious Area (EIATIA).

Enter your EIATIA factor: 2.38

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum irrigated area that would be required.

Minimum required irrigated area: 119.64 AC

Step 5: Determine if harvesting stormwater runoff for irrigation use is feasible for the project by comparing the total area of irrigated landscape (Step 1) to the minimum required irrigated area (Step 4).

Minimum required irrigated area (Step 4)	**Available Irrigated Landscape (Step 1)**
119.64 AC	5.59 AC

Toilet Use Feasibility

Complete the following steps to determine the feasibility of harvesting stormwater runoff for toilet flushing uses on your site:

Step 1: Identify the projected total number of daily toilet users during the wet season, and account for any periodic shut downs or other lapses in occupancy:

Projected Number of Daily Toilet Users: Unknown >200

Project Type: Industrial

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for toilet use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 50.27 AC

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-2 in Chapter 2 to determine the minimum number or toilet users per tributary impervious acre (TUTIA).

Enter your TUTIA factor: 238

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of toilet users that would be required.

Minimum number of toilet users: 11,964

Step 5: Determine if harvesting stormwater runoff for toilet flushing use is feasible for the project by comparing the Number of Daily Toilet Users (Step 1) to the minimum required number of toilet users (Step 4).

Minimum required Toilet Users (Step 4)	**Projected number of toilet users (Step 1)**
11,964	>200

Other Non-Potable Use Feasibility

Are there other non-potable uses for stormwater runoff on the site (e.g. industrial use)? See Chapter 2 of the Guidance for further information. If yes, describe below. If no, write N/A.

Specific Industrial uses are not known at this time.

Step 1: Identify the projected average daily non-potable demand, in gallons per day, during the wet season and accounting for any periodic shut downs or other lapses in occupancy or operation.

Average Daily Demand: Unknown

Step 2: Identify the planned total of all impervious areas on the proposed project from which runoff might be feasibly captured and stored for the identified non-potable use. Depending on the configuration of buildings and other impervious areas on the site, you may consider the site as a whole, or parts of the site, to evaluate reasonable scenarios for capturing and storing runoff and directing the stored runoff to the potential use(s) identified in Step 1 above.

Total Area of Impervious Surfaces: 50.27 AC

Step 3: Enter the Design Storm depth for the project site (see Exhibit A) into the left column of Table 2-4 in Chapter 2 to determine the minimum demand for non-potable uses per tributary impervious acre.

Enter the factor from Table 2-4: 1,310

Step 4: Multiply the unit value obtained from Step 3 by the total of impervious areas from Step 2 to develop the minimum number of gallons per day of non-potable use that would be required.

Minimum required use: 65,854

Step 5: Determine if harvesting stormwater runoff for other non-potable use is feasible for the project by comparing the projected average daily use (Step 1) to the minimum required non-potable use (Step 4).

Minimum required non-potable use (Step 4)	**Projected average daily use (Step 1)**
65,854	Unknown

If Irrigation, Toilet and Other Use feasibility anticipated demands are less than the applicable minimum values, Harvest and Use BMPs are not required and you should proceed to utilize LID Bioretention and Biotreatment per Section 3.4.2 of the WQMP Guidance Document.

D.3 Bioretention and Biotreatment Assessment

Other LID Bioretention and Biotreatment BMPs as described in Chapter 2.4.7 of the WQMP Guidance Document are feasible on nearly all development sites with sufficient advance planning.

Select one of the following:

☒ LID Bioretention/Biotreatment BMPs will be used for some or all DMAs of the project as noted below in Section D.4 (note the requirements of Section 3.4.2 in the WQMP Guidance Document).

☐ A site-specific analysis demonstrating the technical infeasibility of all LID BMPs has been performed and is included in Appendix 5. If you plan to submit an analysis demonstrating the technical infeasibility of LID BMPs, request a pre-submittal meeting with the Copermittee to discuss this option. Proceed to Section E to document your alternative compliance measures.

D.4 Feasibility Assessment Summaries

From the Infiltration, Harvest and Use, Bioretention and Biotreatment Sections above, complete Table D.2 below to summarize which LID BMPs are technically feasible, and which are not, based upon the established hierarchy.

Table D.2 LID Prioritization Summary Matrix

DMA Name/ID	LID BMP Hierarchy				No LID (Alternative Compliance)
	1. Infiltration	2. Harvest and use	3. Bioretention	4. Biotreatment	
DA-1	☐	☐	☐	☒	☐
DA-2	☐	☐	☐	☒	☐
DA-3	☐	☐	☐	☒	☐
DA-1R	☐	☐	☐	☐	☒
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

For those DMAs where LID BMPs are not feasible, provide a brief narrative below summarizing why they are not feasible, include your technical infeasibility criteria in Appendix 5, and proceed to Section E below to document Alternative Compliance measures for those DMAs. Recall that each proposed DMA must pass through the LID BMP hierarchy before alternative compliance measures may be considered.

Biofiltration is used throughout the site for all onsite DMAs. The public road drainage area DA-1R will drain to Floguard +Plus catch basin inlet filters designed to capture sediment, trash, and hydrocarbons.

D.5 LID BMP Sizing

Each LID BMP must be designed to ensure that the Design Capture Volume will be addressed by the selected BMPs. First**,** calculate the Design Capture Volume for each LID BMP using the V_{BMP} worksheet in Appendix F of the LID BMP Design Handbook. Second**,** design the LID BMP to meet the required V_{BMP} using a method approved by the Copermittee. Utilize the worksheets found in the LID BMP Design Handbook or consult with your Copermittee to assist you in correctly sizing your LID BMPs. Complete Table D.3 below to document the Design Capture Volume and the Proposed Volume for each LID BMP. Provide the completed design procedure sheets for each LID BMP in Appendix 6. You may add additional rows to the table below as needed.

Table D.3 DCV Calculations for LID BMPs

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Total Required Modular Wetland Treatment flow for onsite BMPs*		
	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Design Capture Flowrate, Q_{BMP} (cfs)*	*Proposed flowrate on Plans (cfs)*
D/DA-1	*550,163*	*Mixed*	*0.91*	*0.72*	*396,117*			
D/DA-2	*1,149,548*	*Mixed*	*0.91*	*0.72*	*827,675*			
D/DA-3	*374,616*	*Mixed*	*0.91*	*0.72*	*269,725*			
	Σ=2,074,327				Σ=1,493,517	0.20 in	6.9 cfs	6.9 min. TBD on Final WQMP

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document

[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] obtained from Exhibit A in the WQMP Guidance Document

[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12

[H] [I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Impervious Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Total Required Modular Wetland Treatment flow for onsite BMPs*		
	[A]		[B]	[C]	[A] x [C]	*Design Storm Depth (in)*	*Design Capture Flowrate, Q_{BMP} (cfs)*	*Proposed flowrate on Plans (cfs)*
D/DA-1R	*455,638*	*Mixed*	*0.91*	*0.72*	*328,059*			
	Σ=455,638				Σ=328,059	0.20	1.5	1.5 min. TBD on Final WQMP

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document

[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] obtained from Exhibit A in the WQMP Guidance Document

[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12

[H] [I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

Section E: Alternative Compliance (LID Waiver Program)

LID BMPs are expected to be feasible on virtually all projects. Where LID BMPs have been demonstrated to be infeasible as documented in Section D, other Treatment Control BMPs must be used (subject to LID waiver approval by the Copermittee). Check one of the following Boxes:

☒ LID Principles and LID BMPs have been incorporated into the site design to fully address all Drainage Management Areas. No alternative compliance measures are required for this project and thus this Section is not required to be completed.

\- *Or* -

☐ The following Drainage Management Areas are unable to be addressed using LID BMPs. A site-specific analysis demonstrating technical infeasibility of LID BMPs has been approved by the Co-Permittee and included in Appendix 5. Additionally, no downstream regional and/or sub-regional LID BMPs exist or are available for use by the project. The following alternative compliance measures on the following pages are being implemented to ensure that any pollutant loads expected to be discharged by not incorporating LID BMPs, are fully mitigated.

List DMAs here.

E.1 Identify Pollutants of Concern

Utilizing Table A.1 from Section A above which noted your project's receiving waters and their associated EPA approved 303(d) listed impairments, cross reference this information with that of your selected Priority Development Project Category in Table E.1 below. If the identified General Pollutant Categories are the same as those listed for your receiving waters, then these will be your Pollutants of Concern and the appropriate box or boxes will be checked on the last row. The purpose of this is to document compliance and to help you appropriately plan for mitigating your Pollutants of Concern in lieu of implementing LID BMPs.

Table E.1 Potential Pollutants by Land Use Type

Priority Development Project Categories and/or Project Features (check those that apply)	General Pollutant Categories							
	Bacterial Indicators	Metals	Nutrients	Pesticides	Toxic Organic Compounds	Sediments	Trash & Debris	Oil & Grease
☐ Detached Residential Development	P	N	P	P	N	P	P	P
☐ Attached Residential Development	P	N	P	P	N	P	P	P(2)
☐ Commercial/Industrial Development	P(3)	P	P(1)	P(1)	P(5)	P(1)	P	P
☐ Automotive Repair Shops	N	P	N	N	P(4, 5)	N	P	P
☐ Restaurants (>5,000 ft^2)	P	N	N	N	N	N	P	P
☐ Hillside Development (>5,000 ft^2)	P	N	P	P	N	P	P	P
☐ Parking Lots (>5,000 ft^2)	P(6)	P	P(1)	P(1)	P(4)	P(1)	P	P
☐ Retail Gasoline Outlets	N	P	N	N	P	N	P	P
Project Priority Pollutant(s) of Concern	☐	☐	☐	☐	☐	☐	☐	☐

P = Potential

N = Not Potential

(1) *A potential Pollutant if non-native landscaping exists or is proposed onsite; otherwise not expected*

(2) *A potential Pollutant if the project includes uncovered parking areas; otherwise not expected*

(3) *A potential Pollutant is land use involving animal waste*

(4) *Specifically petroleum hydrocarbons*

(5) *Specifically solvents*

(6) *Bacterial indicators are routinely detected in pavement runoff*

E.2 Stormwater Credits

Projects that cannot implement LID BMPs but nevertheless implement smart growth principles are potentially eligible for Stormwater Credits. Utilize Table 3-8 within the WQMP Guidance Document to identify your Project Category and its associated Water Quality Credit. If not applicable, write N/A.

Table E.2 Water Quality Credits

Qualifying Project Categories	Credit Percentage[2]
Total Credit Percentage[1]	

[1]Cannot Exceed 50%
[2]Obtain corresponding data from Table 3-8 in the WQMP Guidance Document

E.3 Sizing Criteria

After you appropriately considered Stormwater Credits for your project, utilize Table E.3 below to appropriately size them to the DCV, or Design Flow Rate, as applicable. Please reference Chapter 3.5.2 of the WQMP Guidance Document for further information.

Table E.3 Treatment Control BMP Sizing

DMA Type/ID	**DMA Area (square feet)**	**Post-Project Surface Type**	**Effective Impervious Fraction, I_f**	**DMA Runoff Factor**	**DMA Area x Runoff Factor**		***Enter BMP Name / Identifier Here***		
	[A]		[B]	[C]	[A] x [C]				
						Design Storm Depth (in)	*Minimum Design Capture Volume or Design Flow Rate (cubic feet or cfs)*	*Total Storm Water Credit % Reduction*	*Proposed Volume or Flow on Plans (cubic feet or cfs)*
	$A_T = \Sigma[A]$				$\Sigma = [D]$	[E]	$[F] = \frac{[D]x[E]}{[G]}$	[F] X (1-[H])	[I]

[B], [C] is obtained as described in Section 2.3.1 from the WQMP Guidance Document
[E] is for Flow-Based Treatment Control BMPs [E] = .2, for Volume-Based Control Treatment BMPs, [E] obtained from Exhibit A in the WQMP Guidance Document
[G] is for Flow-Based Treatment Control BMPs [G] = 43,560, for Volume-Based Control Treatment BMPs, [G] = 12
[H] is from the Total Credit Percentage as Calculated from Table E.2 above
[I] as obtained from a design procedure sheet from the BMP manufacturer and should be included in Appendix 6

E.4 Treatment Control BMP Selection

Treatment Control BMPs typically provide proprietary treatment mechanisms to treat potential pollutants in runoff, but do not sustain significant biological processes. Treatment Control BMPs must have a removal efficiency of a medium or high effectiveness as quantified below:

- **High**: equal to or greater than 80% removal efficiency
- **Medium**: between 40% and 80% removal efficiency

Such removal efficiency documentation (e.g., studies, reports, etc.) as further discussed in Chapter 3.5.2 of the WQMP Guidance Document, must be included in Appendix 6. In addition, ensure that proposed Treatment Control BMPs are properly identified on the WQMP Site Plan in Appendix 1.

Table E.4 Treatment Control BMP Selection

Selected Treatment Control BMP Name or ID[1]	Priority Pollutant(s) of Concern to Mitigate[2]	Removal Efficiency Percentage[3]
Onsite – Bio Clean Modular Wetland	TSS and Hydrocarbons	80% of TSS and 90% of Hydrocarbons
Offsite – Flogard +Plus Filter Inserts	TSS and Hydrocarbons	80% of TSS and 70% of Hydrocarbons

[1] Treatment Control BMPs must not be constructed within Receiving Waters. In addition, a proposed Treatment Control BMP may be listed more than once if they possess more than one qualifying pollutant removal efficiency.
[2] Cross Reference Table E.1 above to populate this column.
[3] As documented in a Co-Permittee Approved Study and provided in Appendix 6.

Section F: Hydromodification

F.1 Hydrologic Conditions of Concern (HCOC) Analysis

Once you have determined that the LID design is adequate to address water quality requirements, you will need to assess if the proposed LID Design may still create a HCOC. Review Chapters 2 and 3 (including Figure 3-7) of the WQMP Guidance Document to determine if your project must mitigate for Hydromodification impacts. If your project meets one of the following criteria which will be indicated by the check boxes below, you do not need to address Hydromodification at this time. However, if the project does not qualify for Exemptions 1, 2 or 3, then additional measures must be added to the design to comply with HCOC criteria. This is discussed in further detail below in Section F.2.

HCOC EXEMPTION 1: The Priority Development Project disturbs less than one acre. The Copermittee has the discretion to require a Project-Specific WQMP to address HCOCs on projects less than one acre on a case by case basis. The disturbed area calculation should include all disturbances associated with larger common plans of development.

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, HCOC criteria do not apply.

HCOC EXEMPTION 2: The volume and time of concentration[1] of storm water runoff for the post-development condition is not significantly different from the pre-development condition for a 2-year return frequency storm (a difference of 5% or less is considered insignificant) using one of the following methods to calculate:

- Riverside County Hydrology Manual
- Technical Release 55 (TR-55): Urban Hydrology for Small Watersheds (NRCS 1986), or derivatives thereof, such as the Santa Barbara Urban Hydrograph Method
- Other methods acceptable to the Co-Permittee

Does the project qualify for this HCOC Exemption? ☐ Y ☒ N

If Yes, report results in Table F.1 below and provide your substantiated hydrologic analysis in Appendix 7.

Table F.1 Hydrologic Conditions of Concern Summary

	2 year – 24 hour		
	Pre-condition	**Post-condition**	**% Difference**
Time of Concentration	INSERT VALUE	INSERT VALUE	INSERT VALUE
Volume (Cubic Feet)	INSERT VALUE	INSERT VALUE	INSERT VALUE

[1] Time of concentration is defined as the time after the beginning of the rainfall when all portions of the drainage basin are contributing to flow at the outlet.

HCOC EXEMPTION 3: All downstream conveyance channels to an adequate sump (for example, Prado Dam, Lake Elsinore, Canyon Lake, Santa Ana River, or other lake, reservoir or naturally erosion resistant feature) that will receive runoff from the project are engineered and regularly maintained to ensure design flow capacity; no sensitive stream habitat areas will be adversely affected; or are not identified on the Co-Permittees Hydromodification Susceptibility Maps.

Does the project qualify for this HCOC Exemption? ☒ Y ☐ N

If Yes, HCOC criteria do not apply and note below which adequate sump applies to this HCOC qualifier:

Cucamonga Creek lower reaches and Prado Dam

F.2 HCOC Mitigation

If none of the above HCOC Exemption Criteria are applicable, HCOC criteria is considered mitigated if they meet one of the following conditions:

a. Additional LID BMPS are implemented onsite or offsite to mitigate potential erosion or habitat impacts as a result of HCOCs. This can be conducted by an evaluation of site-specific conditions utilizing accepted professional methodologies published by entities such as the California Stormwater Quality Association (CASQA), the Southern California Coastal Water Research Project (SCCRWP), or other Co-Permittee approved methodologies for site-specific HCOC analysis.

b. The project is developed consistent with an approved Watershed Action Plan that addresses HCOC in Receiving Waters.

c. 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.

Be sure to include all pertinent documentation used in your analysis of the items a, b or c in Appendix 7.

Section G: Source Control BMPs

Source control BMPs include permanent, structural features that may be required in your project plans — such as roofs over and berms around trash and recycling areas — and Operational BMPs, such as regular sweeping and "housekeeping", that must be implemented by the site's occupant or user. The MEP standard typically requires both types of BMPs. In general, Operational BMPs cannot be substituted for a feasible and effective permanent BMP. Using the Pollutant Sources/Source Control Checklist in Appendix 8, review the following procedure to specify Source Control BMPs for your site:

1. ***Identify Pollutant Sources*:** Review Column 1 in the Pollutant Sources/Source Control Checklist. Check off the potential sources of Pollutants that apply to your site.

2. ***Note Locations on Project-Specific WQMP Exhibit*:** Note the corresponding requirements listed in Column 2 of the Pollutant Sources/Source Control Checklist. Show the location of each Pollutant source and each permanent Source Control BMP in your Project-Specific WQMP Exhibit located in Appendix 1.

3. ***Prepare a Table and Narrative*:** Check off the corresponding requirements listed in Column 3 in the Pollutant Sources/Source Control Checklist. In the left column of Table G.1 below, list each potential source of runoff Pollutants on your site (from those that you checked in the Pollutant Sources/Source Control Checklist). In the middle column, list the corresponding permanent, Structural Source Control BMPs (from Columns 2 and 3 of the Pollutant Sources/Source Control Checklist) used to prevent Pollutants from entering runoff. **Add additional narrative** in this column that explains any special features, materials or methods of construction that will be used to implement these permanent, Structural Source Control BMPs.

4. ***Identify Operational Source Control BMPs:*** To complete your table, refer once again to the Pollutant Sources/Source Control Checklist. List in the right column of your table the Operational BMPs that should be implemented as long as the anticipated activities continue at the site. Copermittee stormwater ordinances require that applicable Source Control BMPs be implemented; the same BMPs may also be required as a condition of a use permit or other revocable Discretionary Approval for use of the site.

Table G.1 Permanent and Operational Source Control Measures

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
On-site Storm Drain Inlets	Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.	Maintain and periodically repaint or replace inlet markings.
Loading Docks		Move loaded and unloaded items indoors as soon as possible. See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the

		CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com
Plazas, sidewalks, and parking lots.	Plazas, sidewalks, and parking lots surface drain to Modular Wetlands.	Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.
Roof drainage and HVAC condensate	Roof drains will discharge through the adjacent curb face and drain to Modular Wetlands.	

Section H: Construction Plan Checklist

Populate Table H.1 below to assist the plan checker in an expeditious review of your project. The first two columns will contain information that was prepared in previous steps, while the last column will be populated with the corresponding plan sheets. This table is to be completed with the submittal of your final Project-Specific WQMP.

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)
		Precise BMP size and Location to be determined on Final WQMP	

Note that the updated table — or Construction Plan WQMP Checklist — is **only a reference tool** to facilitate an easy comparison of the construction plans to your Project-Specific WQMP. Co-Permittee staff can advise you regarding the process required to propose changes to the approved Project-Specific WQMP.

Section I: Operation, Maintenance and Funding

The Copermittee will periodically verify that Stormwater BMPs on your site are maintained and continue to operate as designed. To make this possible, your Copermittee will require that you include in Appendix 9 of this Project-Specific WQMP:

1. A means to finance and implement facility maintenance in perpetuity, including replacement cost.
2. Acceptance of responsibility for maintenance from the time the BMPs are constructed until responsibility for operation and maintenance is legally transferred. A warranty covering a period following construction may also be required.
3. An outline of general maintenance requirements for the Stormwater BMPs you have selected.
4. Figures delineating and designating pervious and impervious areas, location, and type of Stormwater BMP, and tables of pervious and impervious areas served by each facility. Geo-locating the BMPs using a coordinate system of latitude and longitude is recommended to help facilitate a future statewide database system.
5. A separate list and location of self-retaining areas or areas addressed by LID Principles that do not require specialized O&M or inspections but will require typical landscape maintenance as noted in Chapter 5, pages 85-86, in the WQMP Guidance. Include a brief description of typical landscape maintenance for these areas.

Your local Co-Permittee will also require that you prepare and submit a detailed Stormwater BMP Operation and Maintenance Plan that sets forth a maintenance schedule for each of the Stormwater BMPs built on your site. An agreement assigning responsibility for maintenance and providing for inspections and certification may also be required.

Details of these requirements and instructions for preparing a Stormwater BMP Operation and Maintenance Plan are in Chapter 5 of the WQMP Guidance Document.

Maintenance Mechanism: Insert text here.

Will the proposed BMPs be maintained by a Home Owners' Association (HOA) or Property Owners Association (POA)?

☒ Y ☐ N

Include your Operation and Maintenance Plan and Maintenance Mechanism in Appendix 9. Additionally, include all pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs within this Project-Specific WQMP in Appendix 10.

Appendix 1: Maps and Site Plans

Location Map, WQMP Site Plan and Receiving Waters Map

LEGEND

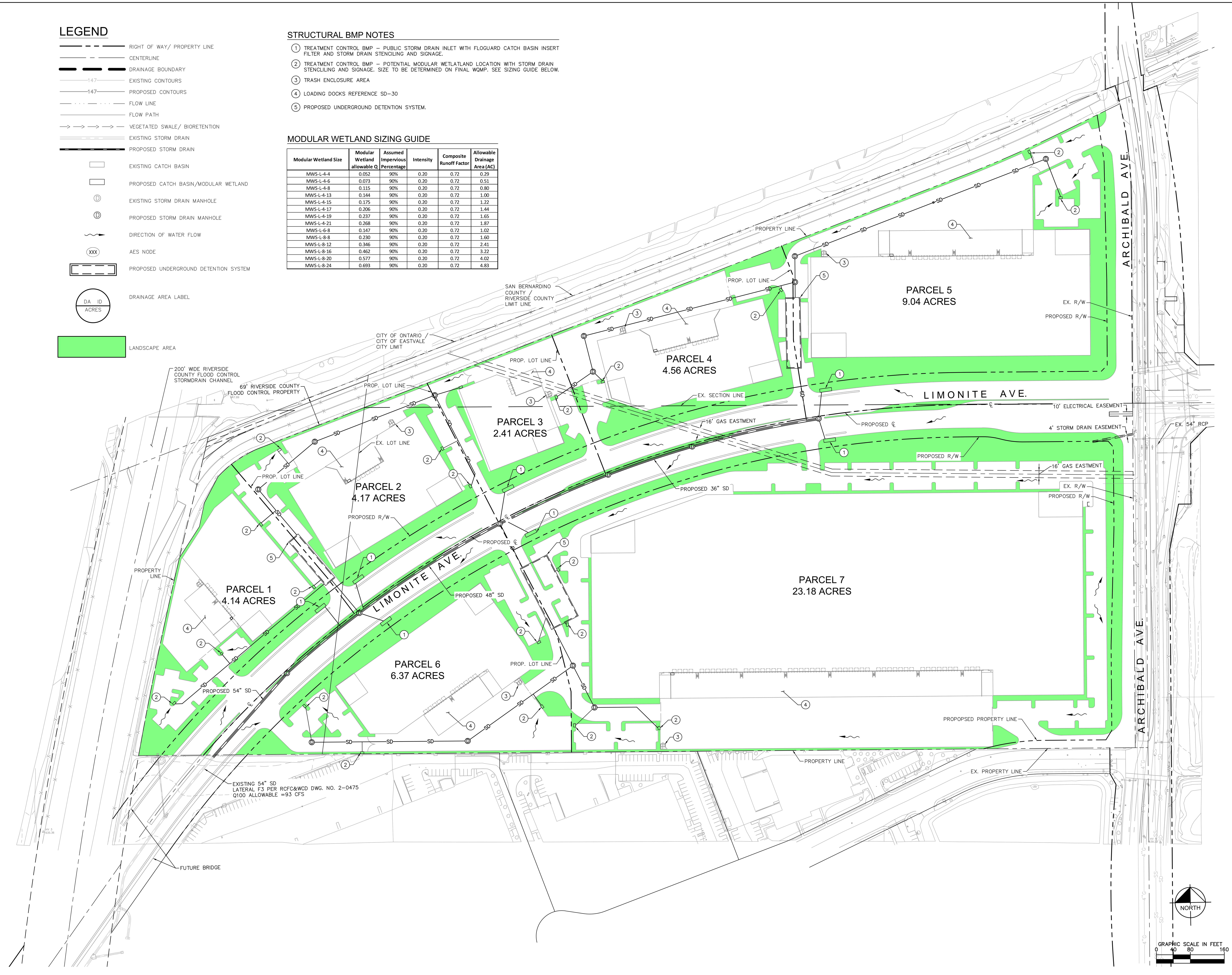
- RIGHT OF WAY/ PROPERTY LINE
- CENTERLINE
- DRAINAGE BOUNDARY
- EXISTING CONTOURS (147)
- PROPOSED CONTOURS (147)
- FLOW LINE
- FLOW PATH
- VEGETATED SWALE/ BIORETENTION
- EXISTING STORM DRAIN
- PROPOSED STORM DRAIN
- EXISTING CATCH BASIN
- PROPOSED CATCH BASIN/MODULAR WETLAND
- EXISTING STORM DRAIN MANHOLE
- PROPOSED STORM DRAIN MANHOLE
- DIRECTION OF WATER FLOW
- AES NODE (XXX)
- PROPOSED UNDERGROUND DETENTION SYSTEM
- DRAINAGE AREA LABEL (DA ID / ACRES)
- LANDSCAPE AREA

STRUCTURAL BMP NOTES

1. TREATMENT CONTROL BMP – PUBLIC STORM DRAIN INLET WITH FLOGUARD CATCH BASIN INSERT FILTER AND STORM DRAIN STENCILING AND SIGNAGE.
2. TREATMENT CONTROL BMP – POTENTIAL MODULAR WETLATLAND LOCATION WITH STORM DRAIN STENCILING AND SIGNAGE. SIZE TO BE DETERMINED ON FINAL WQMP. SEE SIZING GUIDE BELOW.
3. TRASH ENCLOSURE AREA
4. LOADING DOCKS REFERENCE SD–30
5. PROPOSED UNDERGROUND DETENTION SYSTEM.

MODULAR WETLAND SIZING GUIDE

Modular Wetland Size	Modular Wetland allowable Q	Assumed Impervious Percentage	Intensity	Composite Runoff Factor	Allowable Drainage Area (AC)
MWS-L-4-4	0.052	90%	0.20	0.72	0.29
MWS-L-4-6	0.073	90%	0.20	0.72	0.51
MWS-L-4-8	0.115	90%	0.20	0.72	0.80
MWS-L-4-13	0.144	90%	0.20	0.72	1.00
MWS-L-4-15	0.175	90%	0.20	0.72	1.22
MWS-L-4-17	0.206	90%	0.20	0.72	1.44
MWS-L-4-19	0.237	90%	0.20	0.72	1.65
MWS-L-4-21	0.268	90%	0.20	0.72	1.87
MWS-L-6-8	0.147	90%	0.20	0.72	1.02
MWS-L-8-8	0.230	90%	0.20	0.72	1.60
MWS-L-8-12	0.346	90%	0.20	0.72	2.41
MWS-L-8-16	0.462	90%	0.20	0.72	3.22
MWS-L-8-20	0.577	90%	0.20	0.72	4.02
MWS-L-8-24	0.693	90%	0.20	0.72	4.83



No.	REVISIONS	DATE	BY

Kimley»Horn
© 2019 KIMLEY-HORN AND ASSOCIATES, INC.
765 THE CITY DRIVE, SUITE 200, ORANGE, CA 92868
PHONE: 714-939-1030 FAX: 714-938-9488
WWW.KIMLEY-HORN.COM

LICENSED PROFESSIONAL
BRIAN GILLIS
CA LICENSE NUMBER 63021
EXP. DATE 6/30/20

KHA PROJECT 194121001
DATE 6.04.2019
SCALE AS SHOWN
DESIGNED BY ML
DRAWN BY OG
CHECKED BY CK

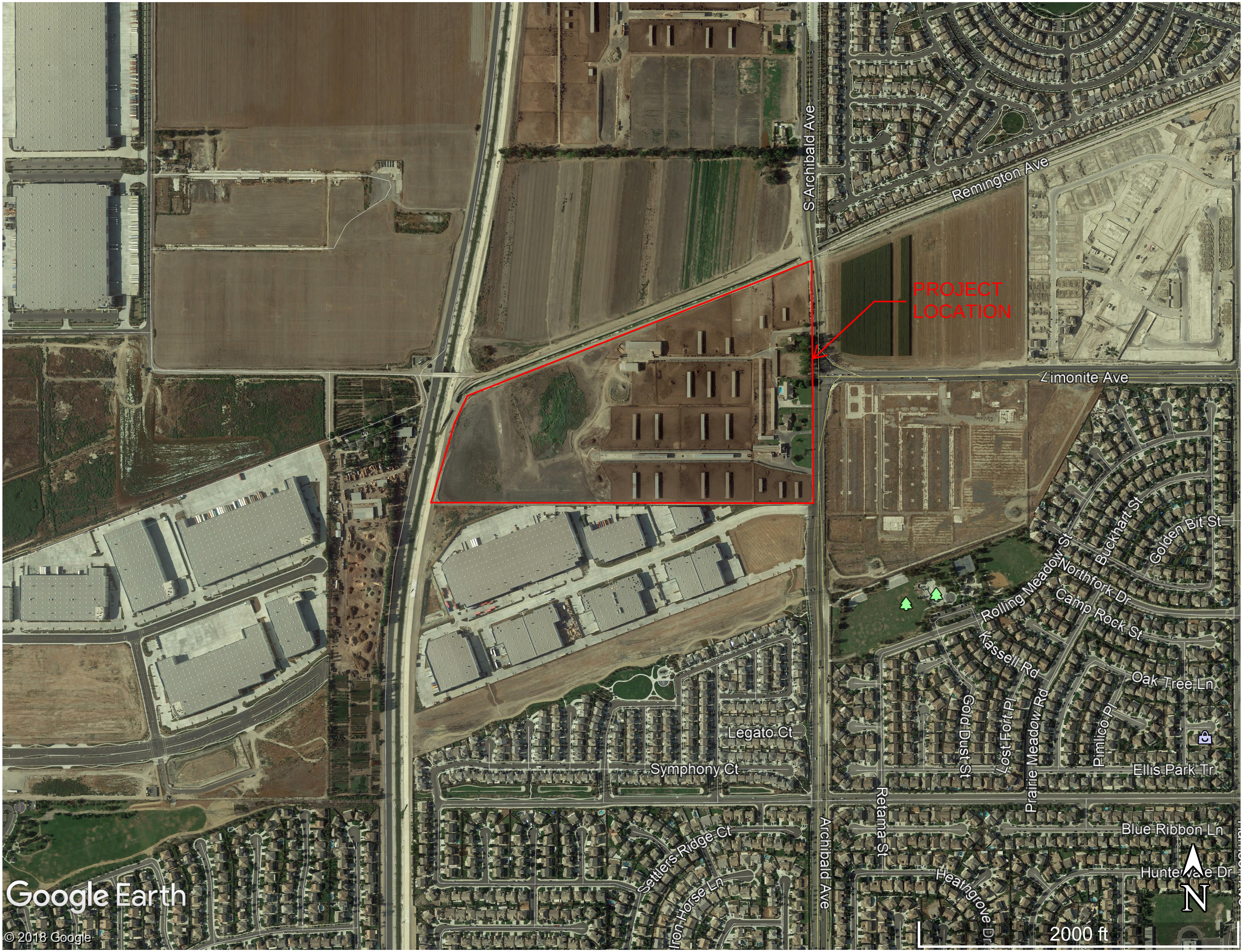
PRELIMINARY WQMP EXHIBIT

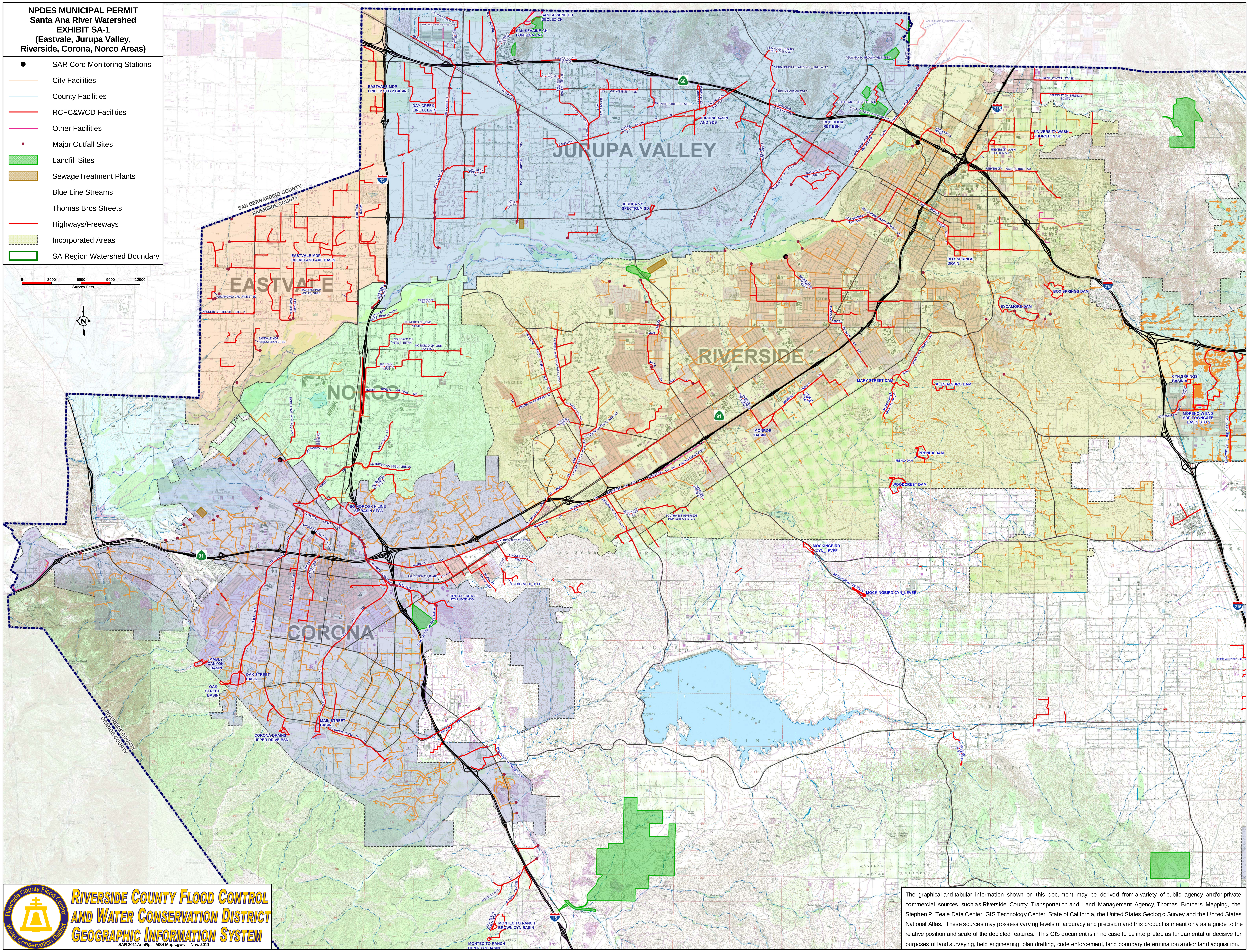
THE HOMESTEAD

PREPARED FOR
ORBIS REAL ESTATE PARTNERS

EASTVALE CA

SHEET NUMBER
1


PROJECT LOCATION
S Archibald Ave
Remington Ave
Limonite Ave
Buckhart St
Golden Bit St
Rolling Meadow St
Northfork Dr
Camp Rock St
Kassell Rd
Oak Tree Ln
Gold Dust St
Lost Fort Pl
Prairie Meadow Rd
Pimlico Pl
Legato Ct
Symphony Ct
Ellis Park Tr
Retama St
Archibald Ave
Blue Ribbon Ln
Settlers Ridge Ct
Iron Horse Ln
Heatngrove Dr
N
2000 ft
Google Earth
© 2018 Google



The graphical and tabular information shown on this document may be derived from a variety of public agency and/or private commercial sources such as Riverside County Transportation and Land Management Agency, Thomas Brothers Mapping, the Stephen P. Teale Data Center, GIS Technology Center, State of California, the United States Geologic Survey and the United States National Atlas. These sources may possess varying levels of accuracy and precision and this product is meant only as a guide to the relative position and scale of the depicted features. This GIS document is in no case to be interpreted as fundamental or decisive for purposes of land surveying, field engineering, plan drafting, code enforcement, land boundary determination and/or land acquisition.

Appendix 2: Construction Plans

Grading and Drainage Plans

TENTATIVE PARCEL MAP #37771

FOR

THE HOMESTEAD

EASTVALE, CA

PROJECT TEAM

OWNER/DEVELOPER
GRANT ROSS
THE HOMESTEAD, LLC
280 NEWPORT CENTER DRIVE,
SUITE 240
NEWPORT BEACH, CA 92660
(949) 330-7564

ARCHITECT
YONG NAM, AIA
HPA
18831 BARDEEN AVE. SUITE 100
IRVINE, CA 92612
(949) 863-1770
YONG@HPARCHS.COM

SURVEYOR
PETER WEILBACHER
CANYON CONSULTING
199 AVENIDA LA CUESTA
SAN CLEMENTE, CA, 92672
(949) 359-1044
PETERW@CANYON-CONSULTING.COM

CIVIL ENGINEER
BRIAN R. GILLIS, PE
KIMLEY-HORN AND ASSOCIATES, INC.
765 THE CITY DRIVE, SUITE 200
ORANGE, CA 92868
(714) 786-6275
BRIAN.GILLIS@KIMLEY-HORN.COM

GEOTECHNICAL CONSULTANT
CHET ROBINSON, PE, GE
GEOCON WEST, INC.
41571 CORNING PLACE, SUITE 101
MURRIETA, CA 92562
(951) 304-2300
(951) 304-2392 FAX

LEGAL DESCRIPTION PER TITLE REPORT

THE LAND REFERRED TO HEREIN BELOW IS SITUATED IN THE CITY OF EASTVALE, COUNTY OF RIVERSIDE, STATE OF CALIFORNIA, AND IS DESCRIBED AS FOLLOWS:

PARCEL 1:
ALL THAT PORTION OF THE FRACTIONAL NORTHEAST QUARTER OF SECTION 27 AND THE FRACTIONAL SOUTHEAST QUARTER OF SECTION 22, TOWNSHIP 2 SOUTH, RANGE 7 WEST, SAN BERNARDINO BASE AND MERIDIAN, AS SHOWN BY SECTIONALIZED SURVEY OF THE JURUPA RANCHO ON FILE IN BOOK 9, PAGE 33, OF MAPS RECORDS OF THE COUNTY OF SAN BERNARDINO, CALIFORNIA, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

COMMENCING AT THE SOUTHEAST CORNER OF SAID FRACTIONAL NORTHEAST QUARTER OF SECTION 27;
THENCE NORTH 00° 15' WEST ALONG THE EAST LINE OF SAID FRACTIONAL NORTHEAST QUARTER OF SECTION 27, A DISTANCE OF 1827.79 FEET TO A POINT THEREON FOR THE TRUE POINT OF BEGINNING;
THENCE SOUTH 89° 45' 10" WEST AND PARALLEL WITH THE SOUTH LINE OF SAID FRACTIONAL NORTHEAST QUARTER A DISTANCE OF 2378.41 FEET, MORE OR LESS, TO A POINT ON THE EASTERLY LINE OF THAT CERTAIN PARCEL OF LAND CONVEYED TO THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT BY DEED RECORDED IN BOOK 738, PAGE 334, OF THE OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA, SAID POINT BEING ON A CURVE IN SAID EASTERLY LINE, CONCAVE TO THE EAST, HAVING A RADIUS OF 8900.00 FEET, FROM WHICH THE CENTER OF SAID CURVE BEARS SOUTH 79° 45' 39" EAST; THENCE NORTHERLY ALONG SAID CURVE, TO THE RIGHT THROUGH A CENTRAL ANGLE OF 03° 22' 19", AN ARC DISTANCE OF 523.78 FEET TO THE END THEREOF, FROM WHICH THE CENTER OF SAID CURVE BEARS SOUTH 76° 23'20" EAST;
THENCE NORTH 13° 36' 40" EAST ALONG THE EASTERLY LINE OF THE PARCEL CONVEYED AS AFORESAID, A DISTANCE OF 244.14 FEET, MORE OR LESS, TO A POINT ON THE NORTHERLY BOUNDARY LINE OF THE JURUPA RANCHO AS SHOWN ON SAID MAP, SAID POINT ALSO BEING ON THE NORTHERLY LINE OF SAID FRACTIONAL NORTHEAST QUARTER OF SECTION 27, DISTANT THEREON NORTH 69° 02' EAST, 457.89 FEET FROM THE NORTHWEST CORNER OF SAID FRACTIONAL NORTHEAST QUARTER:
THENCE NORTH 69° 02' EAST ALONG SAID NORTHERLY BOUNDARY LINE OF THE JURUPA RANCHO AND ALONG THE NORTHERLY LINES OF SAID FRACTIONAL NORTHEAST QUARTER OF SECTION 27 AND SAID FRACTIONAL SOUTHEAST QUARTER OF SECTION 22, A DISTANCE OF 2364.37 FEET TO A POINT ON THE EASTERLY LINE OF SAID FRACTIONAL SOUTHEAST QUARTER OF SAID SECTION 22;
THENCE SOUTH 00° 06' EAST ALONG SAID EASTERLY LINE OF SAID FRACTIONAL SOUTHEAST QUARTER OF SECTION 22, A DISTANCE OF 774.25 FEET TO THE SOUTHEAST CORNER THEREOF, SAID POINT BEING THE NORTHEAST CORNER OF SAID FRACTIONAL NORTHEAST QUARTER OF SECTION 27;
THENCE SOUTH 00° 15' EAST ALONG THE EAST LINE OF SAID FRACTIONAL NORTHEAST QUARTER OF SECTION 27, A DISTANCE OF 811.21 FEET TO THE TRUE POINT OF BEGINNING.

EXCEPTING THEREFROM THAT PORTION OF GOVERNMENT LOTS 5 AND 8 IN FRACTIONAL SECTION 22, TOWNSHIP 2 SOUTH, RANGE 7 WEST, SAN BERNARDINO BASE AND MERIDIAN, DESCRIBED IN A DEED TO OSCAR K. IMBACH, ET. UX., RECORDED JUNE 10, 1944 IN BOOK 1683, PAGE 350, OF THE OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA, AND THAT PORTION OF THE FRACTIONAL SOUTHEAST ONE-QUARTER OF SAID SECTION 22 AND THE FRACTIONAL NORTHEAST ONE-QUARTER OF SECTION 27 IN SAID TOWNSHIP 2 SOUTH, RANGE 7 WEST, DESCRIBED IN A DEED TO OSCAR K. IMBACH, ET. UX., RECORDED JANUARY 22, 1959 AS INSTRUMENT NO. 5716 OF THE OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA, LYING WESTERLY OF A LINE PARALLEL WITH AND DISTANT EASTERLY, 230.00 FEET, MEASURED AT RIGHT ANGLES FROM THE FOLLOWING DESCRIBED SURVEYED REFERENCE LINE:

BEGINNING AT A POINT IN THE NORTHERLY LINE OF THE FRACTIONAL SOUTHEAST ONE-QUARTER OF SAID SECTION 22, SAID POINT BEING SOUTH 88° 54' 26" EAST, 959.04 FEET, MEASURED ALONG SAID NORTHERLY LINE FROM A FOUND SAN BERNARDINO COUNTY SURVEYOR'S NAIL AND FLASH SET AT THE CENTER ONE-QUARTER CORNER OF SAID SECTION 22, SAID POINT ALSO BEING NORTH 88° 54' 26" WEST, 1672.94 FEET, MEASURED ALONG SAID NORTHERLY LINE FROM A FOUND SAN BERNARDINO COUNTY SURVEYOR'S MONUMENT SET AT THE EAST ONE-QUARTER CORNER OF SAID SECTION 22;
THENCE SOUTH 3° 23' 57" WEST, 941.26 FEET;
THENCE SOUTH 11° 03' 04" WEST, 1444.72 FEET;
THENCE SOUTH 8° 01' 16" WEST, 3020.52 FEET TO A POINT IN THE SOUTHERLY LINE OF SAID FRACTIONAL NORTHEAST ONE-QUARTER OF SECTION 27, SAID POINT BEING SOUTH 89° 21' 30" EAST, 112.29 FEET, MEASURED ALONG SAID SOUTHERLY LINE FROM A FOUND 2 INCH IRON PIPE SET AT THE SOUTHWEST CORNER OF THE LAND SHOWN AS "PARCEL 2" ON THAT CERTAIN RECORD SURVEY RECORDED IN BOOK 34, PAGE 81, OF RECORDS OF SURVEY IN THE OFFICE OF THE COUNTY RECORDER OF SAID RIVERSIDE COUNTY, SAID POINT ALSO BEING NORTH 89° 21' 30" WEST, 2414.61 FEET, MEASURED ALONG SAID SOUTHERLY LINE FROM A FOUND RIVERSIDE COUNTY SURVEYOR'S MONUMENT, IN WELL, SET AT THE EAST ONE-QUARTER CORNER OF SAID SECTION 27.

ALSO EXCEPTING THEREFROM THOSE PORTIONS CONVEYED TO SOUTHERN CALIFORNIA EDISON COMPANY BY DEEDS RECORDED DECEMBER 20, 1974 AS INSTRUMENT NOS. 160887 AND 160889, WHICH WAS ALSO RE-RECORDED ON MARCH 20, 1975 AS INSTRUMENT NO. 31976, AND TO SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT BY DEED RECORDED OCTOBER 13, 1976 AS INSTRUMENT NO. 153846, ALL OF THE OFFICIAL RECORDS OF RIVERSIDE COUNTY, CALIFORNIA.

ALSO EXCEPTING THEREFROM THE EASTERLY 30.00 FEET LYING WITHIN ARCHIBALD AVENUE.

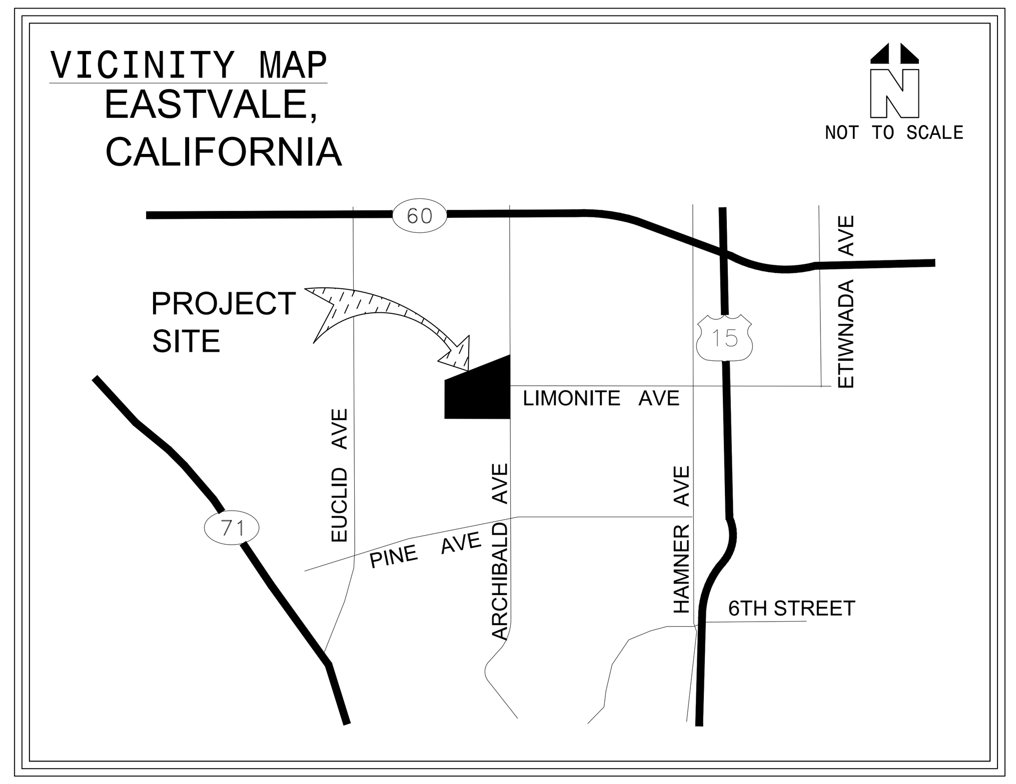
ALSO EXCEPTING THEREFROM THOSE PORTIONS CONVEYED TO THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT UNDER A CORRECTED FINAL ORDER OF CONDEMNATION RECORDED ON OCTOBER 29, 2008 AS INSTRUMENT NO. 2008-0594927 IN THE OFFICIAL RECORDS OF RIVERSIDE COUNTY.

PARCEL 2:
THAT PORTION OF THE FRACTIONAL NORTHEAST ONE-QUARTER OF SECTION 27 AND THAT PORTION OF THE FRACTIONAL SOUTHEAST ONE-QUARTER OF SECTION 22, ALL IN TOWNSHIP 2 SOUTH, RANGE 7 WEST, AS SHOWN BY SECTIONALIZED SURVEY OF THE JURUPA RANCHO ON FILE IN BOOK 9, PAGE 33 OF MAPS, IN THE OFFICE OF THE COUNTY RECORDER OF SAN BERNARDINO COUNTY, CALIFORNIA, DESCRIBED IN DEED TO KENNETH EARLE IMBACH, ET AL., RECORDED JANUARY 13, 1960 AS INSTRUMENT NO. 3050 OF THE OFFICIAL RECORDS IN THE OFFICE OF THE COUNTY RECORDER OF RIVERSIDE COUNTY, LYING WESTERLY OF A LINE PARALLEL WITH AND DISTANT EASTERLY, 230.00 FEET, MEASURED AT RIGHT ANGLES FROM THE FOLLOWING DESCRIBED SURVEYED REFERENCE LINE:

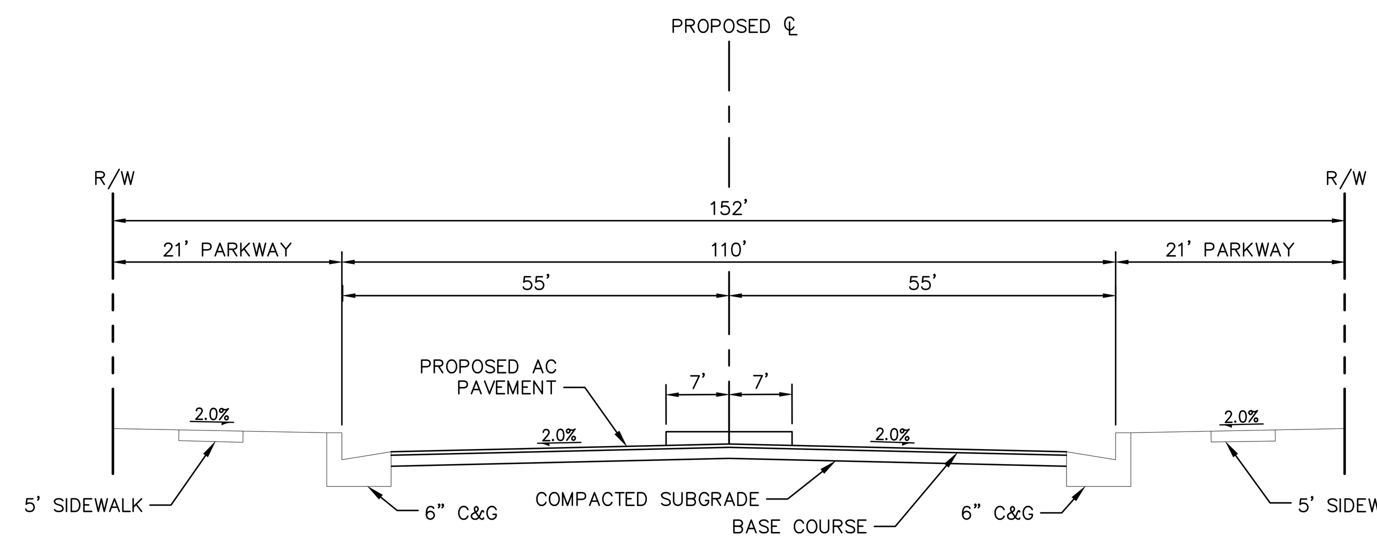
BEGINNING AT A POINT IN THE NORTHERLY LINE OF THE FRACTIONAL SOUTHEAST ONE-QUARTER OF SAID SECTION 22, SAID POINT BEING SOUTH 88° 54' 26" EAST, 959.04 FEET, MEASURED ALONG SAID NORTHERLY LINE FROM A FOUND SAN BERNARDINO COUNTY SURVEYOR'S NAIL AND FLASH SET AT THE CENTER ONE-QUARTER CORNER OF SAID SECTION 22, SAID POINT ALSO BEING NORTH 88° 54' 26" WEST, 1672.94 FEET, MEASURED ALONG SAID NORTHERLY LINE FROM A FOUND SAN BERNARDINO COUNTY SURVEYOR'S MONUMENT SET AT THE EAST ONE-QUARTER CORNER OF SAID SECTION 22;
THENCE SOUTH 3° 23' 57" WEST, 941.26 FEET;
THENCE SOUTH 11° 03' 04" WEST, 1444.72 FEET;
THENCE SOUTH 8° 01' 16" WEST, 3020.52 FEET TO A POINT IN THE SOUTHERLY LINE OF SAID FRACTIONAL NORTHEAST ONE-QUARTER OF SECTION 27, SAID POINT BEING SOUTH 89° 21' 30" EAST, 112.29 FEET, MEASURED ALONG SAID SOUTHERLY LINE FROM A FOUND 2 INCH IRON PIPE SET AT THE SOUTHWEST CORNER OF THE LAND SHOWN AS "PARCEL 2" ON THAT CERTAIN RECORD SURVEY RECORDED IN BOOK 34, PAGE 81, OF RECORDS OF SURVEY IN THE OFFICE OF THE COUNTY RECORDER OF SAID RIVERSIDE COUNTY, SAID POINT ALSO BEING NORTH 89° 21' 30" WEST, 2414.61 FEET, MEASURED ALONG SAID SOUTHERLY LINE FROM A FOUND RIVERSIDE COUNTY SURVEYOR'S MONUMENT, IN WELL, SET AT THE EAST ONE-QUARTER CORNER OF SAID SECTION 27.

EXCEPTING THEREFROM THOSE PORTIONS CONVEYED TO THE SAN BERNARDINO COUNTY FLOOD CONTROL DISTRICT BY DEEDS RECORDED DECEMBER 10, 1976 AS INSTRUMENT NO. 190446 AND APRIL 21, 1986 AS INSTRUMENT NO. 89782 OF OFFICIAL RECORDS.

ALSO EXCEPTING THEREFROM THOSE PORTIONS CONVEYED TO THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT UNDER A CORRECTED FINAL ORDER OF CONDEMNATION RECORDED ON OCTOBER 29, 2008 AS INSTRUMENT NO. 2008-0594927 IN THE OFFICIAL RECORDS OF RIVERSIDE COUNTY.

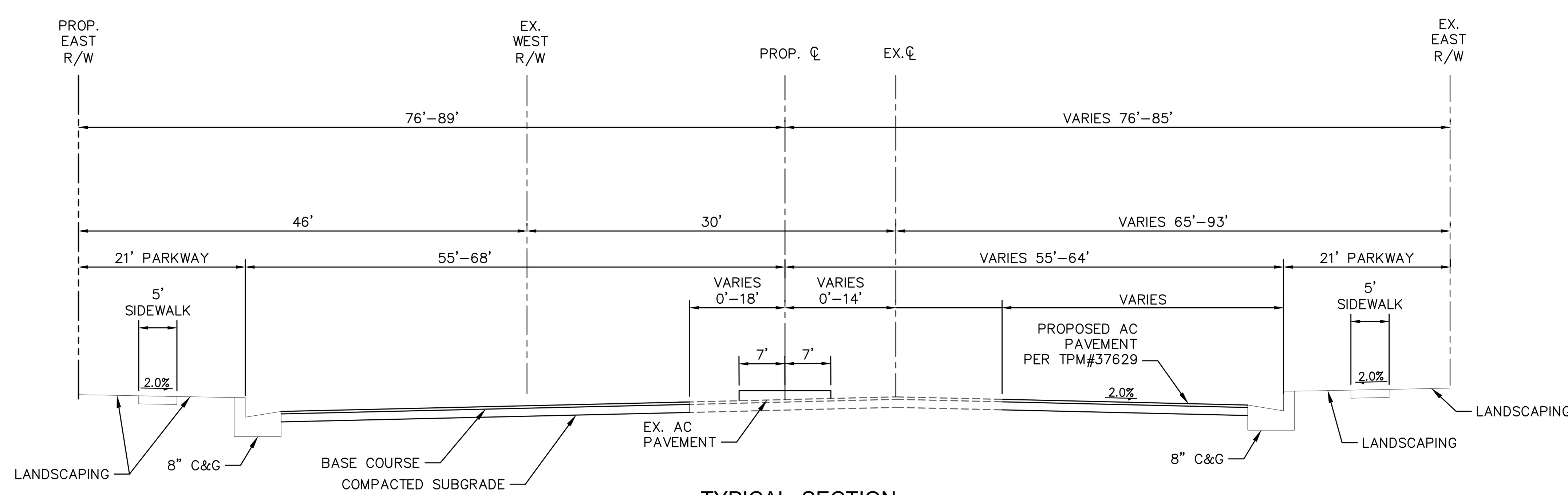


VICINITY MAP
SCALE: NTS
THOMAS GUIDE REF# 683-A5



TYPICAL SECTION
MEDIAN URBAN ARTERIAL HIGHWAY
STD. NO. 91

LIMONITE AVENUE
NOT TO SCALE



TYPICAL SECTION
MODIFIED URBAN ARTERIAL HIGHWAY
STD. NO. 91

ARCHIBALD AVENUE
NOT TO SCALE

ABBREVIATIONS:

R/W	RIGHT OF WAY
BLDG.	BUILDING
SUB.	SUBDIVISION
PROP.	PROPOSED
EX.	EXISTING
℄	CENTERLINE
PL	PROPERTY LINE
AC	ACRES
CONC	CONCRETE

UTILITY PURVEYORS

WATER & SEWER
JURUPA COMMUNITY SERVICES DISTRICT
11201 HARREL STREET
JURUPA VALLEY, CA 91752
(951) 685-7434

STORM DRAIN
RIVERSIDE COUNTY FLOOD CONTROL
1995 MARKET STREET
RIVERSIDE, CA 92501
(951) 955-1200

ELECTRICITY
SOUTHERN CALIFORNIA EDISON (SCE)
1351 E. FRANCIS STREET
IRVINE, CA 91761
(909) 930-8431

CABLE TV
AT&T
1265 N. VAN BUREN STREET
ANAHEIM, CA 92807
(714) 666-5503

GAS
SOUTHERN CALIFORNIA GAS COMPANY
155 S. G STREET
SAN BERNARDINO, CA 92410
(909) 758-8691

PHONE
VERIZON
1400 EAST PHILLIPS BLVD.
POMONA, CA 91766
(909) 469-2260

PARCEL AREA TABLE:

PARCEL NUMBER	AREA (AC)	LAND USE
1	3.21	INDUSTRIAL
2	3.45	INDUSTRIAL
3	1.92	INDUSTRIAL
4	3.68	INDUSTRIAL
5	7.78	INDUSTRIAL
6	4.90	INDUSTRIAL
7	20.53	INDUSTRIAL
NET SUBTOTAL	45.47	
NET DEDICATION	10.39	
GROSS TOTAL	55.86	

SHEET LIST TABLE

SHEET NUMBER	SHEET TITLE
1	COVER SHEET
2	TENTATIVE PARCEL MAP
3	TENTATIVE PARCEL MAP
4	GRADING AND DRAINAGE PLAN
5	UTILITY PLAN

GEOTECHNICAL REPORT

THE PRELIMINARY GEOTECHNICAL INVESTIGATION AND PERCOLATION TESTING DATED APRIL 19, 2019 PREPARED BY GEOCON WEST INC. AND ALL ADDENDA SHALL BE CONSIDERED PART OF THESE CONSTRUCTION DOCUMENTS.

BENCHMARK NOTE

RIVERSIDE COUNTY BENCHMARK NO: M.L. 34-1-64

A 3" ALUMINUM DISK SET IN THE TOP OF CURB STAMPED "M.L. 34-1 REST" AT THE NE CORNER OF THE "T" INTERSECTION OF ORANGE STREET AND SUMNER AVENUE, 84.0 FEET EASTERLY AND 22.0 FEET SOUTHERLY OF THE CENTERLINE INTERSECTION OF SUMNER AVENUE AND ORANGE STREET. TOP OF CURB 10 FEET EASTERLY OF THE SOUTHEAST ECR.

ELEV = 607.06 NGVD 29

BASIS OF BEARINGS NOTE

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE CALIFORNIA COORDINATE SYSTEM 83, ZONE 6, NAD 83, EPOCH 2010.00, AS DETERMINED LOCALLY BY A LINE BETWEEN CONTINUOUS OPERATING REFERENCE STATIONS (CORS) "CNPP" AND "EWPP" BEING NORTH 16°26'56" EAST AS DERIVED FROM GEODETIC VALUES PUBLISHED BY THE NATIONAL GEODETIC SURVEY (NGS) FOR SAID EPOCH, AND MEETS ALL THE REQUIREMENTS OF THE CALIFORNIA PUBLIC RESOURCES CODE.

SITE INFORMATION

SITE ADDRESS:	EASTVALE CA.
APN:	144-010-015, 144-010-018, 144-010-020 144-010-023, 144-010-024 & 144-010-032
TOTAL SITE AREA:	55.86 AC
EXISTING ZONING CLASSIFICATION:	A-2 HEAVY AGRICULTURE
PROPOSED ZONING CLASSIFICATION:	I-P INDUSTRIAL PARK
EXISTING USE:	DAIRY FARM
PROPOSED USE:	PROPOSED USE INDUSTRIAL
TOTAL LOTS:	7
PARKING SPACES:	879

ESTIMATED EARTHWORK QUANTITIES

CUT: 94,000 CY

FILL: 61,000 CY

NET: 33,000 CY (CUT)

NOTE: THE ABOVE QUANTITIES ARE APPROXIMATE IN PLACE VOLUMES CALCULATED FROM THE EXISTING GROUND TO THE PROPOSED FINISHED GRADE. EXISTING GROUND IS DEFINED BY THE CONTOURS AND SPOT GRADES ON THE BASE SURVEY. PROPOSED FINISHED GRADE IS DEFINED AS THE FINAL GRADE AS INDICATED ON THE GRADING PLAN(S).

THE EARTHWORK QUANTITIES ABOVE ARE FOR PERMIT PURPOSES ONLY. THEY HAVE NOT BEEN FACTORED TO ACCOUNT FOR CHANGES IN VOLUME DUE TO BULKING, CLEARING AND GRUBBING, SHRINKAGE, OVER- EXCAVATION AND RE-COMPACTION, AND CONSTRUCTION METHODS. NOR DO THEY ACCOUNT FOR THE THICKNESS OF PAVEMENT SECTIONS, FOOTINGS, SLABS, REUSE OF PULVERIZED MATERIALS THAT WILL UNDERLIE NEW PAVEMENTS, ETC. THE CONTRACTOR SHALL RELY ON THEIR OWN EARTHWORK ESTIMATES FOR BIDDING PURPOSES.

No. | REVISIONS | DATE | BY

Kimley»Horn

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PHONE: 714-939-1030 FAX: 714-938-9488
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CA LICENSE NUMBER 63021
EXP. DATE 6/30/20

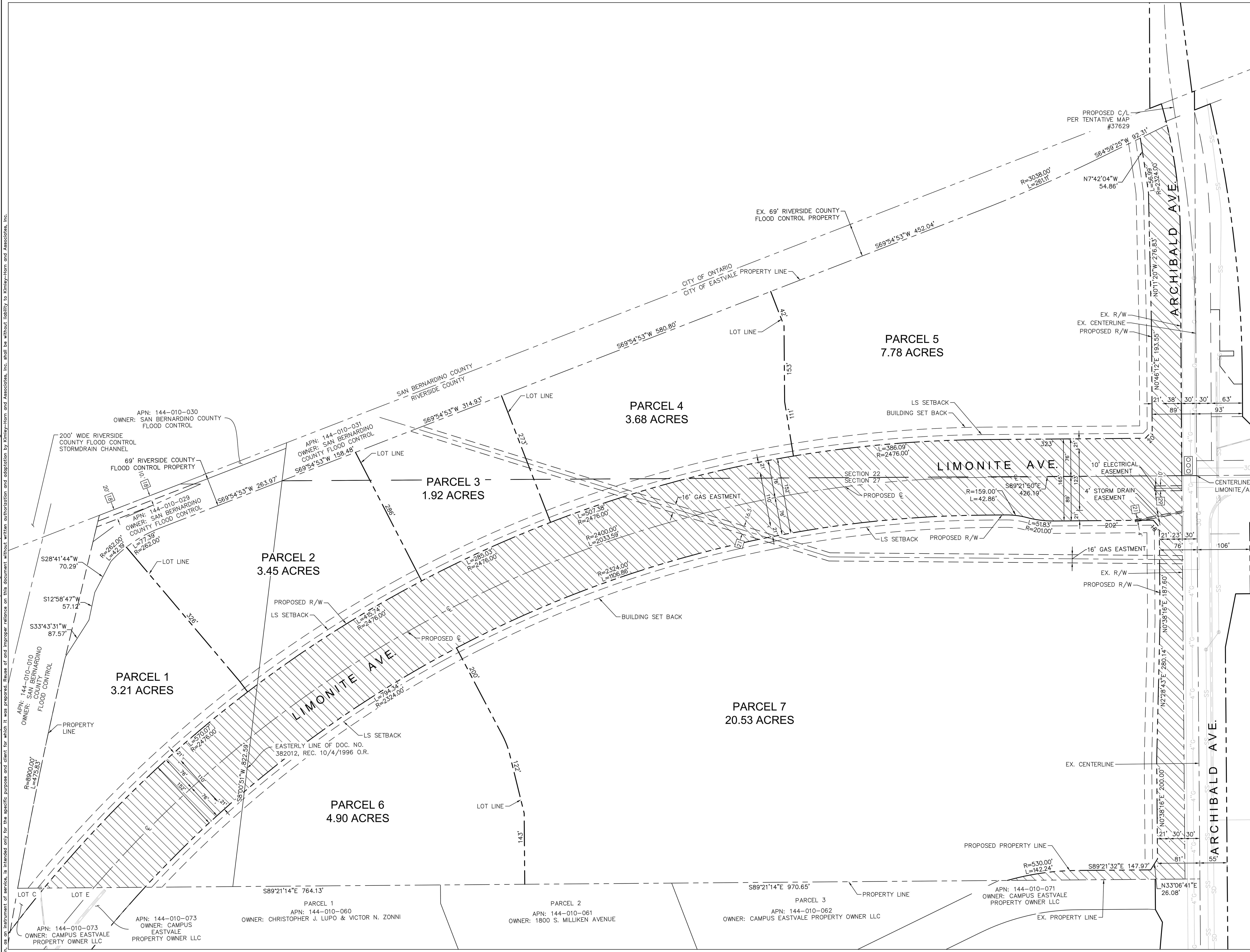
KHA PROJECT 194121001
DATE 6.27.2019
SCALE AS SHOWN
DESIGNED BY ML
DRAWN BY OG
CHECKED BY CK

COVER SHEET

THE HOMESTEAD
PREPARED FOR
ORBIS REAL ESTATE PARTNERS
EASTVALE CA

SHEET NUMBER
1

Know what's below. Call 811 before you dig.



LEGEND

- CENTER LINE
- PROPERTY LINE
- PROP. LOT LINE
- EASEMENT OR SETBACK LINE
- RIGHT OF WAY
- SECTION LINE
- AREA TO BE DEDICATED

PARCEL AREA TABLE:

PARCEL NUMBER	AREA (AC)	LAND USE
1	3.21	INDUSTRIAL
2	3.45	INDUSTRIAL
3	1.92	INDUSTRIAL
4	3.68	INDUSTRIAL
5	7.78	INDUSTRIAL
6	4.90	INDUSTRIAL
7	20.53	INDUSTRIAL
NET SUBTOTAL	45.47	
NET DEDICATION	10.39	
GROSS TOTAL	55.86	

EASEMENTS/EXCEPTIONS/ENCUMBRANCES

SEE TITLE COMMITMENT BY FIRST AMERICAN TITLE INSURANCE COMPANY, COMMITMENT NO. NCS-929239-ONT1, DATED OCTOBER 30, 2018 ITEMS LISTED BELOW ARE SHOWN IN THE TITLE COMMITMENT AND PLOTTABLE ITEMS ARE DENOTED THUS: # WITH LOCATIONS KEYED THE SAME HEREON.

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AFFECTS: AS DESCRIBED THEREIN

NORTH

GRAPHIC SCALE IN FEET
0 40 80 160

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LICENSED PROFESSIONAL
BRIAN GILLIS
CA LICENSE NUMBER 63021
EXP. DATE 6/30/20

KHA PROJECT 194121001
DATE 6.27.2019
SCALE AS SHOWN
DESIGNED BY ML
DRAWN BY GG
CHECKED BY CK

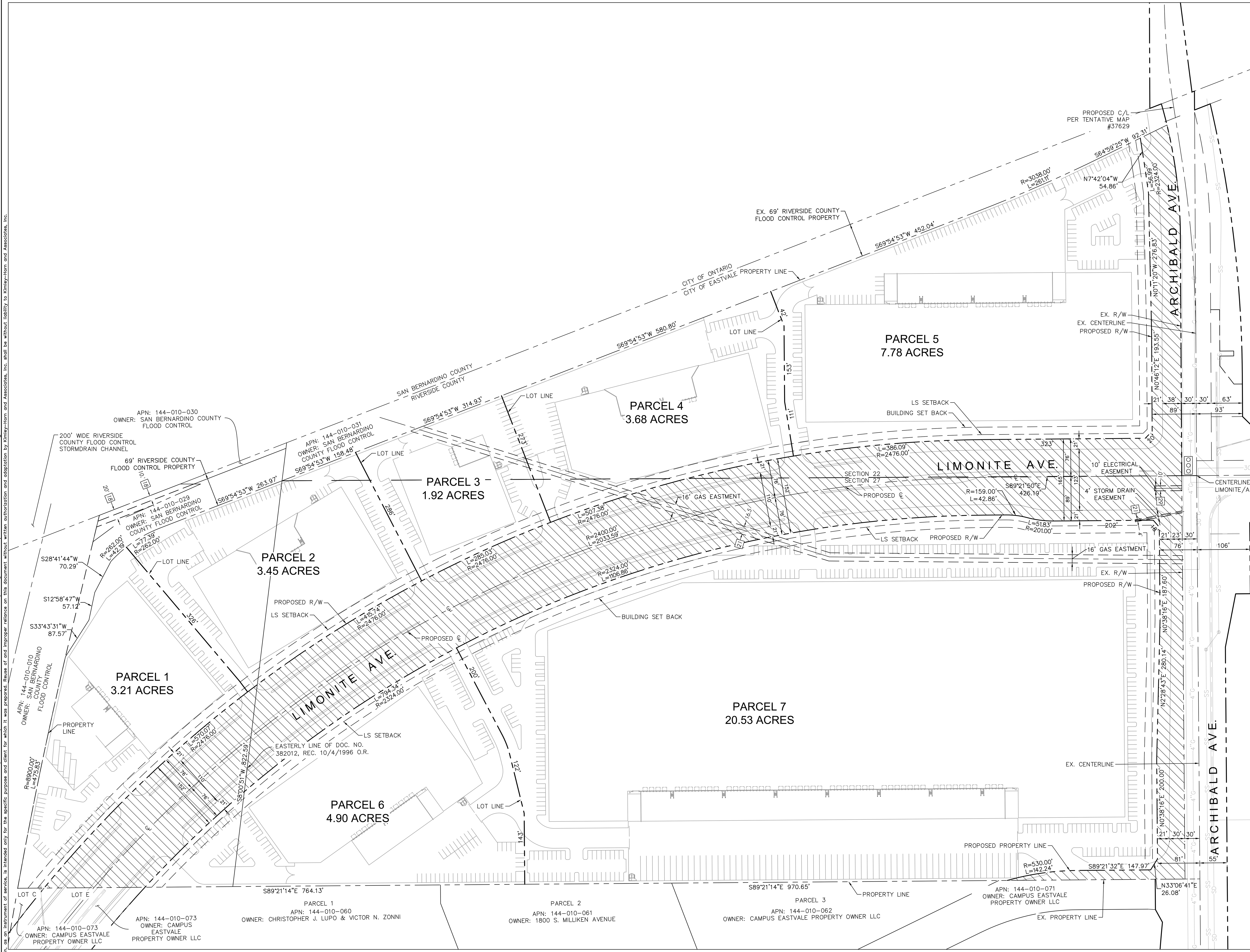
TENTATIVE PARCEL MAP

THE HOMESTEAD

PREPARED FOR
ORBIS REAL ESTATE PARTNERS

EASTVALE CA

SHEET NUMBER
2



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REVISIONS | No. | DATE | BY

Kimley»Horn

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LICENSED PROFESSIONAL
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CA LICENSE NUMBER 63021
EXP. DATE 6/30/20

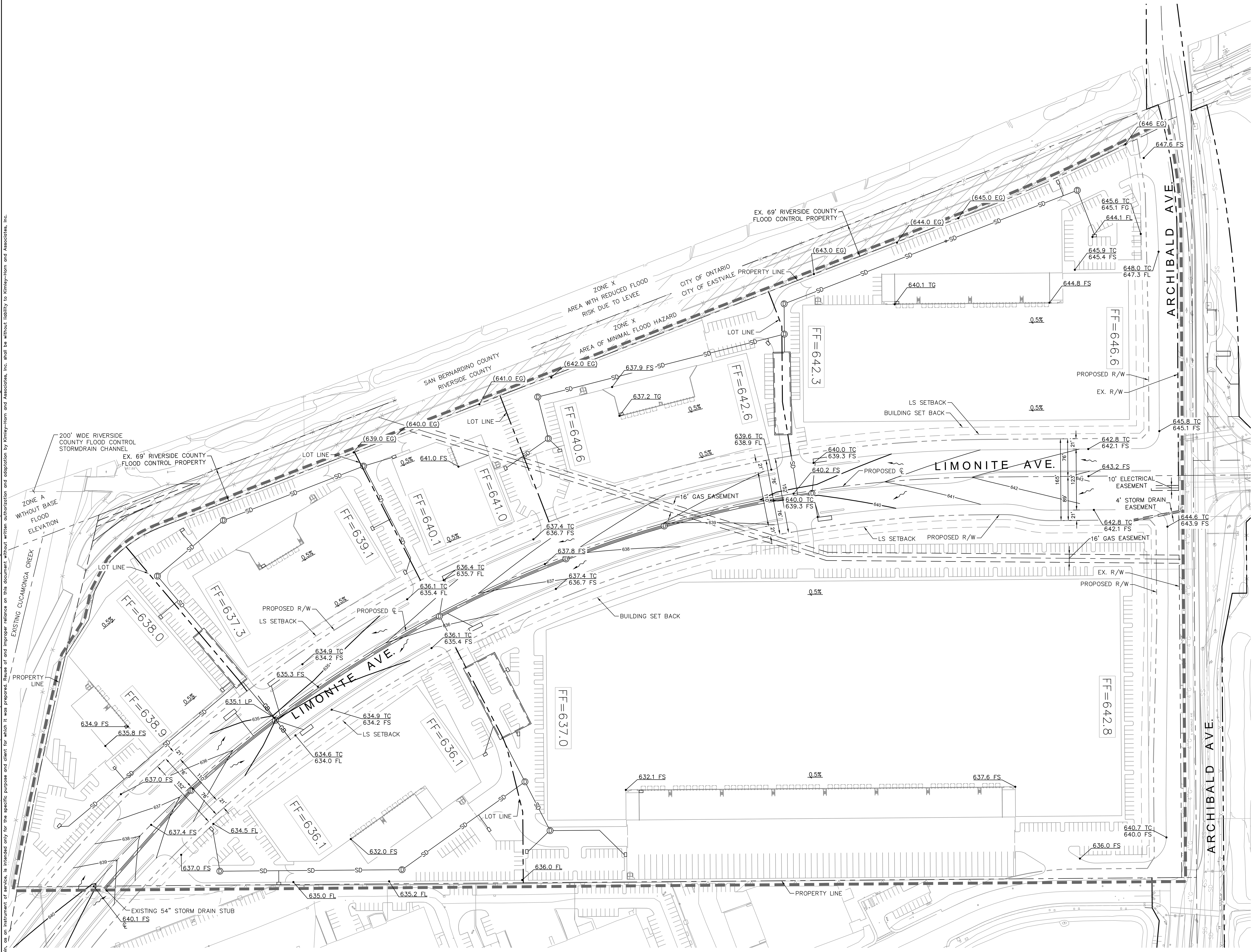
KHA PROJECT 194121001
DATE 6.27.2019
SCALE AS SHOWN
DESIGNED BY ML
DRAWN BY GG
CHECKED BY CK

TENTATIVE PARCEL MAP

THE HOMESTEAD

PREPARED FOR
ORBIS REAL ESTATE PARTNERS
EASTVALE CA

SHEET NUMBER
3



LEGEND

	CENTER LINE
	PROPERTY LINE
	PROP. LOT LINE
	EASEMENT OR SETBACK LINE
	RIGHT OF WAY LINE
	CIVIL LIMIT OF WORK LINE
	DEEPENED FOOTING (DF) OR STEM WALL (SW)
	GRADE BREAK LINE
R R	RIDGE LINE
	FLOW LINE
TOP TOE	2:1 SLOPE (MAX)
XXX.X TC / XXX.X FS	PROPOSED SPOT GRADE
(XXX.X TC) / (XXX.X FS)	EXISTING SPOT GRADE
X.X%	PROPOSED FLOW (DIRECTION AND SLOPE)
	SLOPE DIRECTION
	PROPOSED UNDERGROUND DETENTION SYSTEM
SD SD	PROPOSED STORM DRAIN
	EXISTING FLOOD ZONE

NORTH

GRAPHIC SCALE IN FEET
0 40 80 160

Know what's below. Call 811 before you dig.

Plotted By:Lepore, Michael Sheet Set:Kha Layout:4 GRADING AND DRAINAGE PLAN June 27, 2019 04:56:42pm K:\ORA_LDEV\194121001-the homestead\CAD\plansheets\4 GRADING AND DRAINAGE PLAN.dwg

No.	REVISIONS	DATE	BY

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GRADING AND DRAINAGE PLAN

THE HOMESTEAD

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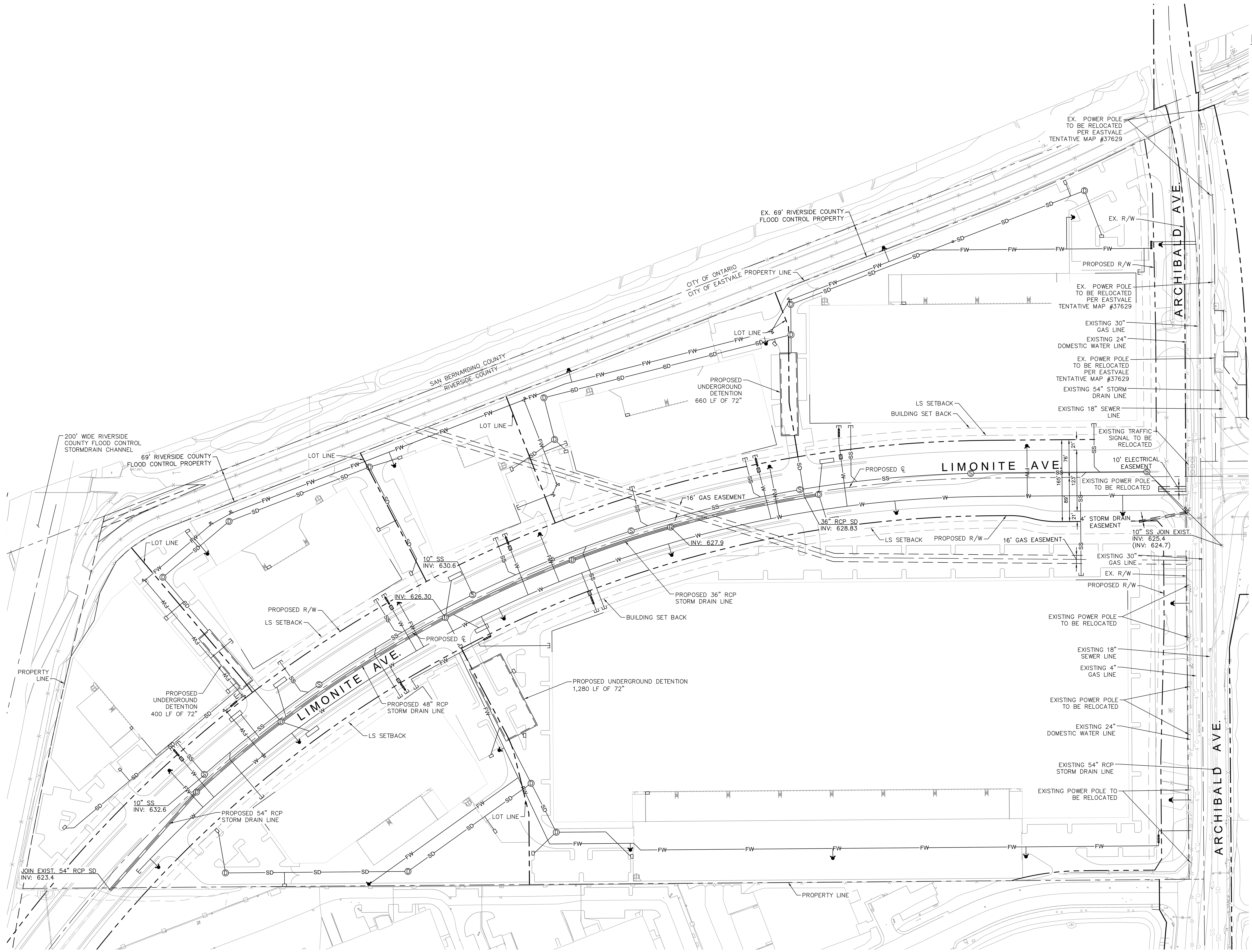
SHEET NUMBER
4



LEGEND

	CENTER LINE
	PROPERTY LINE
	PROP. LOT LINE
	EASEMENT OR SETBACK LINE
	CIVIL LIMIT OF WORK LINE
SS	PROPOSED SANITARY SEWER PIPE
SD	PROPOSED STORM DRAIN PIPE (< 12"ø)
	PROPOSED STORM DRAIN PIPE (> 12"ø)
W	PROPOSED WATER PIPE
DW	PROPOSED DOMESTIC WATER PIPE
FW	PROPOSED FIRE WATER PIPE
	PROPOSED UNDERGROUND DETENTION SYSTEM
	PROPOSED CATCH BASIN
	FIRE HYDRANT
S	SEWER MANHOLE
D	STORM DRAIN MANHOLE
	EXISTING POWER POLE

NORTH

GRAPHIC SCALE IN FEET
0 40 80 160

811 Know what's below. Call 811 before you dig.

Plotted By:Lepore, Michael Sheet Set:Kha Layout:5 UTILITY PLAN June 27, 2019 04:54:46pm K:\ORA_LDEV\194121001-the homestead\CAD\plansheets\5 UTILITY PLAN.dwg

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UTILITY PLAN

THE HOMESTEAD
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ORBIS REAL ESTATE PARTNERS
EASTVALE CA

SHEET NUMBER
5

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

PRELIMINARY GEOTECHNICAL INVESTIGATION AND PERCOLATION TESTING

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

GEOCON
WEST, INC.

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

THE HOMESTEAD, LLC
NEWPORT BEACH, CALIFORNIA

April 19, 2019
PROJECT NO. T2857-22-01

Project No. T2857-22-01
April 19, 2019

The Homestead, LLC
280 Newport Center Drive, Suite 240
Newport Beach, California 92660

Attention: Mr. Grant Ross

Subject: PRELIMINARY GEOTECHNICAL INVESTIGATION
AND PERCOLATION TESTING
THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

Dear Mr. Ross:

In accordance with your authorization of our Proposal IE-2226 dated August 24, 2018, Geocon West, Inc. (Geocon) herein submits the results of our preliminary geotechnical investigation and percolation testing for the proposed retail development and industrial business park at the northeast corner of Limonite Avenue and Archibald Avenue in Eastvale, California. The geotechnical investigation is being issued as preliminary as portions of the site are inaccessible due to the recent rain and active use of the site by livestock.

The accompanying report presents our findings, conclusions and recommendations pertaining to the geotechnical aspects of the proposed development. Based on the results of this study, it is our opinion the site is considered suitable for the proposed development provided the recommendations of this report are followed.

Should you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON WEST, INC.

REGISTERED PROFESSIONAL ENGINEER
CHET E. ROBINSON
No. 2890
GEOTECHNICAL
STATE OF CALIFORNIA

PROFESSIONAL GEOLOGIST
LISA A. BATTIATO
No. 2316
CERTIFIED ENGINEERING GEOLOGIST
STATE OF CALIFORNIA

Chet E. Robinson
GE 2890

Lisa A. Battiato
CEG 2316

CER:LAB:hd

Distribution: Addressee (email)

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

PRELIMINARY GEOTECHNICAL INVESTIGATION AND PERCOLATION TESTING

1. PURPOSE AND SCOPE

This report presents the results of our preliminary geotechnical investigation and percolation testing for the proposed industrial business park located west of Limonite Avenue and Archibald Avenue in Eastvale, California (see *Vicinity Map*, Figure 1). The purpose of the investigation was to evaluate subsurface soil and geologic conditions at the site and, based on the conditions encountered, provide recommendations pertaining to the geotechnical aspects of developing the property as presently proposed.

The scope of our investigation included a review of available historic aerial photographs, subsurface exploration, percolation testing, laboratory testing, engineering analyses, and the preparation of this report. A summary of the information reviewed for this study is presented in the *List of References*.

Our field investigation included the drilling of six small-diameter geotechnical borings and four percolation test borings. Our initial proposed scope included additional borings. However, portions of the site were not accessible due to active use by the livestock, wet soils at the site from recent rains limited access to the drilling equipment, and storm water was ponded in the southwestern portion of the site. An update geotechnical investigation is planned once the site is clear of livestock and the site is accessible to the drilling equipment.

Appendix A presents a discussion of the field investigation, logs of the borings, and percolation test data. The approximate locations of the exploratory borings are presented on the *Geologic Map* (Figure 2). We performed laboratory tests on soil samples obtained from the exploratory borings to evaluate pertinent physical and chemical properties for engineering analysis. The results of the laboratory testing are presented in *Appendix B*.

2. SITE AND PROJECT DESCRIPTION

The site is currently being utilized as a dairy. Residences are in the eastern portion of the site, and the western portion of the site is an open field with a stormwater pond. The general site conditions are shown on Figure 3, *Aerial Photograph*. Based on our review of historic aerial photographs, the site has been utilized for agriculture since at least 1938 and was converted to a dairy in the 1980's or early 1990's (Continental; NETR, 2019).

The area totals approximately 50 acres and is located at latitude 33.9746 and longitude -117.5970. Site grades are relatively level with elevations ranging from approximately 633 feet above mean sea level (MSL) in the southwest corner to 647 feet above MSL in the northeast portion of the site. The property is bounded on the east by Archibald Avenue and on the south by an industrial development. A storm water channel is immediately north and west of the site.

Several stockpiles of soil were observed in the western portion of the site. Manure (organic rich soil) was present in the pen areas and within the western portion of the site. The manure was observed at the ground surface.

Grading plans were not available for our review at the time of this preliminary investigation. The *Conceptual Site Plan* by HP Architecture dated June 21, 2018 was utilized as the base for our *Geologic Map*, Figure 2. The plan indicates four industrial buildings will be constructed in the site, and an extension of Limonite will bisect the site with three buildings to the north and one building south of the roadway. The industrial developments will include associated utility, parking, driveway and flat work improvements. Storm water infiltration structures currently under consideration include one retention basin in the southwest corner, and one retention basin on the eastern portion of the site north of Limonite Avenue.

Based on the site and surrounding grades, we expect that rough grading will result in cuts and fills of up to 10 feet to level the site and fill in the pond. Due to the relatively level topography for the development, graded slopes are expected to be less than 10 feet high. Structural plans were not provided for the buildings; however, we have assumed that the industrial business park will consist of one- or two-story buildings using concrete tilt-up construction. The buildings will likely be supported by shallow foundations with concrete slab-on-grade floors.

Due to the preliminary nature of the design currently, wall and column loads were not available. We expect that column loads for the proposed structures will be up to 100 kips, and wall loads will be up to 10 kips per linear foot. Once the design phase and foundation loading configuration proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary.

If project details differ significantly from those described, Geocon should be contacted for review and possible revision to this report.

3. GEOLOGIC SETTING

The site is located within an alluvial fan and flood plain within the southern part of the Chino Basin, that is part of the Corona-Chino Valley crustal block, a major structural low. This crustal block is bounded on the west by the Chino fault and the Chino and San Jose Hills, on the north by the Cucamonga fault zone and the San Gabriel Mountains, on the east by the Rialto-Colton fault, and on the south by the La Sierra and Pedley Hills. This structural low was filled with late Tertiary to early Quaternary non-marine sedimentary deposits derived from the San Gabriel Mountains, the Chino Hills, Puente Hills, and the San Bernardino Mountains via the Santa Ana River, and capped by a relatively thin layer of windblown sand. At depth, the basin consists of impermeable sedimentary and igneous rocks that are exposed at the surface in the surrounding mountains and hills.

Locally, the site is underlain by several hundred feet of young alluvial fan deposits from the San Gabriel Mountains and flood plain deposits from the Santa Ana River to the south, resulting in interlayered fine- and coarse-grained deposits of clays, silts, and sands. No faults are geologically mapped within or adjacent to the site.

4. GEOLOGIC MATERIALS

4.1 General

Based on our field investigation and published geologic maps of the area, the soils underlying the site consist of undocumented artificial fill and young alluvial fan deposits (Morton and Gray, 2002). Undocumented artificial fill was encountered to depths of 3 to 4 feet in the southern portion of the site and is likely present in other areas from the dairy improvements. The site soils are described in detail on the boring logs in *Appendix A*. The soil and geologic units encountered at the site are discussed below.

4.2 Undocumented artificial fill (afu)

Undocumented artificial fill was encountered within Borings B-1, B-5, P-1, and P-2 to depths of 3 to 4 feet within the southern portion of the site. The fill encountered is fine silty sand to silt which is brown to grey, moist and stiff/medium dense. Fill is likely present in other areas of the site that were not explored.

4.3 Young Alluvial Fan Deposits (Qyf_a)

Holocene alluvial fan deposits with interlayered fluvial flood plain deposits were encountered across the site to depths of 51.5 feet. These soils are collectively referred to as young alluvial fan deposits herein for simplicity. The alluvial fan units consist of silty to clayey sands which are moist and generally medium dense. The fluvial deposits are the fine-grained units of silt and clay which are moist to wet and soft to very stiff.

5. GROUNDWATER

Seepage or perched water was encountered within B-2 at 24½ feet below ground surface and in B-4 at a depth of 18¼ feet below the ground surface. Seepage or groundwater were not encountered in the other borings to depths of 30 to 50 feet below ground surface. At the time of our investigation, the stormwater pond in the western portion of the site had standing water. Perched water was not encountered in the borings near the pond but should be expected in the area and along the storm water channel.

Based on data from the California Department of Water Resources, groundwater was reported at depths of greater than 128 feet BGS at a well approximately 0.8 mi east-northeast of the site between 2011 and 2017. It is not uncommon for seepage conditions to develop where none previously existed due to the permeability characteristics of the geologic units encountered. During the rainy season, localized perched water conditions may develop above silt and clay layers that may require special consideration during grading operations. Groundwater elevations are dependent on seasonal precipitation, irrigation, and land use, among other factors, and therefore vary.

6. GEOLOGIC HAZARDS

6.1 Surface Fault Rupture

The numerous faults in southern California include active, potentially active, and inactive faults. The criteria for these major groups are based on criteria developed by the California Geological Survey (CGS, formerly known as CDMG) for the Alquist-Priolo Earthquake Fault Zone Program (Bryant and Hart, 2007). An active fault is one that has had surface displacement within Holocene time (about the last 11,000 years). A potentially active fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years) but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

The site is not within a currently established State of California Alquist-Priolo Earthquake Fault Zone (CDC, 2018a) or a Riverside County Fault Hazard Zone for surface fault rupture hazards. No active or potentially active faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low. However, the site is in the seismically active southern California region, and could be subjected to moderate to strong ground shaking in the event of an earthquake on one of the many active southern California faults.

The closest active faults to the site are the Chino-Central Avenue fault, located approximately 5.4 miles to the southwest, and the Elsinore Glen Ivy fault, located 8.8 miles south of the site (CDC, 2018b). Faults within a 50-mile radius of the site are listed in Table 6.1.1. Historic earthquakes in southern California of magnitude 6.0 and greater, their magnitude, distance, and direction from the site are listed in Table 6.1.2.

TABLE 6.1.1
Active Faults within 50 Miles of the Site

Fault Name	Maximum Magnitude (Mw)	Geometry (Slip Character)	Slip Rate (mm/yr)	Information Source	Distance from Site (mi)	Direction from Site
Chino Fault	6.7	RL-R-O	1.0	a	4.3	WSW
Elsinore Fault (Glen Ivy North)	6.8	RL-SS	5.0	a	8.8	S
Whittier Fault	6.8	RL-R-O	2.5	a	9.1	SW
Red Hill (Etiwanda Ave)	n/a	n/a	n/a	b	12	NNE
Cucamonga Fault	6.9	R	5.0	a	13	N
San Jacinto Fault (San Bernardino)	6.8	RL-SS	5.0	a	17	NE
San Andreas (San Bernardino Mountains)	7.5	RL-SS	24	a	21	NE
San Jacinto (San Jacinto Valley)	6.9	RL-SS	12	a	24	E
Raymond	6.5	LL-R-O	1.5	a	27	NW
San Jacinto (Casa Loma)	6.9	RL-SS	12	a	28	ESE
Elsinore (Wildomar)	6.8	RL-SS	5.0	a	28	SE
Crafton Hills	n/a	n/a	n/a	b	28	ENE
Newport-Inglewood	7.1	RL-SS	1.0	a	31	SW
Beaumont Plain	n/a	n/a	n/a	b	34	E
North Frontal Thrust	7.2	R	1.0	a	35	NE
San Andreas (Mojave Section)	7.4	RL-SS	30.0	a	36	NNW
Verdugo	6.9	R	0.5	a	38	WNW
Llano	6.1	RO	1.0	a	38	NNW
San Gorgonio Pass	n/a	THRUST	n/a	b	39	E
Palos Verdes	7.3	RS-SS	3.0	a	39	SW
Hollywood	6.4	LL-R-O	1.0	a	40	WNW
Sierra Madre	7.2	R	2.0	a	42	NW
Coronado Bank	7.6	RL-SS	3.0	a	42	SW
San Jacinto (Anza)	7.2	RL-SS	12	a	44	SE
Sierra Madre (San Fernando Section)	6.7	R	2.0	a	45	NW
Redondo Canyon	n/a	n/a	n/a	b	48	WSW
Helendale	7.3	RL-SS	0.6	a	48	NE
Santa Monica	6.6	LL-R-O	1.0	a	48	W

Geometry: BT = blind thrust, LL = left lateral, N = normal, O = oblique, R = reverse, RL = right lateral, SS = strike slip.

Information Sources: a = Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C.J., 2003, The Revised 2002 California Probabilistic Seismic Hazard Maps, including Appendices A, B, and C, dated June; b = online Fault Activity Map of California website, maps.conservation.ca.gov/cgs/fam/, as of 1/2017.

n/a = data not available

TABLE 6.1.2
Historic Earthquake Events with Respect to the Site

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
San Jacinto	April 21, 1918	6.8	37	ESE
Loma Linda Area	July 22, 1923	6.3	20	E
Long Beach	March 10, 1933	6.4	33	SW
Buck Ridge	March 25, 1937	6.0	86	ESE
Imperial Valley	May 18, 1940	6.9	74	E
Desert Hot Springs	December 4, 1948	6.0	69	E
Arroyo Salada	March 19, 1954	6.4	101	ESE
Borrego Mountain	April 8, 1968	6.5	107	ESE
San Fernando	February 9, 1971	6.6	59	WNW
Joshua Tree	April 22, 1992	6.1	80	E
Landers	June 28, 1992	7.3	74	ENE
Big Bear	June 28, 1992	6.4	50	ENE
Northridge	January 17, 1994	6.7	62	WNW
Hector Mine	October 16, 1999	7.1	93	ENE

6.2 Liquefaction

Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soils, in-situ stress conditions, and the depth to groundwater. Liquefaction is typified by a loss of shear strength in the liquefied layers due to rapid increases in pore water pressure generated by earthquake accelerations. Seismically induced settlement may occur whether the potential for liquefaction exists or not.

Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

The site is within an area mapped as having very high liquefaction potential per Riverside County (RCIT, 2018).

As discussed in the Groundwater Section of this report, groundwater is expected in excess of 100 feet below the ground surface, however seepage or perched water was encountered in two of the borings at depths of 18¼ to 24½ feet. The depth of the perched groundwater was used in our liquefaction analysis.

We performed a liquefaction analysis of the soils underlying the site using the spreadsheet template LIQ2_30.WQ1 developed by Thomas F. Blake (1996). This program utilizes the 1996 NCEER method of analysis. The liquefaction potential evaluation was performed by utilizing a magnitude 6.7 earthquake, and the site-specific peak horizontal acceleration for the site. This semi-empirical method is based on a correlation between values of Standard Penetration Test (SPT) resistance

Based on the medium dense to dense consistency of the granular alluvial soils and the relatively cohesive nature of the fine-grained alluvial deposits, the potential for liquefaction and seismic settlement at the site is negligible and not a design consideration. An analysis of the liquefaction potential and seismic induced settlement is included on Figures 4 and 5.

6.3 Expansive Soil

The soils encountered within the site consist of clays, silts, and sands. Laboratory testing results indicate samples of the near surface soils exhibit “very low” expansion potential (expansion index [EI] of 20 or less) with expansion index test results of 0 and 1.

6.4 Hydrocompression

Hydrocompression is the tendency of unsaturated soil structure to collapse upon wetting resulting in the overall settlement of the affected soil and overlying foundations or improvements supported thereon. Potentially compressible soils underlying the site are typically removed and recompacted during remedial site grading. However, if compressible soil is left in-place, a potential for settlement due to hydrocompression of the soil exists. Alluvial soils obtained during our investigation were tested for hydrocompression and exhibited a collapse potential of 0.01 to 0.3 percent when loaded to the expected post-grading pressures.

6.5 Landslides

The site is not located near a hillside. Therefore, landslides are not a design consideration.

6.6 Rock Fall Hazards

Rock falls are not a design consideration due to the lack of natural bedrock slopes above or adjacent to the site.

6.7 Slope Stability

Graded slopes up to 10 feet in height and inclined as steep as 2:1 (horizontal:vertical) are expected at the site. In general, graded fill slopes constructed of on-site soils with gradients of 2:1 (horizontal to vertical) or flatter will possess factors of safety of 1.5 or greater. Geocon should be contacted for additional evaluation is steeper slopes or slopes greater than 10 feet in height are planned for the development.

6.8 Tsunamis and Seiches

A tsunami is a series of long period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The first order driving force for locally generated tsunamis offshore southern California is expected to be tectonic deformation from large earthquakes (Legg, *et al.*, 2003). The site is located approximately 31 miles from the nearest coastline; therefore, the negligible risk associated with tsunamis is not a design consideration.

A seiche is a run-up of water within a lake or embayment triggered by fault- or landslide-induced ground displacement. The site is not located near or below reservoirs or other standing bodies of water. Therefore, seiche hazard is not a design consideration.

6.9 Organic Rich Soil

Samples of soil tested for organic content indicated that the subsurface site soils have between 1.0 and 3.6 percent organics by weight. Soils with a higher organic content are expected near the ground surface and in stockpiles at the site due to previous agricultural activities and where manure has been mixed with the soils.

7. SITE INFILTRATION

Percolation testing was performed in general accordance with the procedures in *Riverside County Flood Control and Water Conservation District LID BMP, Appendix A* (the Handbook) at locations and depths selected by the design team. The percolation test locations are depicted on the *Geologic Map* (see Figure 2). The percolation tests had to be modified due to the operations of the dairy at the time of our investigation. The sandy soil criteria test had to be halted in percolation tests P-3 and P-4 because of livestock within the test area. The tests were resumed later that day once the dairy was able to relocate the animal.

Approximately 2 inches of gravel was placed at the bottom of each percolation test hole and a 3-inch diameter perforated PVC pipe in silt filter sock was placed atop the gravel. The test locations were pre-saturated prior to testing. Percolation data sheets are presented in *Appendix A* of this report. Calculations to convert the percolation test rate to infiltration test rates are presented in Table 7 below. The Handbook requires a factor of safety of 3 be applied to the values below based on the test method used.

TABLE 7
INFILTRATION TEST RATES FOR PERCOLATION AREAS

Parameter	P-1	P-2	P-3	P-6
Depth (inches)	96.0	96.0	97.0	96.0
Test Type	Modified	Modified	Modified	Modified
Change in head over time: ΔH (inches)	1.7	5.0	1.0	1.1
Average head: Havg (in)	23.2	21.5	24.4	23.6
Time Interval (minutes): Δt (minutes)	30	10	10	10
Radius of test hole: r (inches)	4	4	4	4
Tested Infiltration Rate: It (inches/hour)	0.27	2.58	0.44	0.51

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 General

8.1.1 Soil or geologic conditions were not encountered during the investigation that would preclude the proposed development of the project provided the recommendations presented herein are followed and implemented during design and construction.

8.1.2 Potential geologic hazards at the site include seismic shaking, compressibility of the near surface soils, and organic soils. Based on our investigation and available geologic information, active, potentially active, or inactive faults are not present underlying or trending toward the site.

8.1.3 The undocumented artificial fill and the upper portion of the alluvial soil are not considered suitable for the support of additional compacted fill or settlement-sensitive improvements. Remedial grading of the surficial soil will be required as discussed herein. The existing site soils, except as indicated below, are suitable for re-use as engineered fill provided the recommendations in the *Grading* section of this report are followed.

8.1.4 The manure impacted soils at the site are not suitable for use as compacted fill. The manure impacted soils should be removed from the site as part of the clearing and grubbing operations.

8.1.5 Following removal of the manure impacted soils, our laboratory tests indicate that the subsurface soils to be used as fill contain organic contents between 1.0 and 3.6 percent. Processing of the site soils during grading is expected to result in an average organic content of approximately 2 to 3 percent. Additional compactive effort should be planned during grading to mitigate the settlement potential due to the organic content of the soils at the site.

8.1.6 Perched water was encountered in B-2 at 24½ and in B-4 at 18¼ feet during our subsurface investigation. It is likely that this condition is a result of water from recent precipitation flowing along a silty sand unit and perched on the underlying silt layer. However, based on the variability of the soil types encountered, it is possible that perched water will be encountered at shallower depths, depending on after agricultural irrigation, precipitation during rainy seasons, infiltration from the stormwater pond, and other factors.

8.1.7 Moisture contents are expected to vary based on the season and amount of precipitation. Special handling of the soil should be anticipated, particularly if grading occurs during the rainy season, as drying back of the existing materials should be anticipated prior to their use as fill.

8.1.8 Given the loose or soft consistency of the site soils and high moisture contents, relatively soft soils should be expected in the site excavation walls and bottoms, and subgrade stabilization will be required within site excavations during grading or installation of utilities.

8.1.9 Although most on-site soils consist of silts, clays, silty sands, and sandy silts and clays, some granular material, having little to no cohesion and subject to caving in un-shored excavations, should be expected at the site. It is the responsibility of the contractor to ensure that excavations and trenches are properly shored and maintained in accordance with OSHA rules and regulations to maintain the stability of adjacent existing improvements.

8.1.10 The laboratory tests indicate that the site soils are non-expansive and have a "very low" expansion potential. If medium to highly expansive soils are encountered at the site, they should be exported from the site or selectively graded and placed in the deeper fill areas to allow for the placement of low expansion material at the finish pad grade.

8.1.11 Proper drainage should be maintained in order to preserve the design properties of the fill in the sheet-graded pads and slope areas. Recommendations for site drainage are provided herein.

8.1.12 Changes in the design, location or elevation of improvements, as outlined in this report, should be reviewed by this office. Once grading plans become available, they should be reviewed by this office to evaluate the necessity for review and possible revision of this report.

8.1.13 Recommended grading specifications are provided in Appendix C.

8.2 Soil Characteristics

8.2.1 The near surface site soils encountered in the field investigation are "non-expansive" (Expansion Index [EI] of 20 or less) as defined by 2016 California Building Code (CBC) Section 1803.5.3 with a "Very Low" expansion potential. Table 8.2.1 presents soil classifications based on the EI.

TABLE 8.2.1
SOIL CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Expansion Classification	2016 CBC Expansion Classification
0 – 20	**Very Low**	**Non-Expansive**
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

8.2.2 Based on the material classifications and laboratory testing, the near surface site soils are generally expected to possess a low expansion potential (EI of 50 or less). Medium to highly expansive soils should not be placed within 4 feet of the proposed foundations, flatwork or paving improvements. Additional testing for expansion potential should be performed once final grades are achieved.

8.2.3 Laboratory testing was performed on samples of the site soils to evaluate the percentage of water-soluble sulfate content. Results indicate that the on-site materials at the locations tested possess a sulfate content of 0.000 to 0.044% (less than 10 to 440 parts per million [ppm]) equating to an exposure class of S0 to concrete structures as defined by 2016 CBC Section 1904.3 and ACI 318. Table 8.2.3 presents a summary of concrete requirements set forth by 2016 CBC Section 1904.3 and ACI 318. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

TABLE 8.2.3
REQUIREMENTS FOR CONCRETE
EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Sulfate Exposure Class	Water-Soluble Sulfate Percent by Weight	Cement Type	Maximum Water to Cement Ratio by Weight	Minimum Compressive Strength (psi)
S0	**0.00-0.10**	**--**	**--**	**2,500**
S1	0.10-0.20	II	0.50	4,000
S2	0.20-2.00	V	0.45	4,500
S3	> 2.00	V+ Pozzolan or Slag	0.45	4,500

8.2.4 Laboratory testing indicates the site soils have a minimum electrical resistivity of 320 to 26,000 ohm-cm, possess 40 to 180 parts per million chloride, less than 10 to 440 ppm sulfate, and have a pH of 7.24 and 8.32. As shown in Table 8.2.4 below, the site would be classified as "corrosive" to buried improvements, in accordance with the Caltrans Corrosion Guidelines (Caltrans, 2018) based on the electrical resistivity. Additionally, the site historic and current use is for agriculture and as a dairy farm. Several areas of the site were not accessible for our exploration. The client should anticipate corrosive soils will be encountered on the site, particularly where manure or drainage from the cow pens are present.

TABLE 8.2.4
CALTRANS CORROSION GUIDELINES

Corrosion Exposure	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)	pH
Corrosive	<1,100	500 or greater	1,500 or greater	5.5 or less

8.2.5 Geocon does not practice in the field of corrosion engineering. Therefore, further evaluation by a corrosion engineer should be performed if improvements that could be susceptible to corrosion are planned.

8.3 Grading

8.3.1 Grading should be performed in accordance with the *Recommended Grading Specifications* contained in *Appendix C* and the Grading Ordinances of the City of Eastvale.

8.3.2 Prior to commencing grading, a preconstruction conference should be held at the site with the city inspector, owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

8.3.3 Site preparation should begin with the removal of deleterious material, manure impacted soils, debris, buried trash, and vegetation. The depth of removal should be such that material exposed in cut areas or soil to be used as fill is relatively free of organic matter and manure. Material generated during stripping and/or site demolition should be exported from the site.

8.3.4 Undocumented fill and alluvium within a 1:1 (h:v) projection of the limits of grading should be removed to expose competent alluvium with a relative compaction of at least 85 percent (ASTM D1557). Removals in the existing fill and alluvium should be expected on the order of 6 to 8 feet below existing grades. The removals should also extend at least 3 feet below the bottom of the planned foundations. Areas of loose, dry, or compressible soils will require deeper excavation and processing prior to fill placement. Removals in pavement and walkway areas should extend at least 3 feet beneath the pavement or flatwork subgrade elevation. The actual depth of removal should be evaluated by the engineering geologist during grading operations. Where over excavation and compaction is to be conducted, the excavations should be extended laterally a minimum distance of 5 feet beyond the building footprint or for a distance equal to the depth of removal, whichever is greater. Patios and building appurtenances should be considered a part of the building footprint when determining the limits of lateral excavation. The bottom of the excavations should be scarified to a depth of at least 1 foot, moisture conditioned as necessary, and properly compacted to 95 percent of the maximum dry density as determined by ASTM 1557.

8.3.5 Geocon should observe the removal bottoms to check the competence at the bottom of the removal. Deeper excavations may be required if dry, loose, or soft materials are present at the base of the removals. Excavation bottoms require written approval by a Geocon representative.

8.3.6 The site soils are expected to have an average organic content on the average of 2 to 3 percent by weight when placed as compacted fill. Riverside County guidelines (RTLMA, 2000) indicate that fill soils should have an organic content of 1 percent or less. To mitigate the potential settlement from the organic soils at the site, fill should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.

8.3.7 The fill placed within 4 feet of proposed foundations should possess a “low” expansion potential (EI of 50 or less).

8.3.8 If perched groundwater, wet, or saturated materials are encountered during remedial grading, extensive drying and mixing with dryer soil will be required. The excavated materials should then be moisture conditioned as necessary to 0 to 2 percent above optimum moisture content prior to placement as compacted fill.

8.3.9 The site should be brought to finish grade elevations with fill compacted in layers. Layers of fill should be no thicker than will allow for adequate bonding and compaction. Fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content as determined by ASTM D 1557. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill.

8.3.10 Where relatively loose, soft, or wet soils are encountered in the site excavations, subgrade stabilization will be required prior to placing fill or installing utilities. Where required, subgrade stabilization can be achieved by over excavating the loose or soft materials and replacing with compacted fill, placing 3-inch diameter rock in the soft bottom and working it into soil until it is stabilized, or placing gravel wrapped in filter fabric at the bottom of the excavation. Where used, gravel should consist of 12 to 18 inches of washed angular ¾ inch gravel atop a filter fabric (Mirafi 500X or equivalent) on the excavation bottom. The filter fabric should be placed in a manner so that the gravel does not have direct contact with the soil. Once the gravel is placed and vibrated to a relatively dense state, a top layer of filter fabric should be placed to cover the gravel. Recommendations for stabilizing excavation bottoms should be based on an evaluation in the field by Geocon at the time of construction.

8.3.11 Import fill (if necessary) should consist of granular materials with a "low" expansion potential (EI of 50 or less), non-corrosive, generally free of deleterious material and contain no rock fragments larger than 6 inches. Geocon should be notified of the import soil source and should perform laboratory testing of import soil to evaluate its suitability prior to its arrival at the site for use as fill material.

8.4 Earthwork Grading Factors

8.4.1 Estimates of shrinkage factors are based on empirical judgments comparing the material in its existing or natural state as encountered in the exploratory excavations to a compacted state. Variations in natural soil density and in compacted fill density render shrinkage value estimates very approximate. As an example, the contractor can compact the fill to a dry density of 95 percent or higher of the laboratory maximum dry density. Thus, the contractor has an approximately 10 percent range of control over the fill volume. Based on our experience with similar site soils, the shrinkage of the undocumented fill and upper portion of the alluvium is expected to be 5 to 10 percent when compacted to at least 95 percent of the laboratory maximum dry density. This estimate is for preliminary quantity estimates only. Due to the variations in the actual shrinkage/bulking factors, a balance area should be provided to accommodate variations.

8.5 Utility Trench Backfill

8.5.1 Utility trenches should be properly backfilled in accordance with the requirements of the City of Eastvale and the latest edition of the *Standard Specifications for Public Works Construction* (Greenbook). The pipes should be bedded with well graded crushed rock or clean sands (Sand Equivalent greater than 30) to a depth of at least one foot over the pipe. The bedding material must be inspected and approved in writing by the Geotechnical Engineer (a representative of Geocon). <u>The use of well graded crushed rock is only</u>

acceptable if used in conjunction with filter fabric to prevent the gravel from having direct contact with soil. The remainder of the trench backfill may be derived from onsite soil or approved import soil, compacted as necessary, until the required compaction is obtained. Backfill of utility trenches should not contain rocks greater than 3 inches in diameter. The use of 2-sack slurry and controlled low strength material (CLSM) are also acceptable as backfill. However, consideration should be given to the possibility of differential settlement where the slurry ends and earthen backfill begins. These transitions should be minimized, and additional stabilization should be considered at these transitions.

8.5.2 Utility trench backfill should be placed in layers no thicker than will allow for adequate bonding and compaction. Utility backfill should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density and moisture conditioned at 0 to 2 percent above optimum moisture content as determined by ASTM D 1557. Backfill materials placed below the recommended moisture content may require additional moisture conditioning prior to placing additional fill.

8.6 Seismic Design Criteria

8.6.1 We used the computer program *U.S. Seismic Design Maps*, provided by the California Office of Statewide Health Planning and Development (OSHPD) to evaluate the seismic design criteria. Table 8.6.1 summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The building structure and improvements as currently proposed should be designed using a Site Class D in accordance with ASCE 7-10 Section 20.3.1. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10 using blow count data presented on the boring logs in *Appendix A*. The values presented in Table 8.6.1 are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 8.6.1
2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Section 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	1.500g	Figure 1613.3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.600g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.0	Table 1613.3.3(1)
Site Coefficient, F_V	1.5	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.500g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.900g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.000g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.600g	Section 1613.3.4 (Eqn 16-40)

8.6.2 Table 8.6.2 presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10.

TABLE 8.6.2
2016 CBC SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.500	Figure 22-7
Site Coefficient, F_{PGA}	1.0	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.500g	Section 11.8.3 (Eqn 11.8-1)

8.6.3 The Maximum Considered Earthquake Ground Motion (MCE) is the level of ground motion that has a 2 percent chance of exceedance in 50 years, with a statistical return period of 2,475 years. According to the 2016 California Building Code and ASCE 7-10, the MCE is to be utilized for the evaluation of liquefaction, lateral spread, and seismic settlements. We understand the intent of the building code is to maintain "Life Safety" during an MCE event.

8.6.4 Deaggregation of the MCE peak ground acceleration was performed using the online *Unified Hazard Tool* (USGS, 2018b) provided by the USGS. The result of the deaggregation analysis indicates that the predominant earthquake contributing to the MCE peak ground acceleration is characterized as a 6.7 magnitude event occurring at a hypocentral distance of 17.3 kilometers from the site

8.6.5 Conformance to the criteria in the above tables for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

8.7 Foundation and Concrete Slabs-On-Grade

8.7.1 The foundation recommendations presented herein are for the proposed buildings subsequent to the recommended grading assuming that the buildings are founded in soils with a low expansion potential. If soils with a medium or high expansion potential are placed within 4 feet of finish grade, then Geocon should be contacted for additional recommendations. We understand that future buildings will be supported on conventional shallow foundations with a concrete slab-on-grade deriving support in newly placed engineered fill.

8.7.2 Foundations for the structures may consist of either continuous strip footings and/or isolated spread footings. Conventionally reinforced continuous footings should be at least 18 inches wide and extend at least 18 inches below lowest adjacent pad grade. Isolated spread footings should have a minimum width of 24 inches and should extend at least 18 inches below lowest adjacent pad grade. A wall/column footing dimension detail depicting footing embedment is provided on Figure 6.

8.7.3 From a geotechnical engineering standpoint, concrete slabs-on-grade for the structure should be at least 5 inches thick and be reinforced with No. 4 steel reinforcing bars placed 18 inches on center in both directions. The concrete slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slab for supporting equipment and storage loads. A thicker concrete slab may be required for heavier loading conditions. To reduce the effects of differential settlement on the foundation system, thickened slabs and/or an increase in steel reinforcement can provide a benefit to reduce concrete cracking

8.7.4 Following remedial grading, foundations for the buildings may be designed for an allowable soil bearing pressure of 3,000 pounds per square foot (psf) (dead plus live load). The allowable bearing pressure may be increased by one-third for transient loads due to wind or seismic forces.

8.7.5 The maximum expected static settlement for the planned structures supported on conventional foundation systems with the above allowable bearing pressures and deriving support in engineered fill is estimated to be 1 inch and to occur below the heaviest loaded structural element.

8.7.6 Settlement of the foundation system is expected to occur on initial application of loading. Differential settlement is not expected to exceed ½ inch over a horizontal distance of 40 feet.

8.7.7 Once the design and foundation loading configuration proceeds to a more finalized plan, the estimated settlements within this report should be reviewed and revised, if necessary.

8.7.8 Steel reinforcement for continuous footings should consist of at least four No. 4 steel reinforcing bars placed horizontally in the footings, two near the top and two near the bottom. Steel reinforcement for the spread footings should be designed by the project structural engineer.

8.7.9 Foundations near slopes should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

8.7.10 Foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer, prior to placing fill, steel, gravel or concrete.

8.7.11 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials (ACI 302.2R-06). The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity-controlled environment.

8.7.12 The bedding sand thickness should be evaluated by the project foundation engineer, architect, and/or developer. However, we should be contacted to provide recommendations if the bedding sand is thicker than 4 inches. Placement of 3 inches and 4 inches of sand is common practice in southern California for 5-inch and 4-inch thick slabs, respectively. The foundation engineer should provide appropriate concrete mix design criteria and curing measures that may be utilized to assure proper curing of the slab to reduce the potential for rapid moisture loss and subsequent cracking and/or slab curl.

8.7.13 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in such concrete placement.

8.7.14 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular where re-entrant slab corners occur.

8.7.15 Geocon should be consulted to provide additional design parameters as required by the structural engineer.

8.8 Exterior Concrete Flatwork

8.8.1 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations herein assuming the subgrade materials possess an Expansion Index of 50 or less. Subgrade soils should be compacted to 95 percent relative compaction. Slab panels should be a minimum of 4 inches thick and when in excess of 8 feet square should be reinforced with No. 3 reinforcing bars spaced 18 inches center-to-center in both directions to reduce the potential for cracking. In addition, concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing.

8.8.2 Even with the incorporation of the recommendations of this report, the exterior concrete flatwork has a potential to experience some uplift due to expansive soil beneath grade or differential settlement. The steel reinforcement should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork.

8.8.3 Where exterior flatwork abuts the structure at entrant or exit points, the exterior slab should be dowelled into the structure's foundation stem wall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

8.8.4 The recommendations presented herein are intended to reduce the potential for cracking of exterior slabs as a result of differential movement. However, even with the incorporation of the recommendations presented herein, slabs-on-grade will still crack. The occurrence of concrete shrinkage cracks is independent of the soil supporting characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, the use of crack control joints and proper concrete placement and curing. Crack control joints should be spaced at intervals no greater than 12 feet. Literature provided by the Portland Concrete Association (PCA) and American Concrete Institute (ACI) present recommendations for proper concrete mix, construction, and curing practices, and should be incorporated into project construction.

8.9 Conventional Retaining Walls

8.9.1 The recommendations presented herein are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 10 feet. In the event that walls higher than 10 feet or other types of walls are planned, Geocon should be consulted for additional recommendations.

8.9.2 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at no steeper than 2:1 (horizontal to vertical), an active soil pressure of 60 pcf is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an EI of 50 or less. For walls where backfill materials do not conform to the criteria herein, Geocon should be consulted for additional recommendations.

8.9.3 Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall in feet) at the top of the wall. Where walls are restrained from movement at the top, the walls should be designed for a soil pressure equivalent to the pressure exerted by a fluid density of 55 pcf.

8.9.4 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the CBC. If the project possesses a seismic design category of D, E, or F, proposed retaining walls in excess of 6 feet in height should be designed with seismic lateral pressure (Section 1803.5.12 of the 2016 CBC).

8.9.5 A seismic load of 10 pcf should be used for design of walls that support more than 6 feet of backfill in accordance with Section 1803.5.12 of the 2016 CBC. The seismic load is applied as an equivalent fluid pressure along the height of the wall and the calculated loads result in a maximum load exerted at the base of the wall and zero at the top of the wall. This seismic load should be applied in addition to the active earth pressure. The earth pressure is based on half of two-thirds of PGA_M calculated from ASCE 7-10 Section 11.8.3.

8.9.6 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The retaining walls and improvements above the retaining walls should be designed to incorporate an appropriate amount of lateral deflection as determined by the structural engineer.

8.9.7 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and waterproofed as required by the project architect. The soil immediately adjacent to the backfilled retaining wall should be composed of free draining material completely wrapped in Mirafi 140N (or equivalent) filter fabric for a lateral distance of 1 foot for the bottom two-thirds of the height of the retaining wall. The upper one-third should be backfilled with less permeable compacted fill to reduce water infiltration. Alternatively, a drainage panel, such as a Miradrain 6000 or equivalent, can be placed along the back of the wall. Typical retaining wall drainage details are shown on Figure 7. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted backfill (EI of 50 or less) with no hydrostatic forces or imposed surcharge load. If conditions different than those described are expected or if specific drainage details are desired, Geocon should be contacted for additional recommendations.

8.9.8 Wall foundations should be designed in accordance with the above foundation recommendations.

8.10 Lateral Design

8.10.1 Resistance to lateral loading may be provided by friction acting at the base of foundations, slabs and by passive earth pressure. A passive pressure exerted by an equivalent fluid weight of 325 pounds per cubic foot (pcf) with a maximum earth pressure of 3,250 psf should be used for the design of footings or shear keys poured neat against newly compacted fill. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

8.10.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between newly compacted fill soil and concrete of 0.35 should be used for design. When combining passive pressure and friction for lateral resistance, the passive component should be reduced by one-third.

8.11 Pavement Design

8.11.1 The final pavement design should be based on R-value testing of soils at the subgrade following grading at the site. Streets should be designed in accordance with the city of Eastvale and Riverside County *Standard Drawings and Specifications* when final Traffic Indices and R-Value test results of subgrade soil are completed. Roadway classifications and traffic indices are based on Riverside County Standard No. 114. The civil engineer should evaluate the final traffic index for the pavements. Laboratory testing indicated that the site soils possess an R-value of 55 and 70. For the preliminary analysis, we have used an R-value of 50, the maximum allowed by Caltrans. Preliminary flexible pavement sections are presented in Table 8.11.1. We have included TI's for areas within the industrial business park as well as Limonite Avenue. Geocon should be contacted for additional recommendations if other traffic loading is appropriate for the roadways.

TABLE 8.11.1
PRELIMINARY FLEXIBLE PAVEMENT SECTIONS

Road Classification/Use	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete (inches)	Aggregate Base (inches)
Local Street/Parking Areas/Light Duty Vehicles	5.5	50	3.5	6.0
Enhanced Local Street/Moderate Traffic	6.5	50	4.0	6.0
Industrial Collector/Heavy Truck Areas	8.0	50	5.0	6.0
Major Highway	9.0	50	5.5	6.5
Arterial Highway	9.5	50	6.0	7.0

8.11.2 The upper 12 inches of the subgrade soil should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content beneath pavement sections.

8.11.3 The crushed aggregated base and asphalt concrete materials should conform to Section 200-2.2 and Section 203-6, respectively, of the Greenbook and the County of Riverside Standard Drawings and Specifications. Base materials should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content. Asphalt concrete should be compacted to a density of 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

8.11.4 Where prefabricated concrete pavers (80 mm thick) will be used in site roadways and parking areas, it is acceptable from a geotechnical standpoint to construct the pavers over 1 inch of sand underlain by a properly prepared subgrade and aggregate base per the following table. The aggregate base should be compacted to at least 95 percent relative compaction as evaluated by ASTM D 1557 (latest edition). Pavers should be constructed in accordance with the manufacture's guidelines.

TABLE 8.11.4
PAVER DESIGN SECTIONS

Road Classification/Use	Estimated Traffic Index (TI)	Prefabricated Concrete Paver (inches)	Class 2 Aggregate Base (inches)
Local Street/Parking Areas/Light Duty Vehicles	5.5	3⅛	6

8.11.5 Where concrete pavers will be placed in pedestrian walkway areas, and will not be subject to vehicle loading, the inclusion of a 4-inch thick layer of base over properly compacted subgrade underlying the pavers is acceptable from a geotechnical standpoint.

8.11.6 Where different pavement sections are to be constructed adjacent to each other, we recommend that consideration be given to the use of deepened base sections to maintain a uniform base thickness and avoid stepped cuts for placement of base material. This condition is expected to occur across the transition across the areas of asphalt paving and prefabricated pavers.

8.11.7 A rigid Portland cement concrete (PCC) pavement section should be placed in driveway aprons and cross gutters. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330R Guide for Design and Construction of Concrete Parking Lots using the parameters presented in Table 8.11.7.

TABLE 8.11.7
RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of subgrade reaction, k	150 pci
Modulus of rupture for concrete, M_R	550 psi
Traffic Category, TC	A, B, C and D
Average daily truck traffic, ADTT	10, 25, 100 and 700

8.11.8 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in Table 8.11.8.

TABLE 8.11.8
RIGID PAVEMENT RECOMMENDATIONS

Location	Portland Cement Concrete (inches)
Car Parking Areas and Access Lanes (TC=A)	5.0
Entrance and Service Lanes (TC=B)	6.0
Moderate Truck Traffic (TC=C)	6.5
Bus Stops and Heavy Truck Traffic (TC=D)	7.5

8.11.9 The PCC pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content. This pavement section is based on a minimum concrete compressive strength of approximately 3,000 psi (pounds per square inch). Base material will not be required beneath concrete improvements.

8.11.10 A thickened edge or integral curb should be constructed on the outside of concrete slabs subjected to wheel loads. The thickened edge should be 1.2 times the slab thickness or a minimum thickness of 2 inches, whichever results in a thicker edge, and taper back to the recommended slab thickness 4 feet behind the face of the slab (e.g., a 9-inch-thick slab would have an 11-inch-thick edge). Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

8.11.11 In order to control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab in accordance with the referenced ACI report.

8.11.12 Performance of the pavements is highly dependent on providing positive surface drainage away from the edge of the pavement. Ponding of water on or adjacent to the pavement surfaces will likely result in pavement distress and subgrade failure. Drainage from landscaped areas should be directed to controlled drainage structures. Landscape areas adjacent to the edge of asphalt pavements are not recommended due to the potential for surface or irrigation water to infiltrate the underlying permeable aggregate base and cause distress. Where such a condition cannot be avoided, consideration should be given to incorporating measures that will significantly reduce the potential for subsurface water migration into the aggregate base. If planter islands are planned, the perimeter curb should extend at least 6 inches below the level of the base materials.

8.12 Temporary Excavations

8.12.1 Excavations on the order of 5 to 15 feet in vertical height are expected during grading operations and utility installation. The contractor's competent person should evaluate the necessity for lay back of vertical cut areas. Vertical excavations up to 5 feet may be attempted where loose soils or caving sands are not present, and where not surcharged by existing structures or vehicle/construction equipment loads.

8.12.2 Vertical excavations greater than 5 feet will require sloping measures in order to provide a stable excavation. We expect that sufficient space is available to complete the majority of the required earthwork for this project using sloping measures. If necessary, compound excavation, slot-cutting, and or shoring recommendations will be provided in an addendum.

8.12.3 Where sufficient space is available, temporary unsurcharged embankments may be sloped back at a uniform 1.5:1 (h:v) slope gradient or flatter. A uniform slope does not have a vertical portion.

8.12.4 Where sloped embankments are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction embankments are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. The contractor's personnel should inspect the soil exposed in the cut slopes during excavation so that modifications of the slopes can be made if variations in the soil conditions occur. Excavations should be stabilized within 30 days of initial excavation.

8.13 Site Drainage and Moisture Protection

8.13.1 Proper site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2016 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

8.13.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

8.13.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend that area drains be used to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes. In addition, where landscaping is planned adjacent to the pavement, we recommend construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material.

8.13.4 If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to infiltration areas. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeology study at the site. Down-gradient and adjacent structures may be subjected to seeps, movement of foundations and slabs, or other impacts as a result of water infiltration.

8.14 Plan Review

8.14.1 Geocon should be provided the opportunity to review the grading and structural/foundation plans for the project prior to final submittal, to verify that the plans have been prepared in substantial conformance with the recommendations of this report. Additional analyses may be required after review of the project plans.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous materials was not part of the scope of services provided by Geocon.

2. This report is issued with the understanding that it is the responsibility of the owner, or of their representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

4. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

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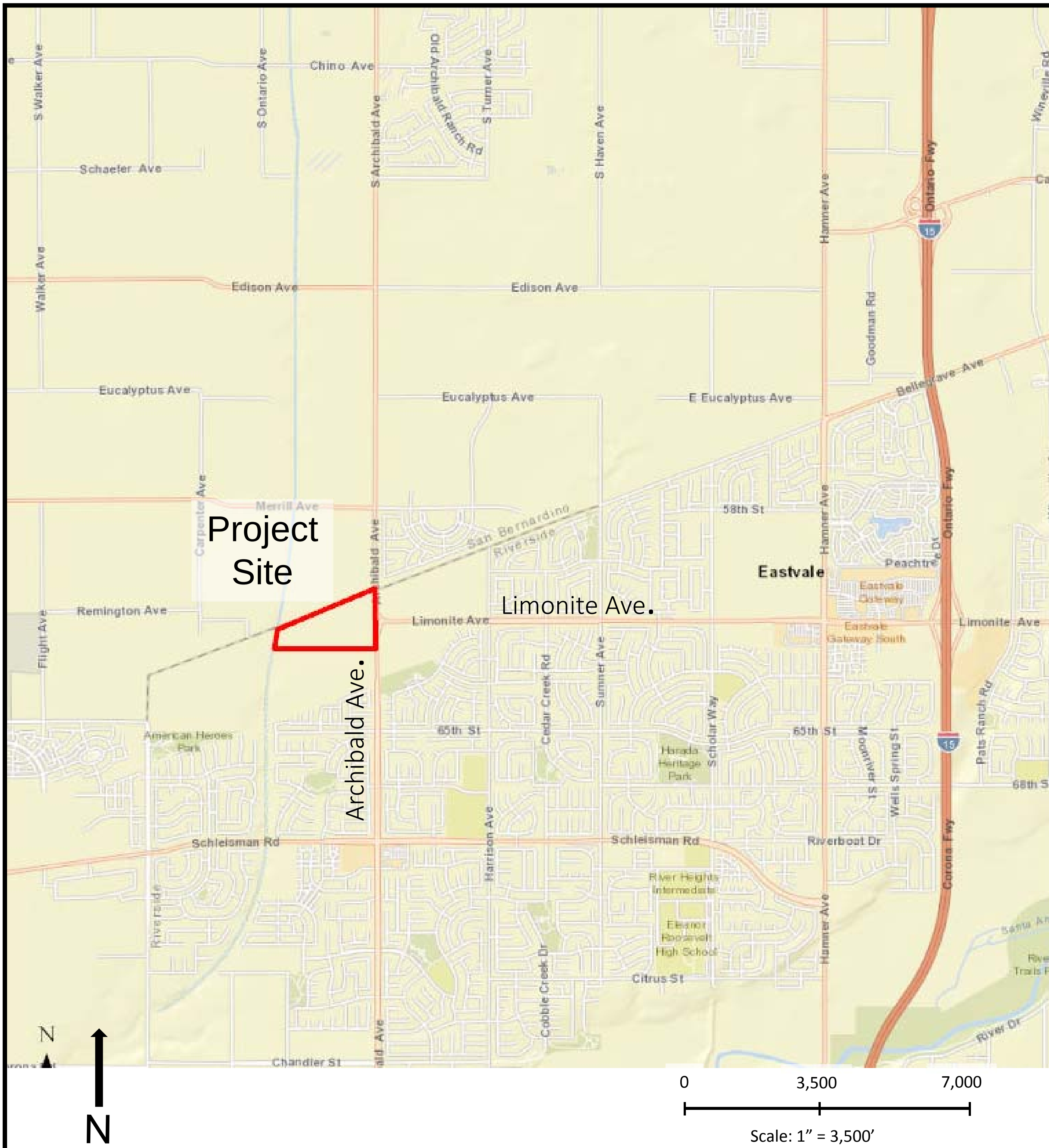

VICINITY MAP

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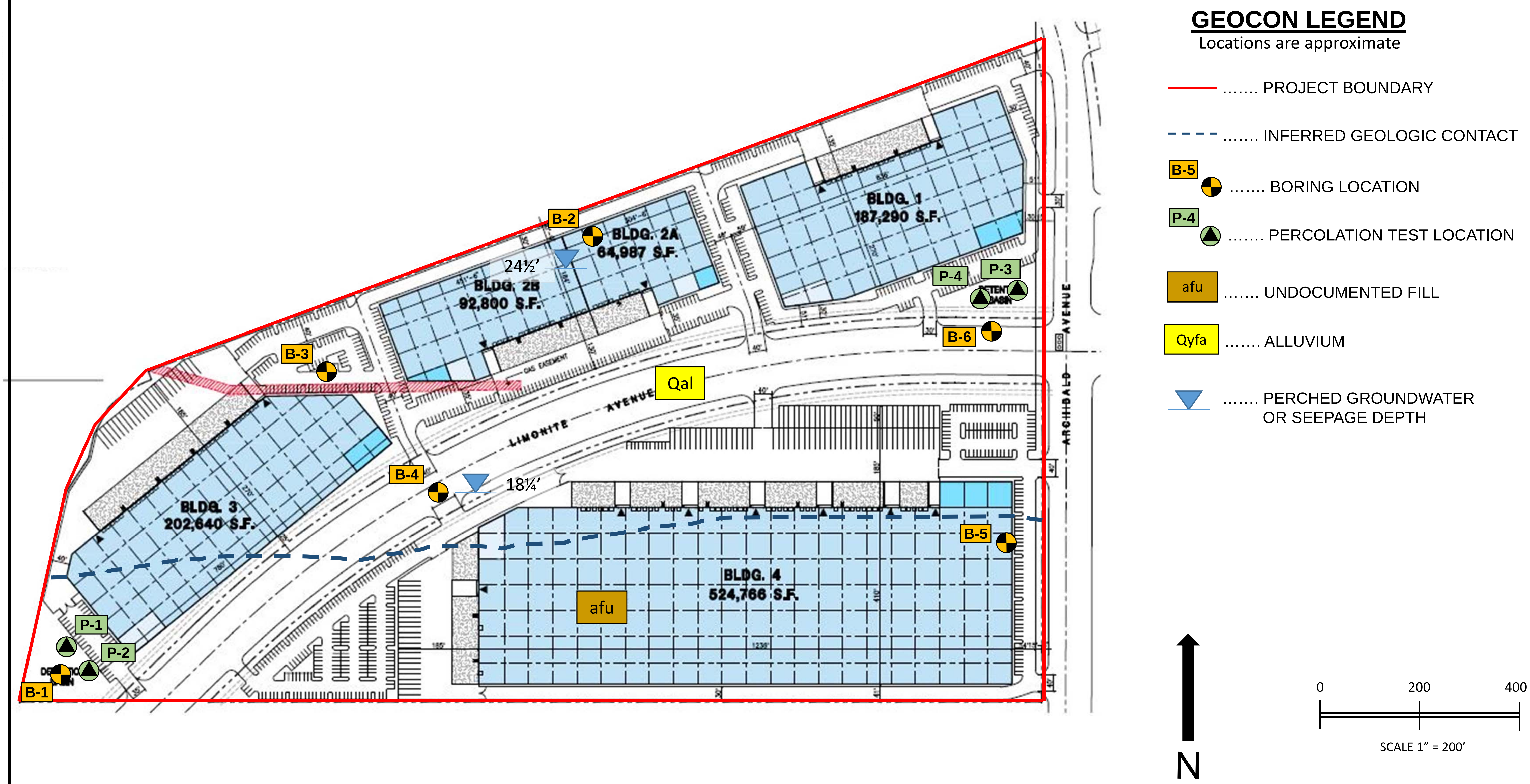
THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

DF			APRIL, 2019	PROJECT NO. T2857-22-01	FIG. 1



SOURCE: HPA ARCHITECTURE, *CONCEPTUAL SITE PLAN, SCHEME 4 – PHASE 2*, DATED JUNE 21, 2018.

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GEOLOGIC MAP

THE HOMESTEAD BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

DF			APRIL, 2019	PROJECT NO. T2857-22-01	FIG. 2

GEOCON LEGEND

Locations are approximate

……. PROJECT BOUNDARY

N

0 200 400

SCALE 1" = 200'

SOURCE: GOOGLE EARTH PRO IMAGERY, DATED MARCH, 2017.

GEOCON WEST, INC.

GEOTECHNICAL ENVIRONMENTAL MATERIALS
41571 CORNING PLACE, SUITE 101, MURRIETA, CA 92562-7065
PHONE 951-304-2300 FAX 951-304-2392

DF

AERIAL PHOTOGRAPH

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG. 3

GEOCON

Project : The Homestead
File No. : T2857-22-01
Boring : B-2 & B-5

LIQUEFACTION SETTLEMENT ANALYSIS
MAXIMUM CONSIDERED EARTHQUAKE

(SATURATED SAND AT INITIAL LIQUEFACTION CONDITION)

NCEER (1996) METHOD
EARTHQUAKE INFORMATION:

Earthquake Magnitude:	6.73
PGA_M (g):	0.500
Calculated Mag.Wtg.Factor:	0.762
Historic High Groundwater:	18.0
Groundwater @ Exploration:	24.0

DEPTH TO BASE	BLOW COUNT N	WET DENSITY (PCF)	TOTAL STRESS O (TSF)	EFFECT STRESS O' (TSF)	REL. DEN. Dr (%)	ADJUST BLOWS (N1)60	Tav/σ'o	LIQUEFACTION SAFETY FACTOR	Volumetric Strain [e_{15}} (%)	EQ. SETTLE. Pe (in.)
1	13	127	0.032	0.032	82	39	0.325	--	0.00	0.00
2	13	127	0.095	0.095	82	39	0.325	--	0.00	0.00
3	13	127	0.159	0.159	82	39	0.325	--	0.00	0.00
4	13	127	0.222	0.222	82	39	0.325	--	0.00	0.00
5	13	127	0.286	0.286	82	38	0.325	--	0.00	0.00
6	24	127	0.349	0.349	106	60	0.325	--	0.00	0.00
7	24	127	0.413	0.413	106	55	0.325	--	0.00	0.00
8	18	127	0.476	0.476	86	41	0.325	--	0.00	0.00
9	18	127	0.540	0.540	86	39	0.325	--	0.00	0.00
10	18	127	0.603	0.603	86	38	0.325	--	0.00	0.00
11	11	130	0.668	0.668	64	25	0.325	--	0.00	0.00
12	11	130	0.733	0.733	64	24	0.325	--	0.00	0.00
13	11	130	0.798	0.798	64	23	0.325	--	0.00	0.00
14	11	130	0.863	0.863	64	23	0.325	--	0.00	0.00
15	36	130	0.928	0.928	106	60	0.325	--	0.00	0.00
16	36	130	0.993	0.993	106	58	0.325	--	0.00	0.00
17	36	130	1.058	1.058	106	57	0.325	--	0.00	0.00
18	36	130	1.123	1.107	106	55	0.330	Non-Liq.	0.00	0.00
19	22	130	1.188	1.141	78	38	0.338	Non-Liq.	0.00	0.00
20	22	130	1.253	1.175	78	37	0.347	Non-Liq.	0.00	0.00
21	22	130	1.318	1.208	78	36	0.354	Non-Liq.	0.00	0.00
22	22	130	1.383	1.242	78	35	0.362	Non-Liq.	0.00	0.00
23	22	130	1.448	1.276	78	35	0.369	Non-Liq.	0.00	0.00
24	22	130	1.513	1.310	78	34	0.375	Non-Liq.	0.00	0.00
25	22	130	1.578	1.344	78	34	0.382	Non-Liq.	0.00	0.00
26	38	130	1.643	1.377	99	53	0.388	Non-Liq.	0.00	0.00
27	38	130	1.708	1.411	99	52	0.393	Non-Liq.	0.00	0.00
28	38	130	1.773	1.445	99	52	0.399	Non-Liq.	0.00	0.00
29	38	130	1.838	1.479	99	51	0.404	Non-Liq.	0.00	0.00
30	19	130	1.903	1.513	68	33	0.409	Non-Liq.	0.00	0.00
31	19	130	1.968	1.546	68	32	0.414	Non-Liq.	0.00	0.00
32	19	130	2.033	1.580	68	32	0.418	Non-Liq.	0.00	0.00
33	19	130	2.098	1.614	68	32	0.422	Non-Liq.	0.00	0.00
34	19	130	2.163	1.648	68	32	0.427	Non-Liq.	0.00	0.00
35	19	130	2.228	1.682	68	31	0.431	Non-Liq.	0.00	0.00
36	19	130	2.293	1.715	65	31	0.434	Non-Liq.	0.00	0.00
37	19	130	2.358	1.749	65	31	0.438	Non-Liq.	0.00	0.00
38	19	130	2.423	1.783	65	31	0.442	Non-Liq.	0.00	0.00
39	19	130	2.488	1.817	65	31	0.445	Non-Liq.	0.00	0.00
40	19	130	2.553	1.851	65	30	0.448	Non-Liq.	0.00	0.00
41	45	130	2.618	1.884	98	62	0.451	Non-Liq.	0.00	0.00
42	45	130	2.683	1.918	98	62	0.455	Non-Liq.	0.00	0.00
43	45	130	2.748	1.952	98	61	0.457	Non-Liq.	0.00	0.00
44	45	130	2.813	1.986	98	61	0.460	Non-Liq.	0.00	0.00
45	45	130	2.878	2.020	98	60	0.463	Non-Liq.	0.00	0.00
46	24	130	2.943	2.053	69	35	0.466	Non-Liq.	0.00	0.00
47	24	130	3.008	2.087	69	35	0.468	Non-Liq.	0.00	0.00
48	24	130	3.073	2.121	69	35	0.471	Non-Liq.	0.00	0.00
49	66	130	3.138	2.155	112	82	0.473	Non-Liq.	0.00	0.00
50	66	130	3.203	2.189	112	81	0.476	Non-Liq.	0.00	0.00

TOTAL SETTLEMENT = 0.0 INCHES

GEOCON

Project : The Homestead
File No. : T2857-22-01
Boring : B-2 & B-5

TECHNICAL ENGINEERING AND DESIGN GUIDES AS ADAPTED FROM THE US ARMY CORPS OF ENGINEERS, NO. 9
EVALUATION OF EARTHQUAKE-INDUCED SETTLEMENTS IN DRY SANDY SOILS
MAXIMUM CONSIDERED EARTHQUAKE

MCE EARTHQUAKE INFORMATION:

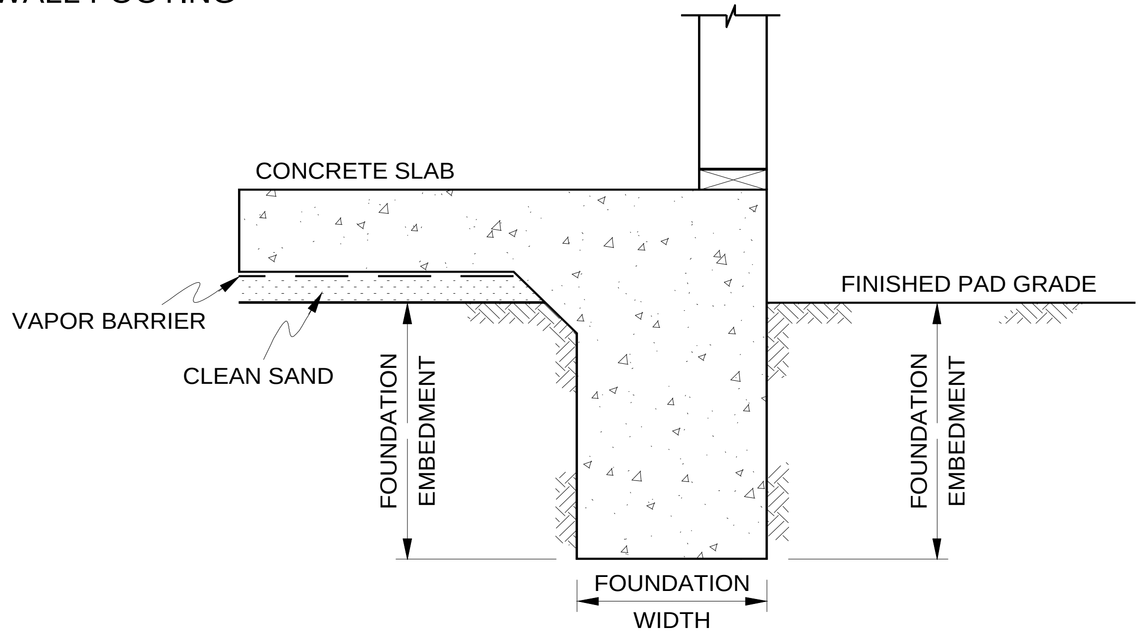
Earthquake Magnitude:	6.73
Peak Horiz. Acceleration (g):	0.500

Depth of Base of Strata (ft)	Thickness of Layer (ft)	Depth of Mid-point of Layer (ft)	Soil Unit Weight (pcf)	Overburden Pressure at Mid-point (tsf)	Mean Effective Pressure at Mid-point (tsf)	Average Cyclic Shear Stress [Tav]	Field SPT [N]	Correction Factor [Cer]	Relative Density [Dr] (%)	Correction Factor [Cn]	Corrected [N1]60	rd Factor	Maximum Shear Mod. [Gmax] (tsf)	[yeff]*[Geff] [Gmax]	yeff Shear Strain	[yeff]*100%	Volumetric Strain M7.5 [E15} (%)	Number of Strain Cycles [Nc]	Corrected Vol. Strains [Ec]	Estimated Settlement [S] (inches)
1.0	1.0	0.5	127.0	0.03	0.02	0.010	13	1.25	82.3	2.0	39.5	1.0	221.977	4.60E-05	6.00E-05	0.006	2.65E-03	8.8404	2.09E-03	0.001
2.0	1.0	1.5	127.0	0.10	0.06	0.031	13	1.25	82.3	2.0	39.5	1.0	384.476	7.82E-05	1.40E-04	0.014	6.19E-03	8.8404	4.88E-03	0.001
3.0	1.0	2.5	127.0	0.16	0.11	0.052	13	1.25	82.3	2.0	39.5	1.0	496.357	9.89E-05	1.60E-04	0.016	7.08E-03	8.8404	5.58E-03	0.001
4.0	1.0	3.5	127.0	0.22	0.15	0.072	13	1.25	82.3	2.0	39.5	1.0	587.297	1.15E-04	1.70E-04	0.017	7.52E-03	8.8404	5.93E-03	0.001
5.0	1.0	4.5	127.0	0.29	0.19	0.093	13	1.25	82.3	1.9	38.0	1.0	657.447	1.29E-04	1.70E-04	0.017	7.87E-03	8.8404	6.21E-03	0.001
6.0	1.0	5.5	127.0	0.35	0.23	0.113	24	1.25	106.2	1.7	59.5	1.0	844.230	1.21E-04	1.50E-04	0.015	4.05E-03	8.8404	3.19E-03	0.001
7.0	1.0	6.5	127.0	0.41	0.28	0.134	24	1.25	106.2	1.6	55.2	1.0	895.107	1.32E-04	1.50E-04	0.015	4.43E-03	8.8404	3.50E-03	0.001
8.0	1.0	7.5	127.0	0.48	0.32	0.154	18	1.25	85.8	1.5	41.5	1.0	874.055	1.53E-04	1.50E-04	0.015	6.25E-03	8.8404	4.93E-03	0.001
9.0	1.0	8.5	127.0	0.54	0.36	0.174	18	1.25	85.8	1.4	39.4	1.0	914.592	1.63E-04	1.50E-04	0.015	6.65E-03	8.8404	5.24E-03	0.001
10.0	1.0	9.5	127.0	0.60	0.40	0.194	18	1.25	85.8	1.3	37.6	1.0	952.341	1.72E-04	1.50E-04	0.015	7.02E-03	8.8404	5.54E-03	0.001
11.0	1.0	10.5	130.0	0.67	0.45	0.215	11	1.25	64.4	1.3	24.8	1.0	871.716	2.04E-04	4.50E-04	0.045	3.48E-02	8.8404	2.74E-02	0.007
12.0	1.0	11.5	130.0	0.73	0.49	0.235	11	1.25	64.4	1.2	24.0	0.9	903.146	2.12E-04	4.50E-04	0.045	3.62E-02	8.8404	2.85E-02	0.007
13.0	1.0	12.5	130.0	0.80	0.53	0.255	11	1.25	64.4	1.1	23.3	0.9	933.015	2.19E-04	3.70E-04	0.037	3.08E-02	8.8404	2.43E-02	0.006
14.0	1.0	13.5	130.0	0.86	0.58	0.275	11	1.25	64.4	1.1	22.7	0.9	961.523	2.26E-04	3.70E-04	0.037	3.19E-02	8.8404	2.51E-02	0.006
15.0	1.0	14.5	130.0	0.93	0.62	0.295	36	1.25	106.2	1.1	60.1	0.9	1380.551	1.67E-04	1.60E-04	0.016	4.27E-03	8.8404	3.37E-03	0.001
16.0	1.0	15.5	130.0	0.99	0.66	0.315	36	1.25	106.2	1.0	58.4	0.9	1413.961	1.71E-04	1.60E-04	0.016	4.43E-03	8.8404	3.49E-03	0.001
17.0	1.0	16.5	130.0	1.06	0.71	0.335	36	1.25	106.2	1.0	56.8	0.9	1446.036	1.75E-04	1.60E-04	0.016	4.58E-03	8.8404	3.61E-03	0.001
18.0	1.0	17.5	130.0	1.12	0.75	0.354	36	1.25	106.2	1.0	55.3	0.9	1476.909	1.79E-04	1.60E-04	0.016	4.72E-03	8.8404	3.72E-03	0.001
19.0	1.0	18.5	130.0	1.19	0.80	0.373	22	1.25	78.2	0.9	37.7	0.9	1336.683	2.06E-04	3.70E-04	0.037	1.73E-02	8.8404	1.36E-02	0.000
20.0	1.0	19.5	130.0	1.25	0.84	0.392	22	1.25	78.2	0.9	36.8	0.9	1362.533	2.09E-04	3.70E-04	0.037	1.78E-02	8.8404	1.40E-02	0.000
21.0	1.0	20.5	130.0	1.32	0.88	0.411	22	1.25	78.2	0.9	36.1	0.9	1387.578	2.13E-04	3.70E-04	0.037	1.82E-02	8.8404	1.44E-02	0.000
22.0	1.0	21.5	130.0	1.38	0.93	0.429	22	1.25	78.2	0.9	35.3	0.9	1411.882	2.16E-04	3.70E-04	0.037	1.87E-02	8.8404	1.47E-02	0.000
23.0	1.0	22.5	130.0	1.45	0.97	0.448	22	1.25	78.2	0.8	34.7	0.9	1435.501	2.18E-04	3.70E-04	0.037	1.91E-02	8.8404	1.51E-02	0.000
24.0	1.0	23.5	130.0	1.51	1.01	0.466	22	1.25	78.2	0.8	34.2	0.9	1460.577	2.21E-04	3.00E-04	0.030	1.58E-02	8.8404	1.24E-02	0.000
25.0	1.0	24.5	130.0	1.58	1.06	0.484	22	1.25	78.2	0.8	33.9	0.9	1487.038	2.22E-04	3.00E-04	0.030	1.59E-02	8.8404	1.26E-02	0.000
26.0	1.0	25.5	130.0	1.64	1.10	0.501	38	1.25	99.0	0.8	52.8	0.9	1759.034	1.93E-04	1.30E-04	0.013	4.06E-03	8.8404	3.20E-03	0.000
27.0	1.0	26.5	130.0	1.71	1.14	0.519	38	1.25	99.0	0.8	52.2	0.9	1787.323	1.94E-04	1.30E-04	0.013	4.11E-03	8.8404	3.24E-03	0.000
28.0	1.0	27.5	130.0	1.77	1.19	0.536	38	1.25	99.0	0.8	51.7	0.9	1814.883	1.95E-04	1.30E-04	0.013	4.16E-03	8.8404	3.28E-03	0.000
29.0	1.0	28.5	130.0	1.84	1.23	0.552	38	1.25	99.0	0.8	51.2	0.9	1841.758	1.96E-04	1.30E-04	0.013	4.21E-03	8.8404	3.32E-03	0.000
30.0	1.0	29.5	130.0	1.90	1.27	0.569	19	1.25	67.6	0.8	32.7	0.9	1613.605	2.28E-04	3.00E-04	0.030	1.66E-02	8.8404	1.31E-02	0.000
31.0	1.0	30.5	130.0	1.97	1.32	0.585	19	1.25	67.6	0.8	32.4	0.9	1636.716	2.29E-04	3.00E-04	0.030	1.68E-02	8.8404	1.32E-02	0.000
32.0	1.0	31.5	130.0	2.03	1.36	0.601	19	1.25	67.6	0.8	32.2	0.9	1659.344	2.30E-04	3.00E-04	0.030	1.69E-02	8.8404	1.34E-02	0.000
33.0	1.0	32.5	130.0	2.10	1.41	0.617	19	1.25	67.6	0.8	32.0	0.9	1681.513	2.31E-04	3.00E-04	0.030	1.71E-02	8.8404	1.35E-02	0.000
34.0	1.0	33.5	130.0	2.16	1.45	0.632	19	1.25	67.6	0.8	31.7	0.8	1703.246	2.32E-04	3.00E-04	0.030	1.72E-02	8.8404	1.36E-02	0.000
35.0	1.0	34.5	130.0	2.23	1.49	0.647	19	1.25	67.6	0.7	31.5	0.8	1724.565	2.32E-04	3.00E-04	0.030	1.74E-02	8.8404	1.37E-02	0.000
36.0	1.0	35.5	130.0	2.29	1.54	0.662	19	1.25	65.4	0.7	31.3	0.8	1745.489	2.32E-04	3.00E-04	0.030	1.75E-02	8.8404	1.38E-02	0.000
37.0	1.0	36.5	130.0	2.36	1.58	0.676	19	1.25	65.4	0.7	31.1	0.8	1766.038	2.33E-04	3.00E-04	0.030	1.77E-02	8.8404	1.39E-02	0.000
38.0	1.0	37.5	130.0	2.42	1.62	0.690	19	1.25	65.4	0.7	30.9	0.8	1786.227	2.33E-04	3.00E-04	0.030	1.78E-02	8.8404	1.41E-02	0.000
39.0	1.0	38.5	130.0	2.49	1.67	0.704	19	1.25	65.4	0.7	30.7	0.8	1806.072	2.33E-04	3.00E-04	0.030	1.80E-02	8.8404	1.42E-02	0.000
40.0	1.0	39.5	130.0	2.55	1.71	0.718	19	1.25	65.4	0.7	30.5	0.8	1825.589	2.34E-04	3.00E-04	0.030	1.81E-02	8.8404	1.43E-02	0.000
41.0	1.0	40.5	130.0	2.62	1.75	0.731	45	1.25	97.7	0.7	62.1	0.8	2344.243	1.84E-04	1.30E-04	0.013	3.34E-03	8.8404	2.63E-03	0.000
42.0	1.0	41.5	130.0	2.68	1.80	0.744	45	1.25	97.7	0.7	61.7	0.8	2367.501	1.84E-04	1.30E-04	0.013	3.37E-03	8.8404	2.65E-03	0.000
43.0	1.0	42.5	130.0	2.75	1.84	0.756	45	1.25	97.7	0.7	61.2	0.8	2390.383	1.84E-04	1.30E-04	0.013	3.39E-03	8.8404	2.68E-03	0.000
44.0	1.0	43.5	130.0	2.81	1.88	0.769	45	1.25	97.7	0.7	60.8	0.8	2412.906	1.84E-04	1.30E-04	0.013	3.42E-03	8.8404	2.70E-03	0.000
45.0	1.0	44.5	130.0	2.88	1.93	0.781	45	1.25	97.7	0.7	60.4	0.8	2435.082	1.84E-04	1.30E-04	0.013	3.45E-03	8.8404	2.72E-03	0.000
46.0	1.0	45.5	130.0	2.94	1.97	0.792	24	1.25	69.3	0.7	35.3	0.8	2058.095	2.19E-04	3.00E-04	0.030	1.52E-02	8.8404	1.20E-02	0.000
47.0	1.0	46.5	130.0	3.01	2.02	0.804	24	1.25	69.3	0.7	35.0	0.8	2076.549	2.19E-04	1.00E-02	1.000	5.10E-01	8.8404	4.02E-01	0.000
48.0	1.0	47.5	130.0	3.07	2.06	0.815	24	1.25	69.3	0.7	34.8	0.8	2094.746	2.19E-04	1.00E-02	1.000	5.14E-01	8.8404	4.05E-01	0.000
49.0	1.0	48.5	130.0	3.14	2.10	0.826	66	1.25	111.8	0.7	81.8	0.8	2813.887	1.64E-04	1.00E-02	1.000	1.84E-01	8.8404	1.45E-01	0.000
50.0	1.0	49.5	130.0	3.20	2.15	0.836	66	1.25	111.8	0.7	81.3	0.8	2836.589	1.64E-04	1.00E-02	1.000	1.86E-01	8.8404	1.46E-01	0.000

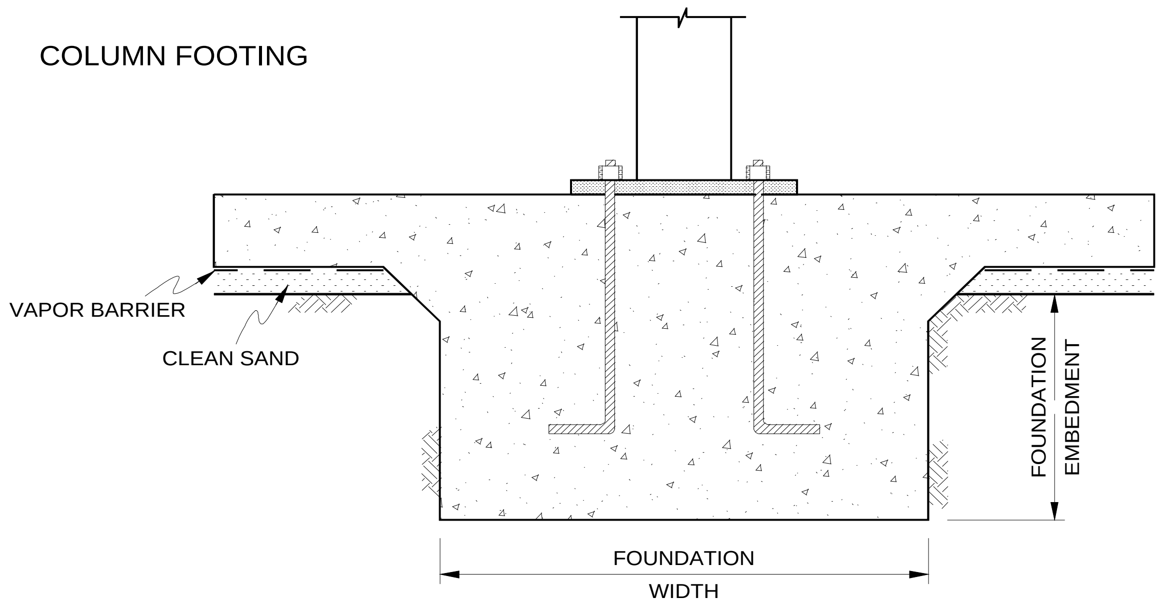
TOTAL SETTLEMENT = **0.04**

Figure 5

WALL FOOTING



COLUMN FOOTING



NOTE: SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

GEOCON WEST, INC.
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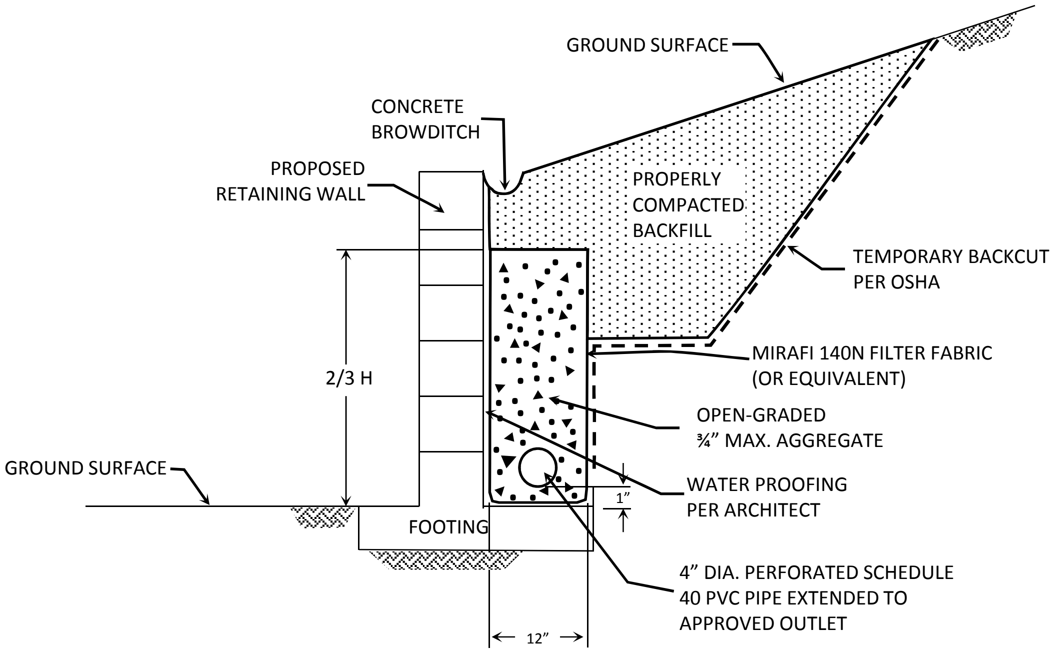
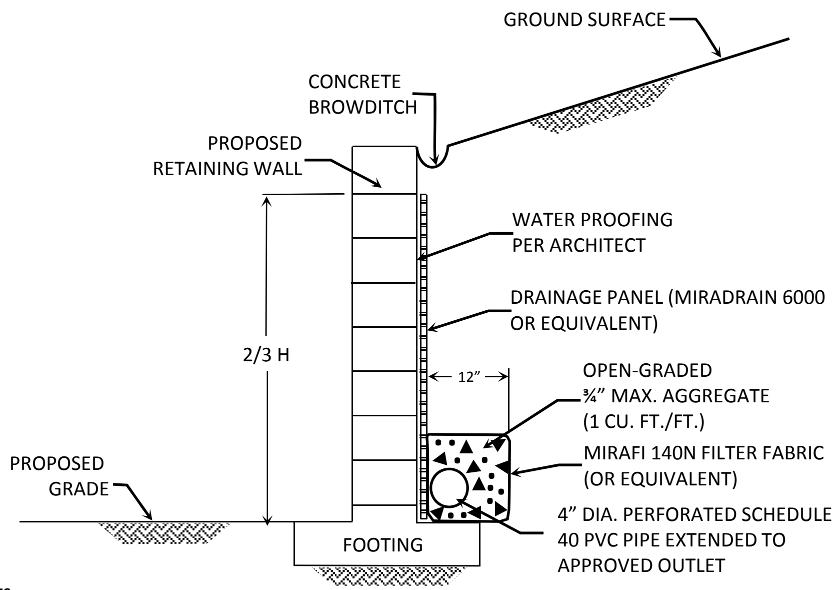
DF		

WALL / COLUMN FOOTING DETAIL

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL 2019	PROJECT NO. T2857-22-01	FIG. 6





NOTES:

DRAIN SHOULD BE UNFORMLY SLOPED TO GRAVITY OUTLET
OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPIMG

CONCRETE BROW DITCH RECOMMENDED FOR SLOPE HEIGHTS
GREATER THAN 6 FEET

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

GEOCON
WEST, INC.
GEOTECHNICAL ENVIRONMENTAL MATERIALS
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THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

DF			APRIL, 2019	PROJECT NO. T2857-22-01	FIG. 7

APPENDIX A

APPENDIX A

EXPLORATORY EXCAVATIONS

Geocon performed the field investigation on March 14 and 15, 2019. Our subsurface exploration consisted of drilling six small-diameter borings and four percolation tests at the site. The borings were drilled to depths of 30 to 51 feet below the existing ground surface and the percolation tests were advanced to depths of approximately 8 feet below the existing ground surface using a track-mounted, hollow stem auger drill rig. We collected bulk and relatively undisturbed samples from the borings by driving a 3-inch O. D., California Modified Sampler into the "undisturbed" soil mass with blows from a 140-pound hammer falling 30 inches or a slide hammer. The California Modified Sampler was equipped with 1-inch high by $2^3/_8$-inch inside diameter brass sampler rings to facilitate removal and testing. Standard Penetration Test samples were also collected by driving a 2-inch diameter sampler 18 inches into the soil to retrieve small bulk samples. Relatively undisturbed samples and bulk samples of disturbed soils were transported to our laboratory for testing.

The soil conditions encountered in the borings were visually examined, classified and logged in general accordance with the Unified Soil Classification System (USCS). Logs of the borings are presented on Figures A-1 through A-10. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The approximate locations of the excavations are indicated the *Geologic Map*, Figure 2.

Percolation testing was performed on March 28, 2018 in general accordance with *Riverside County Flood Control and Water Conservation District, LID BMP Manual, Appendix A.* The testing procedures were modified because of site constraints from the active dairy. The percolation tests were run in accordance with *Section 2.3., Shallow Percolation Test*. The percolation test data is presented on Figures A-11 through A-14.

PROJECT NO. T2857-22-01

BORING B-1

ELEV. (MSL.) 637 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-1@0-5'			SM	**UNDOCUMENTED FILL (Afu)** Silty SAND, medium dense, moist, grayish brown; fine sand			
2	B-1@2.5'					38	106.7	19.2
4				SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, dense, moist, light olive brown; fine sand			
6	B-1@5'					92	107.6	10.1
8	B-1@7.5'					71	113.7	15.4
10	B-1@10'			ML	Sandy SILT, very stiff, moist, dark brown	42	106.8	20.3
12								
14				SM	Silty SAND, dense, damp, orangish brown; fine to medium sand			
16	B-1@15'					68	118.9	12.2
18								
20				CL	CLAY with sand, very stiff, moist, brown with orange and gray			
	B-1@20'					75	113.9	17.7
22								
24								
	B-1@25'				-becomes fine to medium sand; iron oxide staining	61		
26								
28								

Figure A-1,
Log of Boring B-1, Page 1 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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BORING B-1

ELEV. (MSL.) **637** DATE COMPLETED **03/14/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **C. Robinson**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B-1@30'			SM	Silty SAND, very dense, moist, orangish brown; fine to medium sand; trace gravel	91/10'	121.2	11.0
32								
34				SC	Clayey SAND, very dense, olive brown; fine sand			
	B-1@35'					50/6'		
36								
38								
40	B-1@40'					50/6'		

Total depth 41'
No Groundwater encountered
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-1,
Log of Boring B-1, Page 2 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2857-22-01

BORING B-2

ELEV. (MSL.) 642 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML	**TOPSOIL** SILT with sand, soft, wet, dark brown with orange			
2	B-2@2.5'			SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, wet, olive brown; fine sand	20	111.1	14.5
4								
6	B-2@5-7' B-2@5'			ML	Sandy SILT, stiff, wet, olive brown; fine to medium sand	36	103.8	22.0
8	B-2@7.5'					27		
10	B-2@10'			ML	SILT, stiff, wet, brown; trace fine sand	17	111.5	16.7
12								
14								
16	B-2@15'				-becomes very stiff	54	92.8	31.1
18				SM	Silty SAND, medium dense, moist, brown with gray and dark brown; micaceous			
20	B-2@20'					33	105.6	20.9
22								
24								
26	B-2@25'			SM	Silty SAND, dense, saturated, grayish brown; medium sand	38		
28			▽					
				CL	Sandy CLAY, stiff, saturated, dark brown			

Figure A-2,
Log of Boring B-2, Page 1 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T2857-22-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-2 ELEV. (MSL.) 642 DATE COMPLETED 03/14/2019 EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B-2@30'			CL	Sandy CLAY, stiff, saturated, dark brown	29		
32								
34								
	B-2@35'					19		
36				ML	Sandy SILT, very stiff, saturated, bluish gray; fine sand			
38								
40	B-2@40'			SM	Silty SAND, very dense, saturated, brown; fine to medium sand	50/4"		

Total depth 40' 3"
Seepage or perched water encountered at 24' 5" during drilling
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-2,
Log of Boring B-2, Page 2 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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PROJECT NO. T2857-22-01

BORING B-3

ELEV. (MSL.) 638 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			**TOPSOIL** Organic, loose, wet			
	B-3@1-5'	SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, dense, moist, grayish brown	4		
	B-3@2.5'			58	112.7	16.0
	B-3@5'	CL-ML	Sandy silty CLAY, stiff, wet, grayish brown	12	101.5	23.7
	B-3@7.5'			15	96.8	27.5
10	B-3@10'	SC	Clayey SAND, dense, wet, grayish brown	44	123.1	14.6
		CL	CLAY with sand, stiff, moist, brown			
	B-3@15'			25	101.4	24.7
20	B-3@20'			41	116.1	17.7
	B-3@25'			46		

Depth scale: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28

Figure A-3,
Log of Boring B-3, Page 1 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS		
... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

GEOCON

BORING B-3

ELEV. (MSL.) 638 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B-3@30'			SM	Silty SAND, very dense, moist, brown	50/4"	113.7	14.6
					Total depth 30' 10" No Groundwater encountered Penetration resisance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 03/14/19			

Figure A-3,
Log of Boring B-3, Page 2 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

PROJECT NO. T2857-22-01

BORING B-4

ELEV. (MSL.) 636 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			SM	**FILL (Disturbed soils)** Silty SAND, loose, moist, brown			
	B-4@1-5'		SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, moist, brown			
	B-4@2.5'				28		
			ML	SILT with sand, stiff, moist, olive		94.5	23
	B-4@5'				63	100.7	26.9
6			CL	CLAY, very stiff, moist, greenish brown			
8	B-4@7.5'			-becomes light brown	18	102.4	22.4
10	B-4@10'		SM	Silty SAND, medium dense, wet, brown with light brown	21		
15	B-4@15'				20		
18		▽					
19			ML	SILT with sand, very stiff, saturated, brown			
20	B-4@20'				28	100.3	28.0
25	B-4@25'		SC	Clayey SAND, medium dense, saturated, brown	20		

Figure A-4,
Log of Boring B-4, Page 1 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T2857-22-01

DEPTH IN FEET	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-4 ELEV. (MSL.) 636 DATE COMPLETED 03/14/2019 EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
							MATERIAL DESCRIPTION			
30	B-4@30'					SC	-becomes very dense	50/6"	117.5	14.2
							Total depth 31' Seepage or perched water encountered at 18'3" during drilling Penetration resisance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 03/14/19			

Figure A-4,
Log of Boring B-4, Page 2 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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BORING B-5

ELEV. (MSL.) 643 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			**TURF AND TOPSOIL** Loose, wet, dark brown			
	B-5@1-5'	SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, moist, dark brown; fine sand			
2	B-5@2.5'			77		
		SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, dense, moist, dark brown; fine sand			
4						
	B-5@5'			20	100.2	9.0
6		ML	SILT with sand, very stiff, moist, olive brown			
8	B-5@7.5'		-becomes wet; trace roots	28		
10	B-5@10'	CL	CLAY, stiff, wet, olive brown	25	90.7	31.4
12						
14						
	B-5@15'		-becomes greenish brown	35	104.6	22.8
16						
18		CL	CLAY with sand,and gravel size cemented pieces, stiff, wet, light olive brown			
20	B-5@20'			13	90.5	34.6
22						
24		ML	Clayey SILT with sand, stiff, wet, dark brown; fine sand			
	B-5@25'			19		
26						
28						

Figure A-5,
Log of Boring B-5, Page 1 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2857-22-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-5 ELEV. (MSL.) 643 DATE COMPLETED 03/14/2019 EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	B-5@30'			ML	-becomes fine to medium sand; very stiff	34		
32								
34				SC	Clayey SAND, very dense, wet, olive brown; fine to medium sand			
36	B-5@35'					50/6"	121.4	14.0
38								
40	B-5@40'			ML	SILT with sand, hard, moist, olive brown; iron oxide staining; fine sand	67		
42								
44								
46	B-5@45'				-becomes very stiff	36	86.8	39.3
48				SM	Silty SAND, very dense, moist, olive brown; iron oxide staining			
50	B-5@50'					50/6"		

Total depth 51'
No Groundwater encountered
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-5,
Log of Boring B-5, Page 2 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

PROJECT NO. T2857-22-01

BORING B-6

ELEV. (MSL.) 645 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**TOPSOIL** Silty SAND, loose, damp, light brown			
	B-6@1-5'			SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, damp, light brown; fine sand			
2	B-6@2.5'					23	102.7	5.9
4					-becomes olive brown			
6	B-6@5'					22	106.9	13.3
8	B-6@7.5'			ML	SILT with sand, very stiff, moist, olive brown; fine sand	43	95.1	27.6
10	B-6@10'					43		
12								
14				SM	Silty SAND, medium dense, damp, olive brown; fine to medium sand			
16	B-6@15'					44	110.7	11.6
				CL	Sandy CLAY, stiff, wet, light brown; fine to medium sand			
18								
				SM	Silty SAND, very dense, damp, olive brown; fine sand			
20	B-6@20'					50/5"		

Total depth 20' 5"
No Groundwater encountered
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-6,
Log of Boring B-6, Page 1 of 1

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING P-1

ELEV. (MSL.) 637 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML	**UNDOCUMENTED FILL (afu)** SILT with sand, stiff, moist, medium brown; fine sand			
4				SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, moist, light brown; fine sand			
6	P-1@6-8'							
8					Total depth 8' No Groundwater encountered Penetration resisance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 03/14/19			

Depth scale: 0, 2, 4, 6, 8. Sample columns: BULK, DR/SPT.

Figure A-7,
Log of Boring P-1, Page 1 of 1

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

PROJECT NO. T2857-22-01

BORING P-2

ELEV. (MSL.) 637 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML	**UNDOCUMENTED FILL (afu)** SILT with sand, stiff, moist, medium brown; fine sand			
2								
4				SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, moist, light brown			
6	P-2@6-8'							
8					Total depth 8' No Groundwater encountered Penetration resisance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 03/14/19			

Figure A-8,
Log of Boring P-2, Page 1 of 1

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

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BORING P-3

ELEV. (MSL.) 645 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0						SM	**UNDOCUMENTED FILL (afu)** Silty SAND, loose, damp, light brown			
1						SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, damp, light brown			
2										
4										
6	P-3@6-8'	X								
8										

Total depth 8' 2"
No Groundwater encountered
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-9,
Log of Boring P-3, Page 1 of 1

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING P-4

ELEV. (MSL.) **645** DATE COMPLETED **03/14/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **C. Robinson**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, loose, damp, light brown			
2				SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, damp, light brown			
4								
6	P-4@6-8'							
8								

Total depth 8' 2"
No Groundwater encountered
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-10,
Log of Boring P-4, Page 1 of 1

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

PERCOLATION TEST REPORT

Project Name:	The Homestead	**Project No.:**	T2857-22-01
Test Hole No.:	P-1	**Date Excavated:**	3/14/2019
Length of Test Pipe:	96.0 inches	**Soil Classification:**	SM
Height of Pipe above Ground:	0.0 inches	**Presoak Date:**	3/14/2019
Depth of Test Hole:	96.0 inches	**Perc Test Date:**	3/28/2019
Check for Sandy Soil Criteria Tested by:	SP	**Percolation Tested by:**	CER

Water level measured from BOTTOM of hole

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	8:15 AM 8:40 AM	25	25	23.4	19.2	4.2	6.0
2	8:40 AM 9:05 AM	25	50	19.2	16.3	2.9	8.7

Soil Criteria: Normal

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:05 AM 9:35 AM	30	30	24.0	21.8	2.2	13.9
2	9:35 AM 10:05 AM	30	60	23.9	22.2	1.7	17.9
3	10:05 AM 10:35 AM	30	90	23.9	22.0	1.9	15.6
4	10:35 AM 11:05 AM	30	120	24.0	22.2	1.8	16.7
5	11:05 AM 11:35 AM	30	150	24.0	22.2	1.8	16.7
6	11:35 AM 12:05 PM	30	180	24.0	22.3	1.7	17.9
7	12:05 PM 12:35 PM	30	210	24.0	22.3	1.7	17.9

Infiltration Rate (in/hr):	0.27
Radius of test hole (in):	4
Average Head (in):	23.2

Figure A-11

PERCOLATION TEST REPORT

Project Name:	The Homestead	**Project No.:**	T2857-22-01
Test Hole No.:	P-2	**Date Excavated:**	3/14/2019
Length of Test Pipe:	96.0 inches	**Soil Classification:**	SM
Height of Pipe above Ground:	0.0 inches	**Presoak Date:**	3/14/2019
Depth of Test Hole:	96.0 inches	**Perc Test Date:**	3/28/2019
Check for Sandy Soil Criteria Tested by:	SP	**Percolation Tested by:**	CER

Water level measured from BOTTOM of hole

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	8:15 AM 8:40 AM	25	25	25.2	13.1	12.1	2.1
2	8:40 AM 9:05 AM	25	50	13.1	4.8	8.3	3.0

Soil Criteria: Normal

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:15 AM 9:45 AM	30	30	25.2	8.3	16.9	1.8
2	9:45 AM 10:15 AM	30	60	24.1	8.6	15.5	1.9
3	10:15 AM 10:35 AM	20	80	24.2	11.2	13.1	1.5
4	10:35 AM 10:45 AM	10	90	24.0	19.8	4.2	2.4
5	10:45 AM 10:55 AM	10	100	24.0	19.0	5.0	2.0
6	10:55 AM 11:05 AM	10	110	23.8	19.0	4.8	2.1
7	11:05 AM 11:15 AM	10	120	24.1	19.1	5.0	2.0
8	11:15 AM 11:25 AM	10	130	24.1	19.0	5.2	1.9
9	11:25 AM 11:35 AM	10	140	24.0	19.0	5.0	2.0

Infiltration Rate (in/hr):	2.58
Radius of test hole (in):	4
Average Head (in):	21.5

Figure A-12

PERCOLATION TEST REPORT

Project Name:		The Homestead			**Project No.:**		T2857-22-01
Test Hole No.:		P-3			**Date Excavated:**		3/14/2019
Length of Test Pipe:			109.0	inches	**Soil Classification:**		SM
Height of Pipe above Ground:			12.0	inches	**Presoak Date:**		3/14/2019
Depth of Test Hole:			97.0	inches	**Perc Test Date:**		3/28/2019
Check for Sandy Soil Criteria Tested by:				SP	**Percolation Tested by:**		CER

Water level measured from BOTTOM of hole

Sandy Soil Criteria Test

Trial No.	**Time**	**Time Interval (min)**	**Total Elapsed Time (min)**	**Initial Water Level (in)**	**Final Water Level (in)**	**Δ in Water Level (inches)**	**Percolation Rate (min/inch)**
1	8:50 AM			35.9			
2		Not measured due to livestock in test area					

Soil Criteria: Normal

Percolation Test

Reading No.	**Time**	**Time Interval (min)**	**Total Elapsed Time (min)**	**Initial Water Level (in)**	**Final Water Level (in)**	**Δ in Water Level (inches)**	**Percolation Rate (min/inch)**
1	1:00 PM 1:10 PM	10	10	24.5	23.8	0.7	13.9
2	1:10 PM 1:20 PM	10	20	24.9	23.8	1.1	9.3
3	1:20 PM 1:30 PM	10	30	25.0	23.8	1.2	8.3
4	1:30 PM 1:40 PM	10	40	25.0	23.9	1.1	9.3
5	1:40 PM 1:50 PM	10	50	24.9	23.4	1.4	6.9
6	1:50 PM 2:00 PM	10	60	24.9	23.7	1.2	8.3
7	2:00 PM 2:10 PM	10	70	25.0	23.8	1.2	8.3
8	2:10 PM 2:20 PM	10	80	24.9	23.9	1.0	10.4
9	2:20 PM 2:30 PM	10	90	24.9	23.7	1.2	8.3
10	2:30 PM 2:40 PM	10	100	25.0	23.9	1.1	9.3
11	2:40 PM 2:50 PM	10	110	25.0	24.0	1.0	10.4
12	2:50 PM 3:00 PM	10	120	24.9	23.9	1.0	10.4

Infiltration Rate (in/hr):		0.44	
Radius of test hole (in):		4	**Figure A-13**
Average Head (in):		24.4	

PERCOLATION TEST REPORT

Project Name:	The Homestead	**Project No.:**	T2857-22-01
Test Hole No.:	P-4	**Date Excavated:**	3/14/2019
Length of Test Pipe:	96.0 inches	**Soil Classification:**	SM
Height of Pipe above Ground:	0.0 inches	**Presoak Date:**	3/14/2019
Depth of Test Hole:	96.0 inches	**Perc Test Date:**	3/28/2019
Check for Sandy Soil Criteria Tested by:	SP	**Percolation Tested by:**	CER

Water level measured from BOTTOM of hole

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	8:55 AM			22.8			
2		Not measured due to livestock in test area					

Soil Criteria: Normal

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	1:05 PM 1:15 PM	10	10	24.2	22.6	1.7	6.0
2	1:15 PM 1:25 PM	10	20	24.0	22.4	1.6	6.4
3	1:25 PM 1:35 PM	10	30	24.2	22.7	1.6	6.4
4	1:35 PM 1:45 PM	10	40	24.2	22.8	1.4	6.9
5	1:45 PM 1:55 PM	10	50	24.0	22.7	1.3	7.6
6	1:55 PM 2:05 PM	10	60	24.2	23.0	1.2	8.3
7	2:05 PM 2:15 PM	10	70	24.4	23.2	1.2	8.3
8	2:15 PM 2:25 PM	10	80	24.4	23.2	1.2	8.3
9	2:25 PM 2:35 PM	10	90	24.2	23.2	1.1	9.3
10	2:35 PM 2:45 PM	10	100	24.4	23.3	1.1	9.3
11	2:45 PM 2:55 PM	10	110	24.2	23.0	1.2	8.3
12	2:55 PM 3:05 PM	10	120	24.1	23.0	1.1	9.3

Infiltration Rate (in/hr):	0.51
Radius of test hole (in):	4
Average Head (in):	23.6

Figure A-14

APPENDIX B

APPENDIX B

LABORATORY TESTING

We performed laboratory tests in accordance with current, generally accepted test methods of ASTM International (ASTM) or other suggested procedures. We analyzed selected soil samples for in-situ density and moisture content, maximum dry density and optimum moisture content, expansion index, corrosivity, grain size distribution, R-Value, plasticity, organic content, consolidation characteristics, and direct shear strength. The results of the laboratory tests are presented on Figures B-1 through B-13. The in-place dry density and moisture content of the samples tested are presented on the boring logs in *Appendix A*.

SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS ASTM D1557

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% of dry wt.)
B-1 @ 0-5'	Silty SAND (SM), grayish brown	120.0	12.5
B-5 @ 1-5'	Silty SAND (SM), dark brown	111.5	12.5

SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS ASTM D4829

Sample No.	Moisture Content		After Test Dry Density (pcf)	Expansion Index
	Before Test (%)	After Test (%)		
B-1 @ 0-5'	11.8	19.1	103.2	0
B-2 @ 5-7'	10.0	18.4	108.0	1

SUMMARY OF CORROSIVITY TEST RESULTS

Sample No.	Chloride Content (ppm)	Sulfate Content (%)	pH	Resistivity (ohm-centimeter)
B-4 @ 1-5'	40	0.044	7.24	320
B-5 @ 1-5'	180	0.000	8.32	26,000

Chloride content determined by California Test 422.
Water-soluble sulfate determined by California Test 417.
Resistivity and pH determined by Caltrans Test 643.

SUMMARY OF LABORATORY R-VALUE TEST RESULTS ASTM D2844

Sample No.	R-Value
B-4 @ 1-5'	55
B-6 @ 1-5'	70

SUMMARY OF LABORATORY ORGANIC MATTER CONTENT TESTS
ASTM D2974 (Methods ‘A’ & ‘C’)

Sample No.	Organic Matter Content (%)
B-1 @ 2.5’	3.6
B-1 @ 7.5’	2.0
B-2 @ 2.5’	2.1
B-3 @ 2.5’	1.9
B-3 @ 10’	1.1
B-4 @ 2.5’	2.4
B-4 @ 5’	3.2
B-4 @ 20’	2.9
B-5 @ 2.5’	1.0
B-5 @ 7.5’	3.1
B-5 @ 10’	3.3
B-6 @ 2.5’	1.0
B-6 @ 5’	2.1

SUMMARY OF ONE-DIMENSIONAL CONSOLIDATION (COLLAPSE) TESTS
ASTM D2435

Sample No.	In-situ Dry Density (pcf)	Moisture Content Before Test (%)	Final Moisture Content (%)	Axial Load with Water Added (psf)	Percent Hydrocompression
B-2 @ 5’	103.8	22.0	20.6	2,000	0.02
B-2 @ 10’	111.5	16.7	15.2	2,000	0.03
B-3 @ 5’	101.5	23.7	22.7	2,000	0.02
B-3 @ 15’	101.4	24.7	22.9	4,000	0.10
B-5 @ 5’	100.2	9.0	20.5	2,000	0.30
B-5 @ 10’	90.7	31.4	30.8	2,000	0.01

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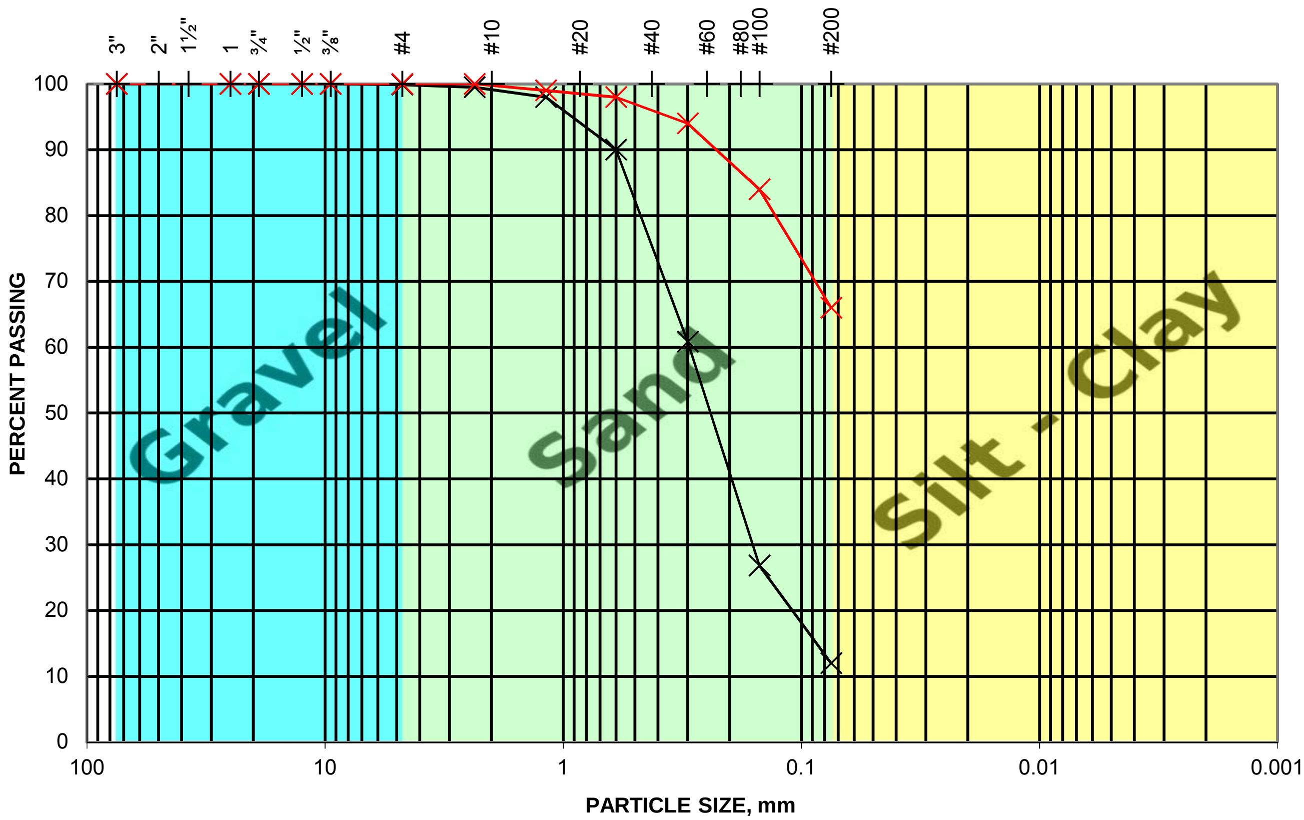
SUMMARY OF ATTERBERG LIMIT TEST RESULTS
ASTM D4318

Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	USCS
B-2 @ 10’	**	**	0	ML
B-2 @ 35’	**	**	0	ML
B-3 @ 5’	23	19	4	CL-ML
B-4 @ 7.5’	26	17	9	CL
B-5 @ 10’	33	22	11	CL

** Non-plastic (NP): Material could not be rolled to 3 mm thread at any moisture content.



SAMPLE ID	SAMPLE DESCRIPTION
B-2 @ 25'	SM - Silty Sand
B-2 @ 35'	CL - Sandy Clay

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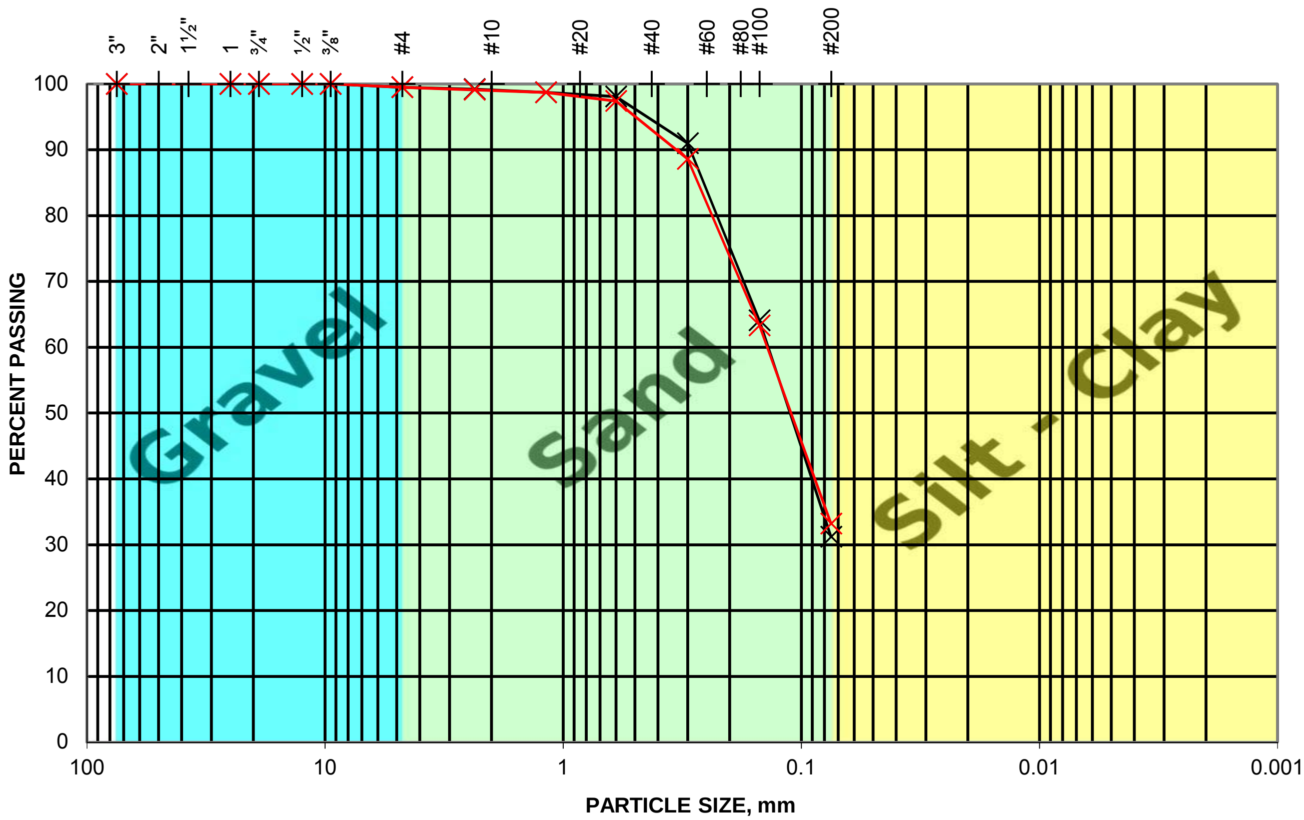
GRAIN SIZE DISTRIBUTION

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019	PROJECT NO. T2857-22-01	FIG B-4



SAMPLE ID	SAMPLE DESCRIPTION
P-1 @ 6-8'	SM - Silty Sand
P-3 @ 6-8'	SM - Silty Sand

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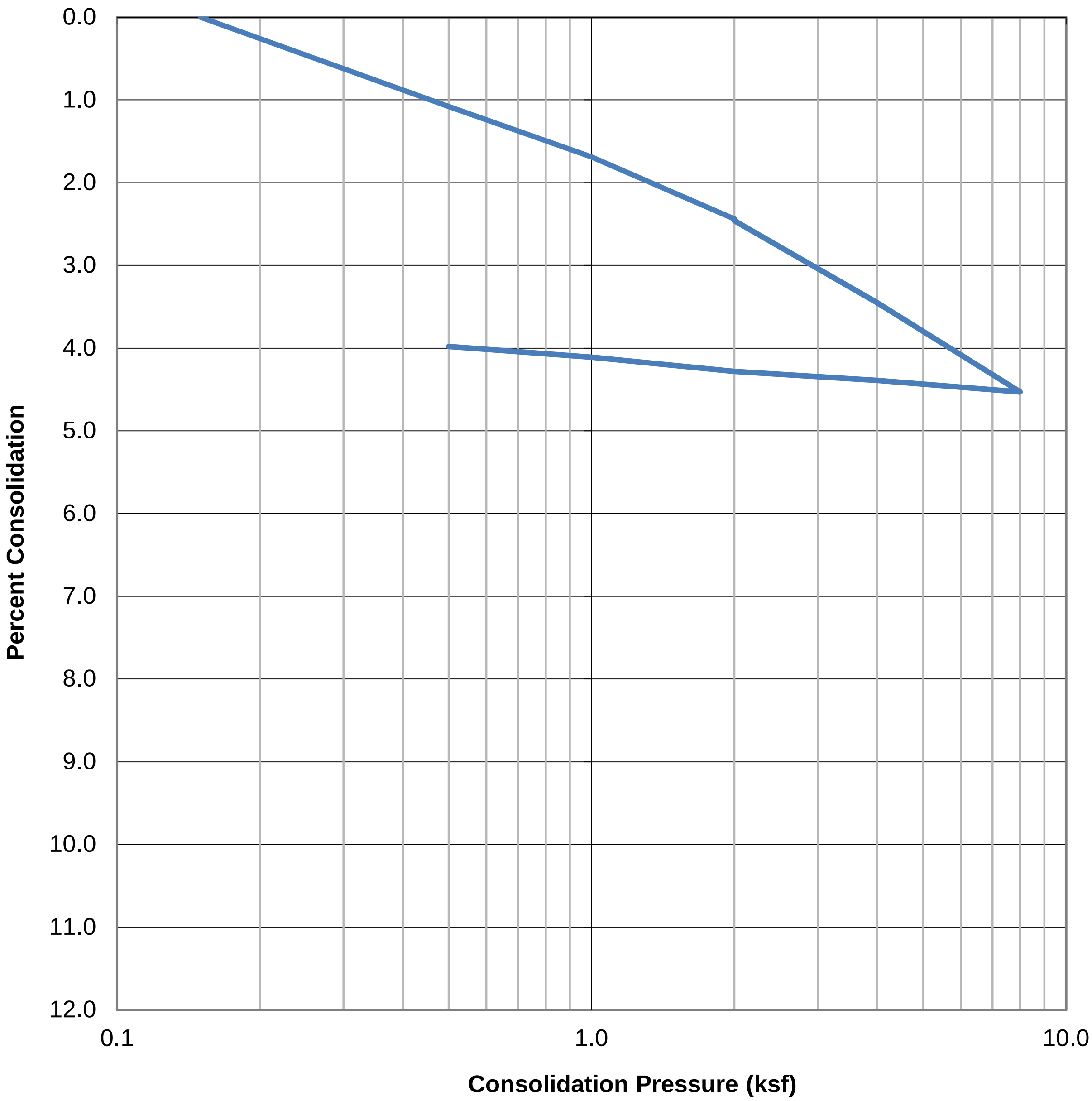
GRAIN SIZE DISTRIBUTION

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019	PROJECT NO. T2857-22-01	FIG B-5

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2@5'	ML	103.8	22.0	20.6

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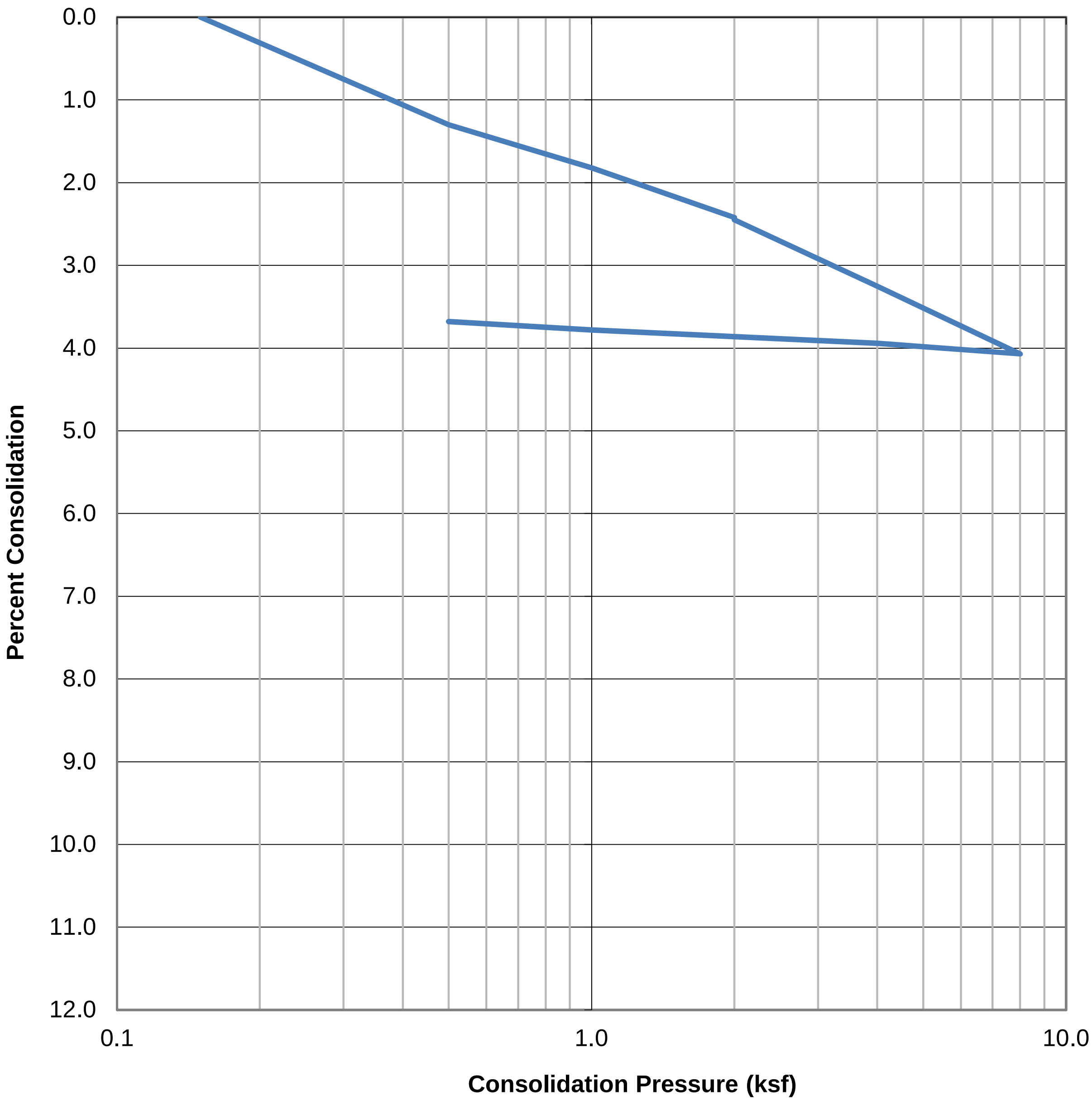
CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
ANDARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG B-6

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2@10'	ML	111.5	16.7	15.2

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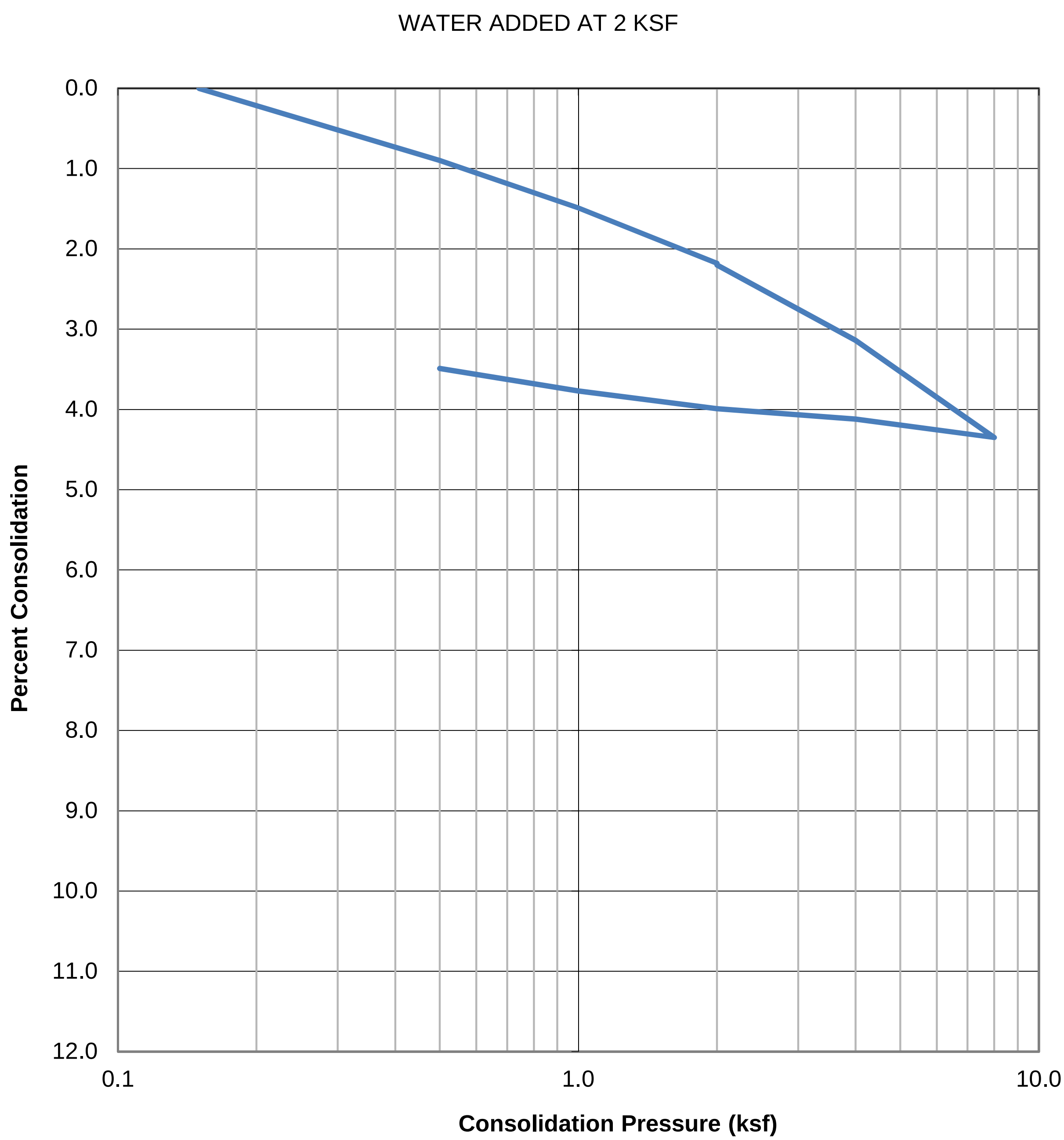
CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019	PROJECT NO. T2857-22-01	FIG B-7



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B3@5'	CL-ML	101.5	23.7	22.7

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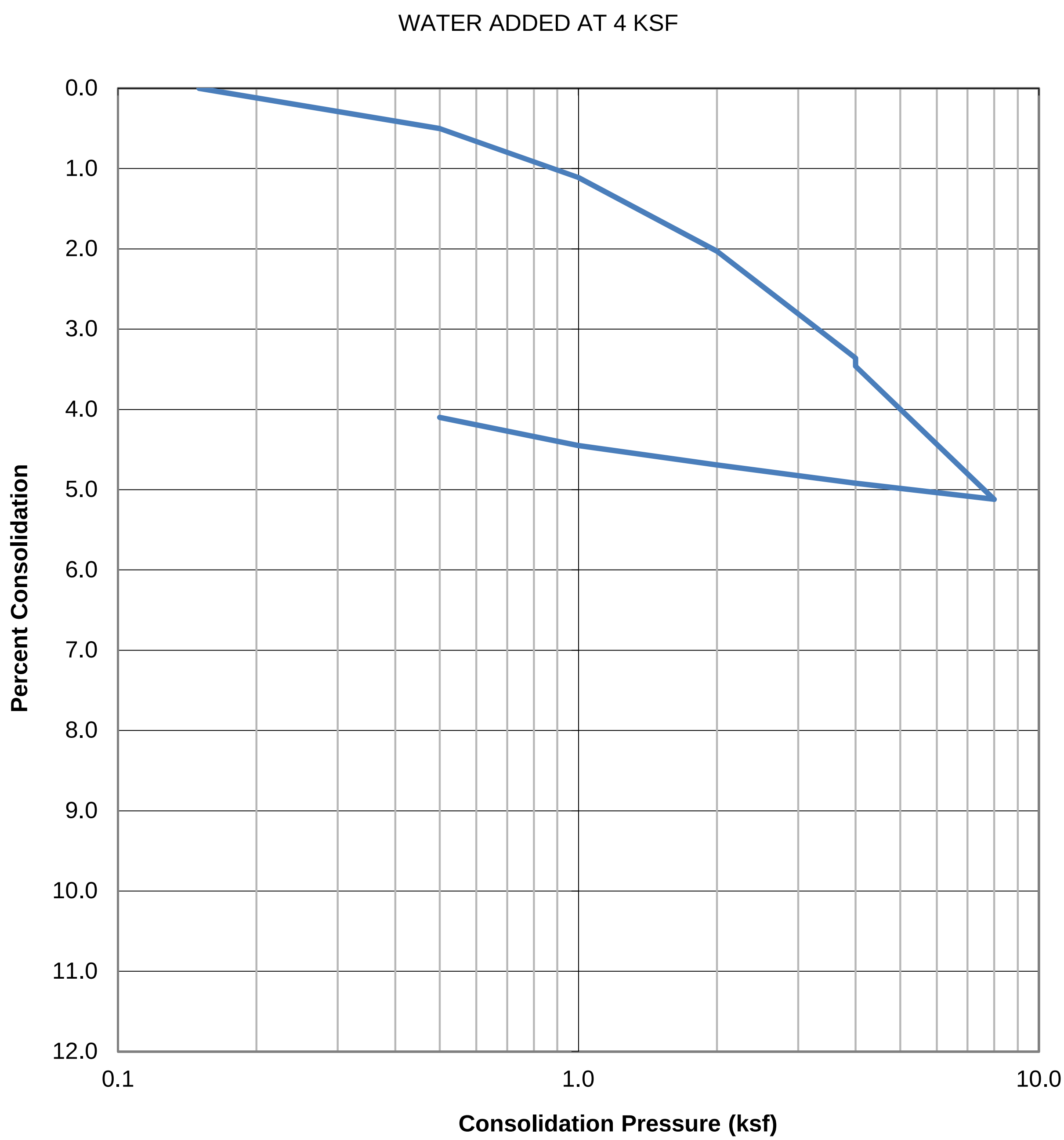
CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019	PROJECT NO. T2857-22-01	FIG B-8



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B3@15'	CL	101.4	24.7	22.9

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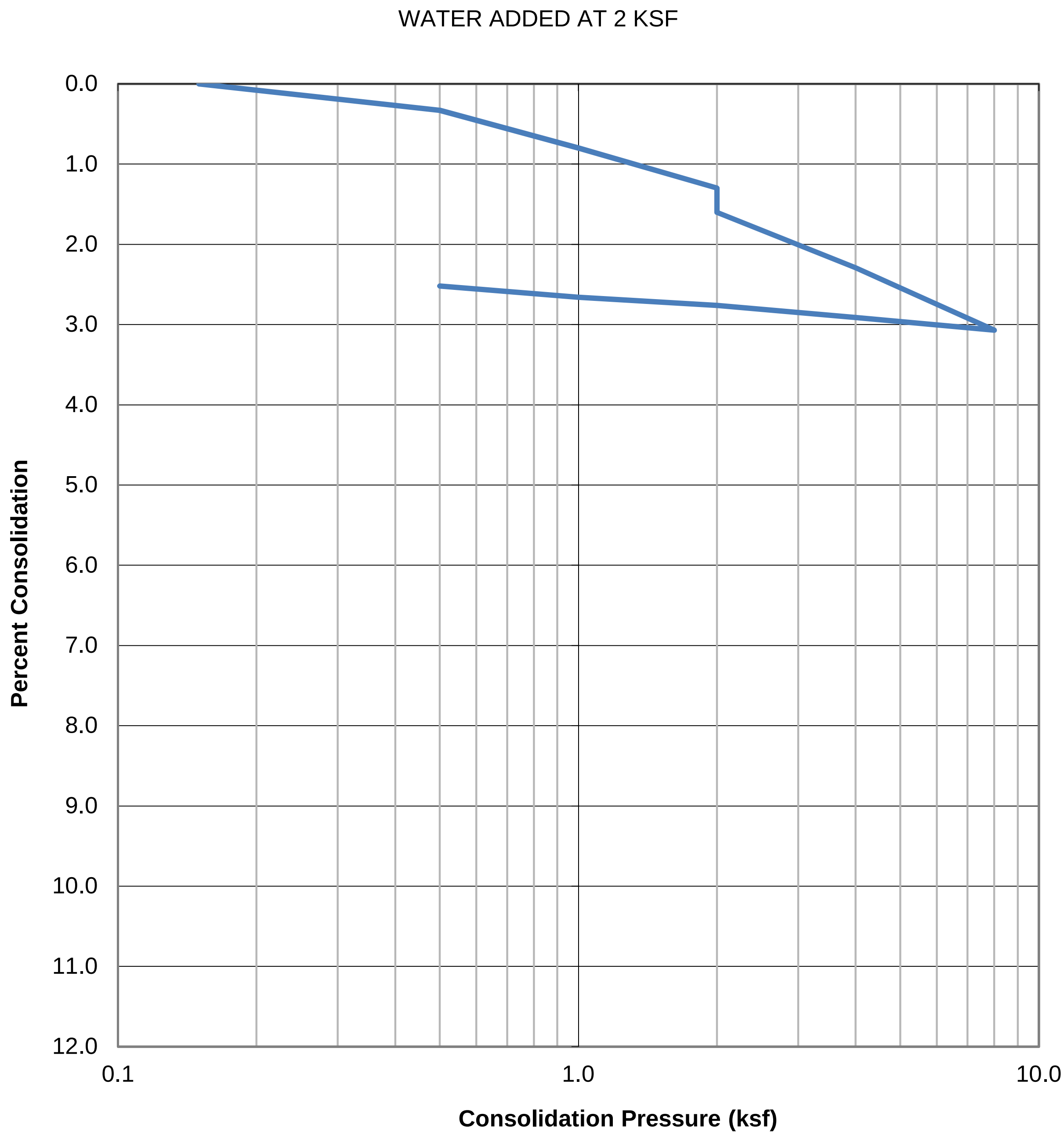
CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG B-9



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B5@5'	ML	100.2	9.0	20.5

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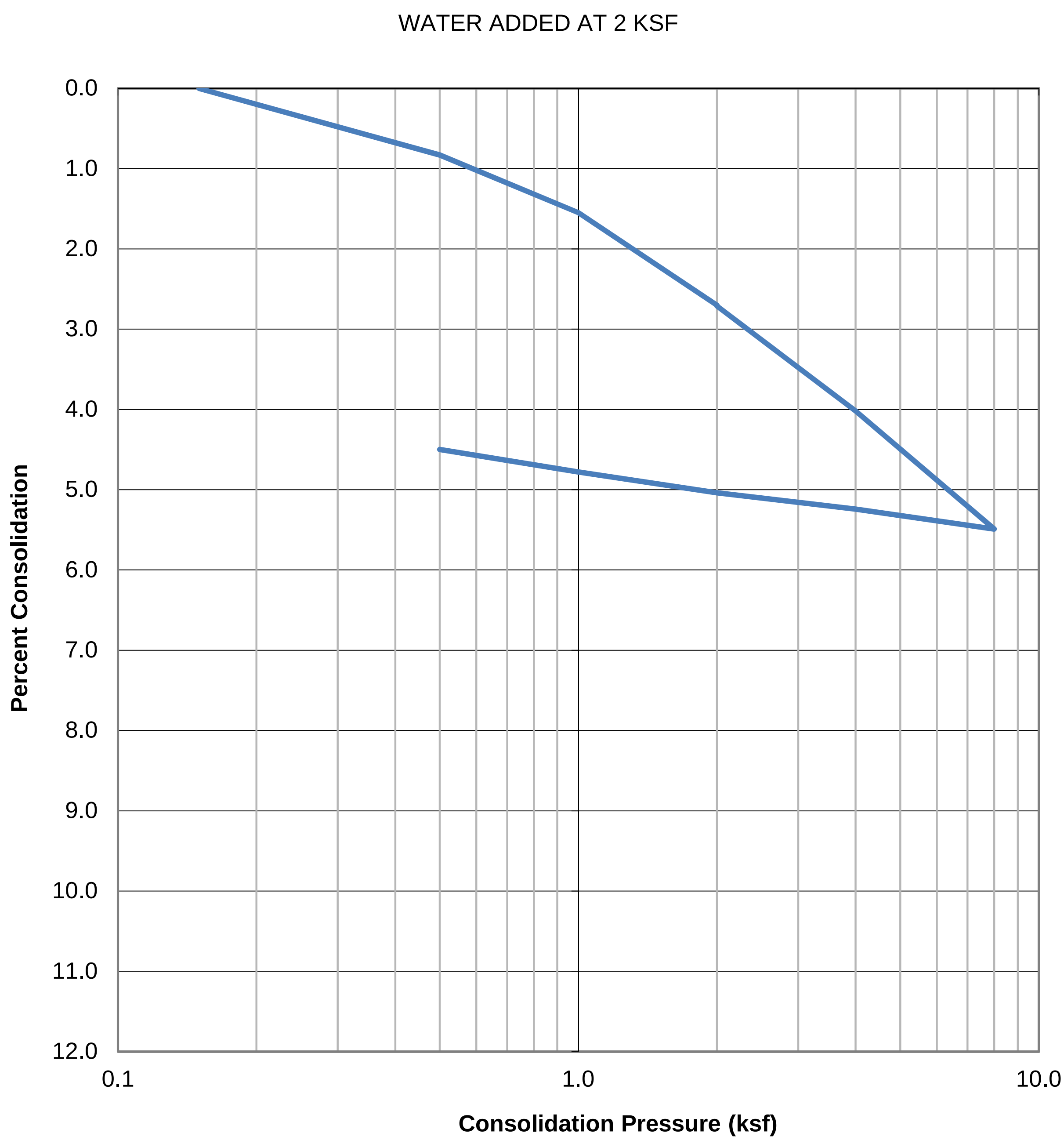
CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG B-10



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B5@10'	CL	90.7	31.4	30.8

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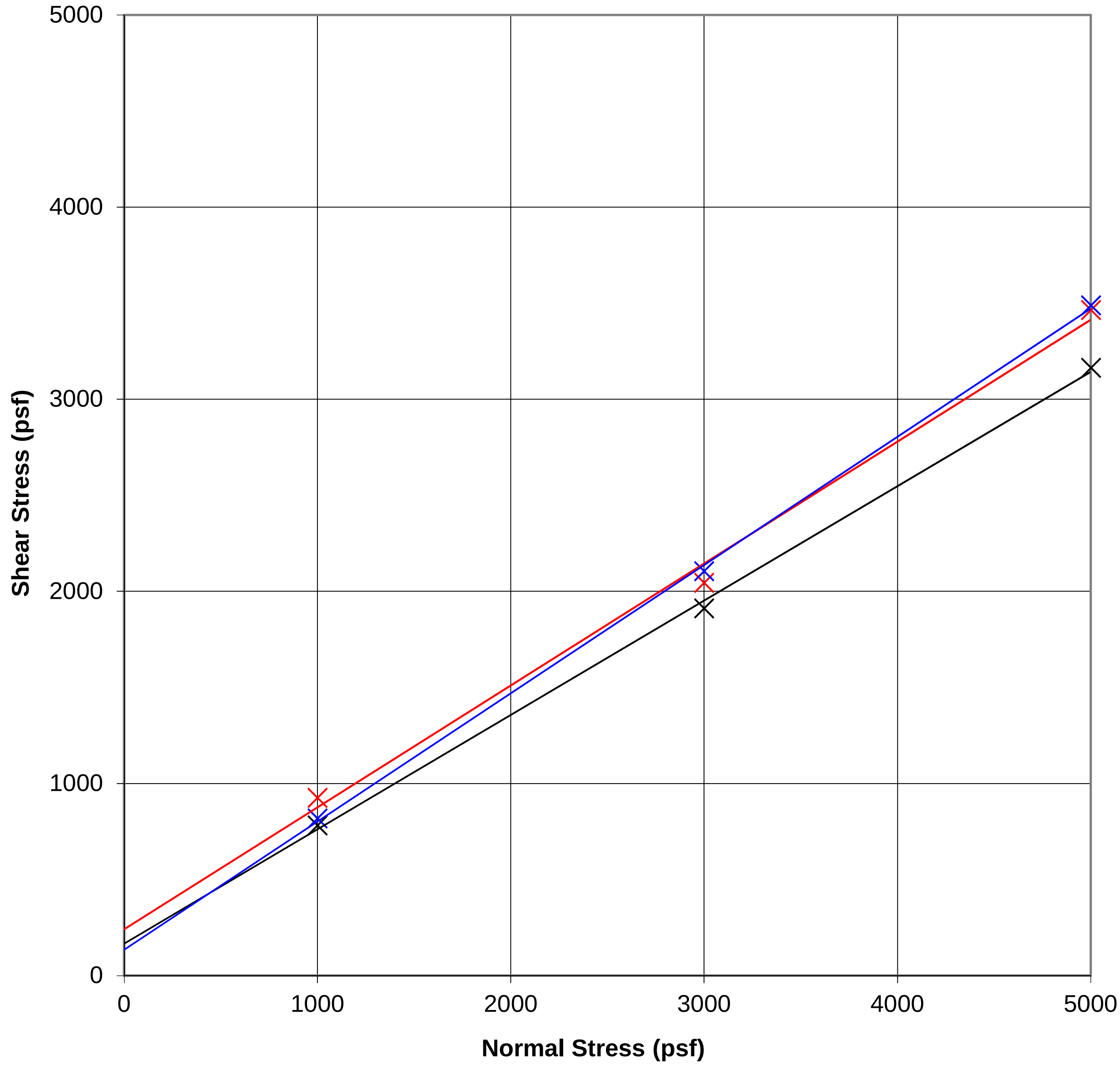
CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG B-11



SAMPLE ID	SOIL TYPE	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	C (psf)	ϕ (deg)
*B-1@0-5	SM	120.0	12.5	3.3	170	31
B-1@7.5	SM	113.7	15.4	20.6	240	32
B-3@7.5	CL-ML	96.8	27.5	24.3	130	34

*Sample remolded to approximately 90% of the test maximum dry density at optimum moisture content.

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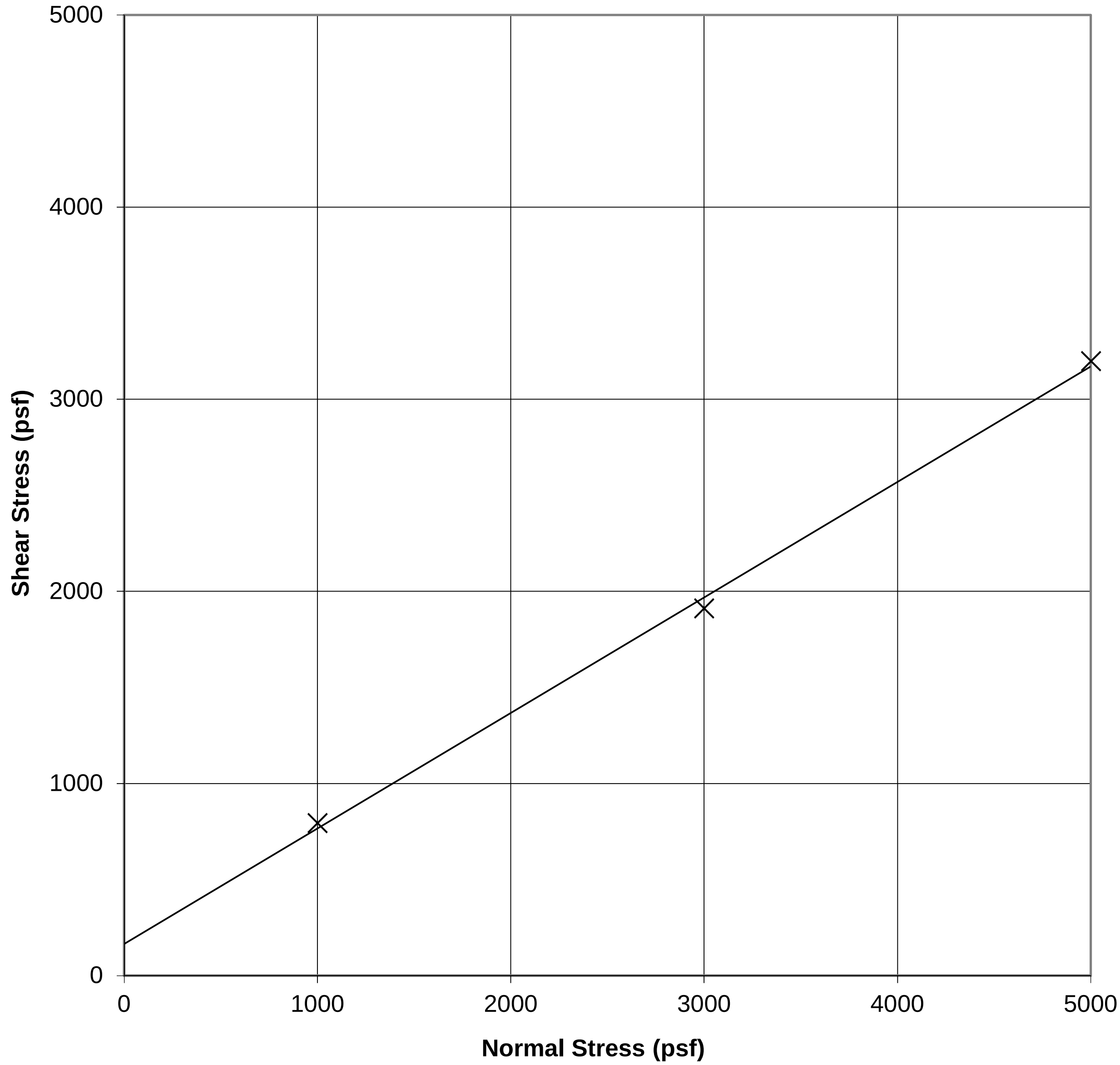
DIRECT SHEAR TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG B-12



SAMPLE ID	SOIL TYPE	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	C (psf)	ϕ (deg)
*B-5@1-5	SM	111.5	12.5	11.2	160	31

*Sample remolded to approximately 90% of the test maximum dry density at optimum moisture content.

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DIRECT SHEAR TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG B-13

APPENDIX C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

PROJECT NO. T2857-22-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

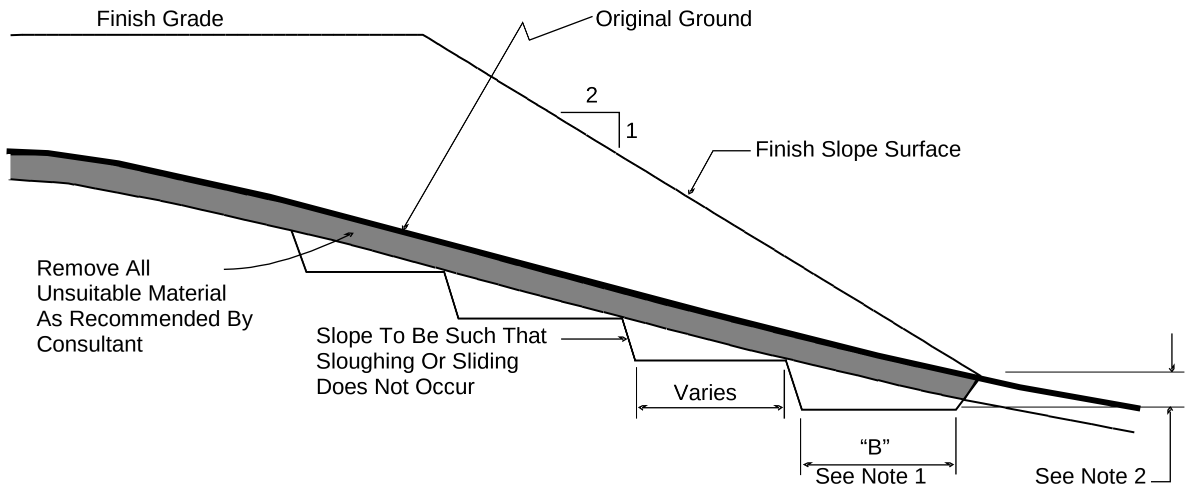
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



No Scale

DETAIL NOTES: (1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of “passes” have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

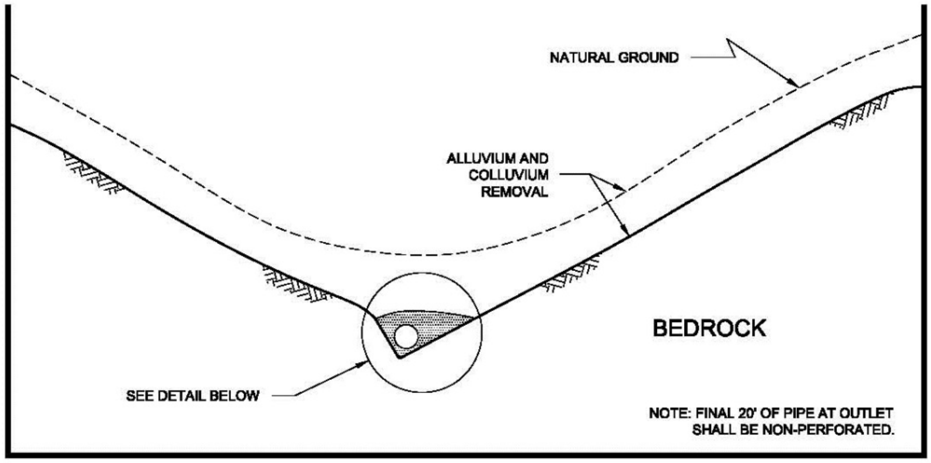
6.3.6 To reduce the potential for “piping” of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

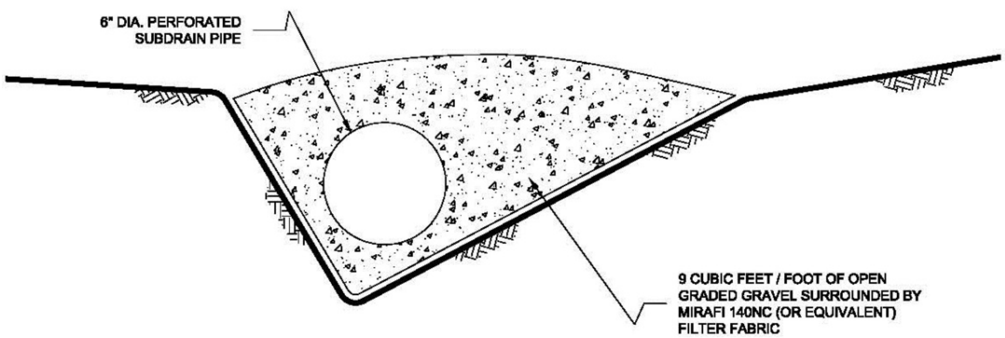
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

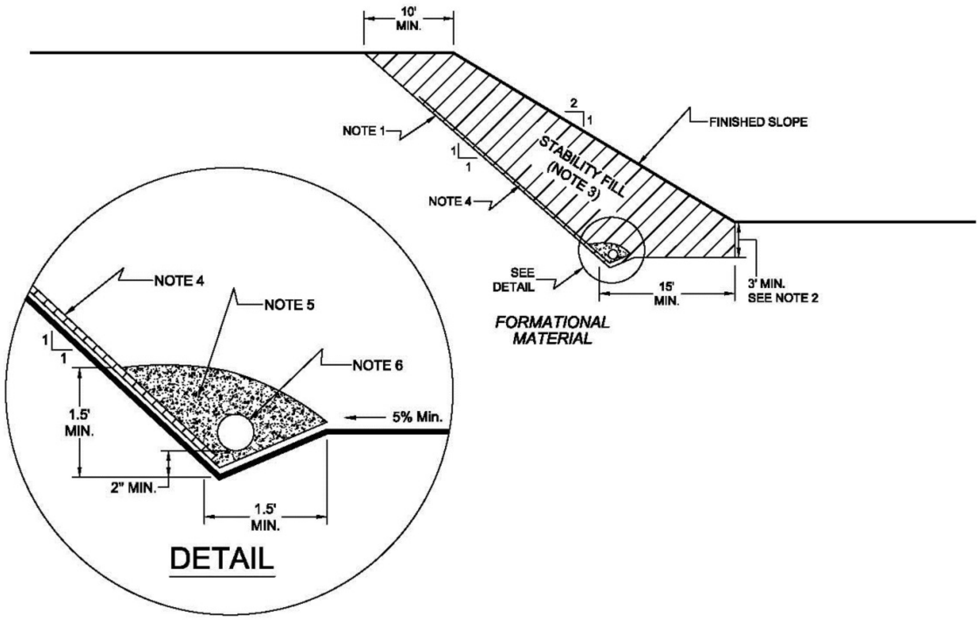
1......6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or larger) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

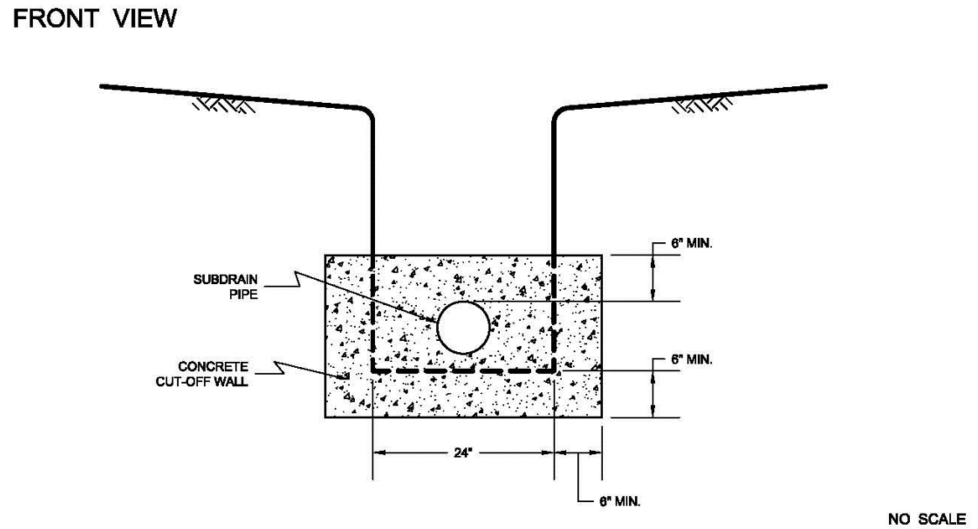
NO SCALE

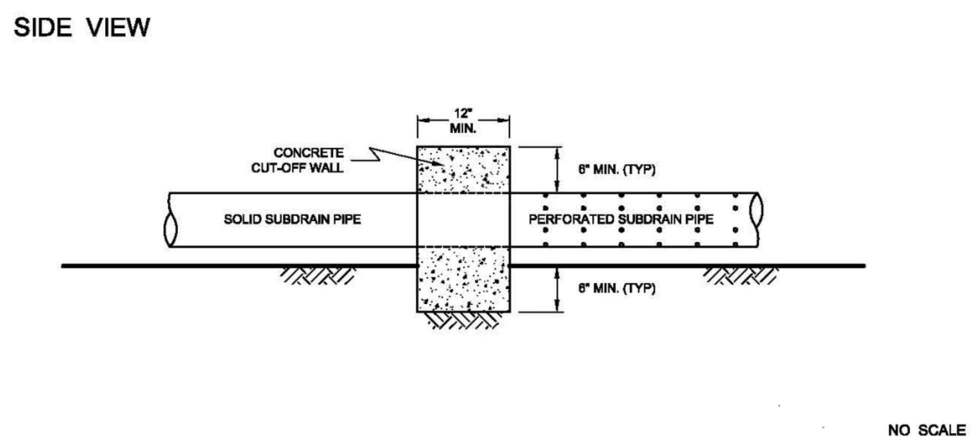
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

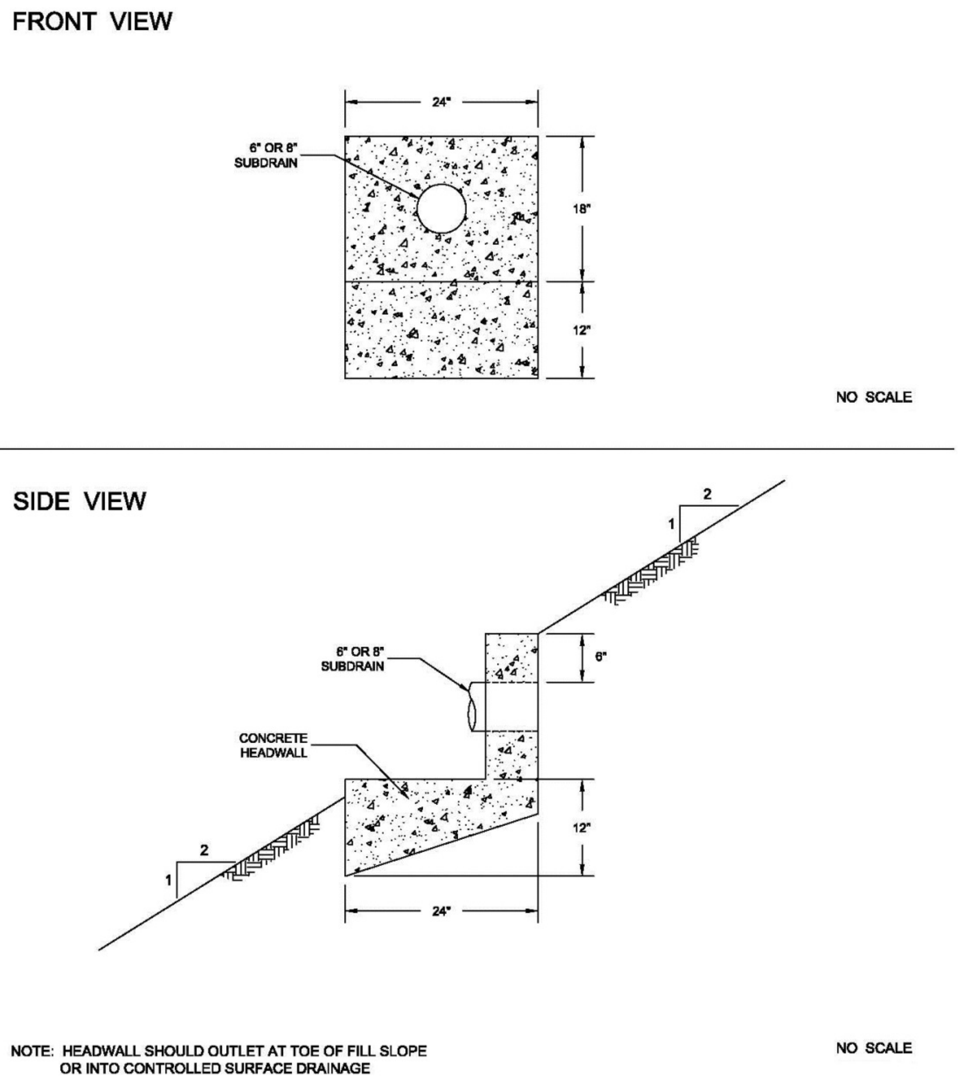
TYPICAL CUT OFF WALL DETAIL





7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

TYPICAL HEADWALL DETAIL



7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.

Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

7. SITE INFILTRATION

Percolation testing was performed in general accordance with the procedures in *Riverside County Flood Control and Water Conservation District LID BMP, Appendix A* (the Handbook) at locations and depths selected by the design team. The percolation test locations are depicted on the *Geologic Map* (see Figure 2). The percolation tests had to be modified due to the operations of the dairy at the time of our investigation. The sandy soil criteria test had to be halted in percolation tests P-3 and P-4 because of livestock within the test area. The tests were resumed later that day once the dairy was able to relocate the animal.

Approximately 2 inches of gravel was placed at the bottom of each percolation test hole and a 3-inch diameter perforated PVC pipe in silt filter sock was placed atop the gravel. The test locations were pre-saturated prior to testing. Percolation data sheets are presented in *Appendix A* of this report. Calculations to convert the percolation test rate to infiltration test rates are presented in Table 7 below. The Handbook requires a factor of safety of 3 be applied to the values below based on the test method used.

TABLE 7
INFILTRATION TEST RATES FOR PERCOLATION AREAS

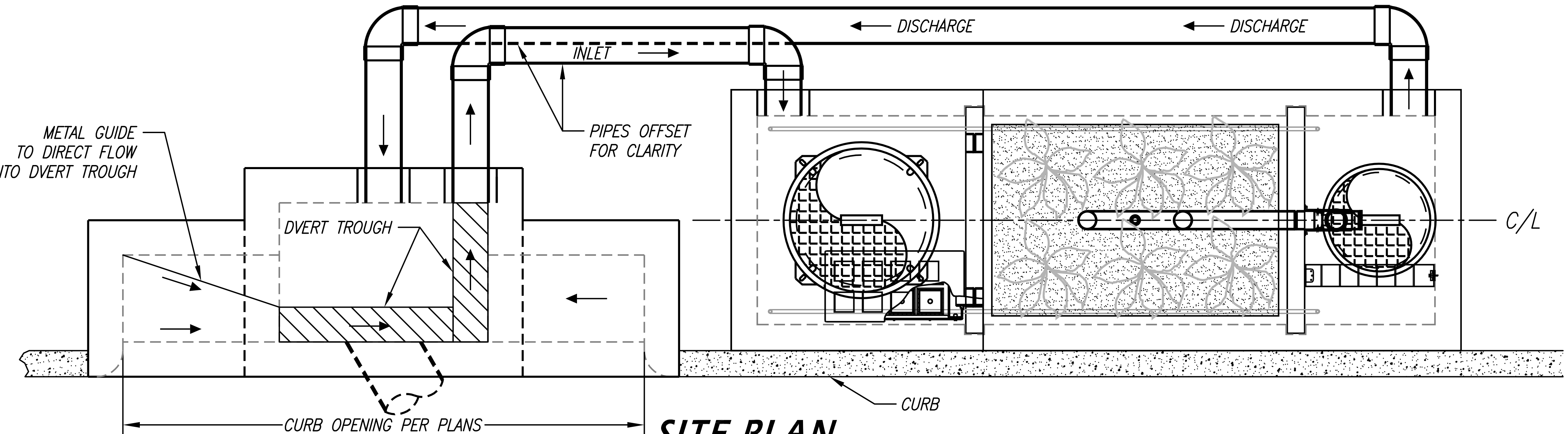
Parameter	P-1	P-2	P-3	P-6
Depth (inches)	96.0	96.0	97.0	96.0
Test Type	Modified	Modified	Modified	Modified
Change in head over time: ΔH (inches)	1.7	5.0	1.0	1.1
Average head: Havg (in)	23.2	21.5	24.4	23.6
Time Interval (minutes): Δt (minutes)	30	10	10	10
Radius of test hole: r (inches)	4	4	4	4
Tested Infiltration Rate: It (inches/hour)	0.27	2.58	0.44	0.51

Appendix 6: BMP Design Details

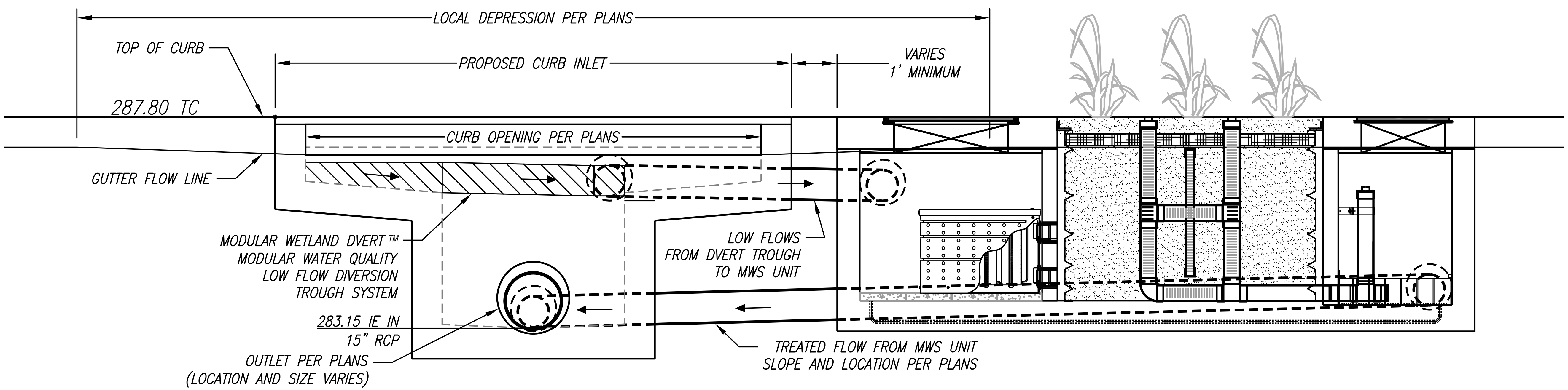
BMP Sizing, Design Details and other Supporting Documentation

DVERT ™

MODULAR WATER QUALITY DIVERSION WEIR SYSTEM



SITE PLAN



TYPICAL SECTION VIEW

INSTALLATION NOTES:

1. TROUGH TO BE CONNECTED TO CONCRETE BELOW CURB OPENING USING 1/2" x 1-1/2" 316 STAINLESS STEEL SPIKE MUSHROOM HEAD DRIVE ANCHORS SPACED 12" ON CETNTER

2. USE DAP CONCRETE WATERTIGHT FILLER & SEALANT TO SEAL SEAM BETWEEN FIBERGLASS WEIR & CONCRETE WALL OF CATCH BASIN.

MODULAR WETLAND SYSTEMS INC.
P.O. BOX 869
OCEANSIDE, CA 92049
www.ModularWetlands.com

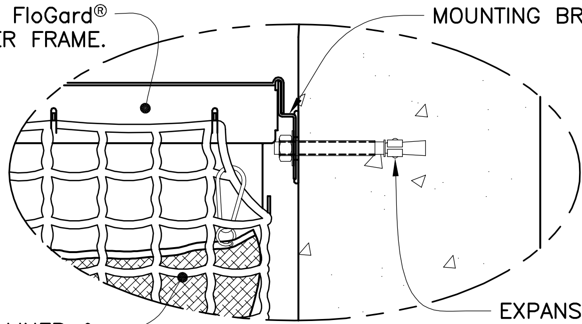
	NAME	DATE
DRAWN		
EDITED		
COMMENTS:		

TITLE: DVERT SYSTEM

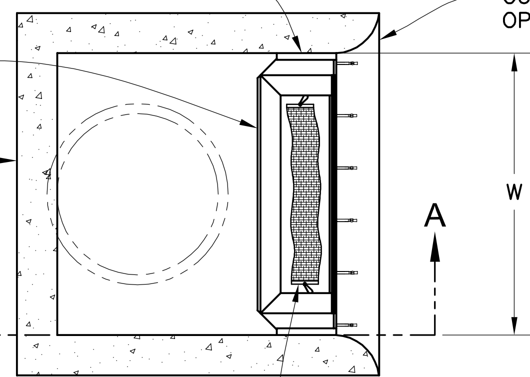
SIZE	DWG. NO.	REV

SCALE NTS | UNITS = INCHES | SHEET 1 OF 1

FGP-0002



DETAIL A
MOUNTING BRACKET & EXPANSION BOLTS
SEE NOTE 2
SCALE: 6X

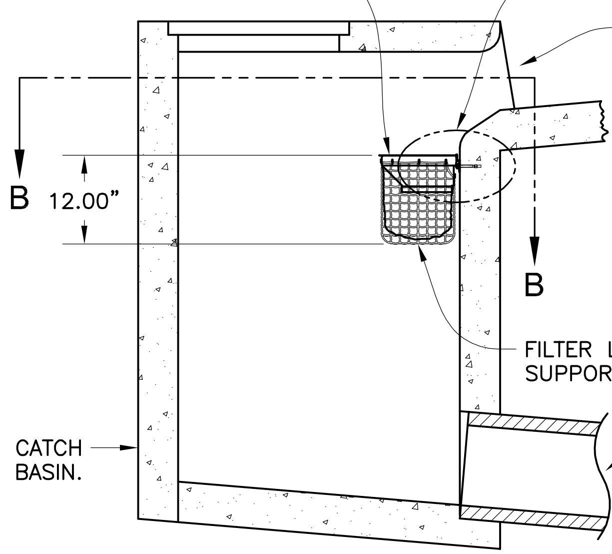


SECTION B-B
TOP VIEW
SCALE: 1X

SPECIFIER CHART				
MODEL NO.	Curb Opening Width - W -	Storage Capacity - Cu. Ft. -	Filtered Flow Rate - GPM/CFS -	Bypass Flow Rate - GPM/CFS -
FGP-24CI	2.0' (24")	.95	338 / .75	2,513 / 5.6
FGP-30CI	2.5' (30")	1.20	450 / 1.00	3,008 / 6.7
FGP-36CI	3.0' (36")	1.50	563 / 1.25	3,547 / 7.9
FGP-42CI	3.5' (42")	1.80	675 / 1.50	3,951 / 8.8
FGP-48CI	4.0' (48")	2.10	768 / 1.76	4,445 / 9.9
FGP-5.0CI	5.0' (60")	2.40	900 / 2.00	5,208 / 11.6
FGP-6.0CI	6.0' (72")	3.05	1,126 / 2.51	6,196 / 13.8
FGP-7.0CI	7.0' (84")	3.65	1,350 / 3.01	7,139 / 15.9
FGP-8.0CI	8.0' (96")	4.25	1,576 / 3.51	8,082 / 18.0
FGP-10.0CI	10.0' (120")	4.85	1,800 / 4.01	9,833 / 21.9
FGP-12.0CI	12.0' (144")	6.10	2,252 / 5.02	11,764 / 26.2
FGP-14.0CI	14.0' (168")	7.30	2,700 / 6.02	13,515 / 30.1
FGP-16.0CI	16.0' (192")	8.55	3.152 / 7.02	15,446 / 34.4
FGP-18.0CI	18.0' (216")	9.45	3,490 / 7.78	17,152 / 38.2
FGP-21.0CI	21.0' (252")	10.95	4,050 / 9.02	19,891 / 44.3
FGP-28.0CI	28.0 (336")	14.60	5,400 / 12.03	26,311 / 58.6

NOTES:

1. Filter insert shall have a high flow bypass feature.
2. Filter support frame shall be constructed from stainless steel Type 304.
3. Filter medium shall be *Fossil Rock ™*, installed and maintained in accordance with manufacturer specifications.
4. Storage capacity reflects 80% of maximum solids collection prior to impeding filtering bypass.



SECTION A-A
SIDE VIEW
SCALE: 1X

Inlet
Filtration

FloGard®

Catch Basin Insert Filter

Curb Inlet Style

Oldcastle®
Stormwater Solutions

7921 Southpark Plaza, Suite 200 | Littleton, CO | 80120 | Ph: 800.579.8819 | oldcastlestormwater.com

DRAWING NO.	REV	ECO	DATE	
FGP-0002	E	ECO-0127 JPR 5/18/15	JPR 1/3/06	SHEET 1 OF 1

Biofilter Products

The Modular Wetland System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity.

MODULAR WETLANDS™

The Modular Wetland System Linear™ (MWS Linear) represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and pre-filter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

Applications

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater applications treating rooftops, streetscapes, parking lots, and industrial sites. The MWS Linear can be used for the following applications: industrial, residential, streets, parking lots, commercial, mixed use, agricultural, reuse, low impact development and waste water.

Performance

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With its advanced pre-treatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses nature's ability to process, transform and remove even the most harmful pollutants.

Approvals

State of Washington TAPE GULD Basic Enhanced/Metals Phosphorus

Washington State TAPE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced and Phosphorus treatment at 1 gpm/ft2 loading rate. The highest performing BMP on the market for all main pollutant categories.

VA

DEQ Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Technical Criteria.

MD

Maryland Department of the Environment Approved

Granted ESD (Environmental Site Design) status for new construction, redevelopment and retrofitting when designed in accordance with the Design Manual.

MA

MASTEP Evaluation

The University of Massachusetts at Amherst – Water Resources Research Center issued a technical evaluation report noting removal rates up to 84% TSS, 70% Total Phosphorus, 68.5% Total Zinc and more.

RI

Rhode Island DEM Approved

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% Pathogens, 30% Total Phosphorus and 30% Total Nitrogen.

Biofilter Products

Orientations

Side-By-Side

The Side-By-Side orientation places the pre-treatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk.

Internal Bypass Weir (Side-by-Side Only)

The Side-By-Side orientation places the pre-treatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pre-treatment chamber directly to the discharge chamber.

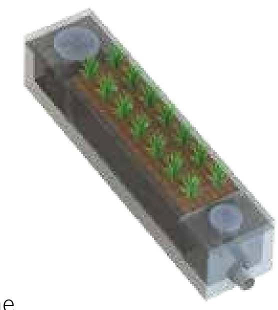
External Diversion Weir Structure

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

Flow By Design

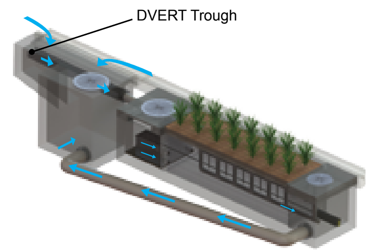
This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

End-To-End



The End-To-End orientation places the pre-treatment and discharge chambers on opposite ends of the biofiltration chamber, therefore minimizing the width of the system to 5 ft (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation.

DVERT Low Flow Diversion



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications.

Flow Based Sizing

Model#	Dimensions	Wetland Media Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4'x4'	23 sq.ft.	0.052
MWS-L-4-6	4'x6'	32 sq.ft.	0.073
MWS-L-4-8	4'x8'	50 sq.ft.	0.115
MWS-L-4-13	4'x13'	63 sq.ft.	0.144
MWS-L-4-15	4'x15'	76 sq.ft.	0.175
MWS-L-4-17	4'x17'	90 sq.ft.	0.206
MWS-L-4-19	4'x19'	103 sq.ft.	0.237
MWS-L-4-21	4'x21'	117 sq.ft.	0.268
MWS-L-6-8	7'x9'	64 sq.ft.	0.147
MWS-L-8-8	8'x8'	100 sq.ft.	0.230
MWS-L-8-12	8'x12'	151 sq.ft.	0.346
MWS-L-8-16	8'x16'	201 sq.ft.	0.462
MWS-L-8-20	9'x21'	252 sq.ft.	0.577
MWS-L-8-24	9'x25'	302 sq.ft.	0.693

Volume Based Sizing

Model #	Treatment Capacity (cu.ft.) @ 24-Hour Drain Down	Treatment Capacity (cu.ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-6-8	3191	6382
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145
MWS-L-8-20	12560	25120
MWS-L-8-24	15108	30216

Biofilter Products

featured advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

Advantages & Operation

① Pre-Treatment

Separation
Trash, sediment and debris are separated before entering the pre-filter cartridges. Designed for easy maintenance access.

Pre-Filter Cartridges
Over 25 sq.ft. of surface area per cartridge. Utilizes BioMediaGREEN filter material. Removes over 80% of TSS & 90% of hydrocarbons. Prevents pollutants that cause clogging from migrating to the biofiltration chamber.

② Bio Filtration

Horizontal Flow
Less clogging than downward flow biofilters. Water flow is subsurface. Improves biological filtration.

Patented Perimeter Void Area
Vertically extends void area between the walls and the WetlandMEDIA on all four sides. Maximizes surface area of the media for higher treatment capacity.

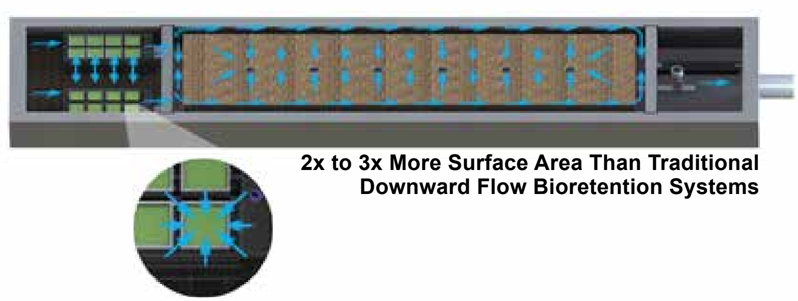
WetlandMEDIA
Contains no organics and removes phosphorus. Greater surface area and 48% void space. Maximum evapo-transpiration. High ion exchange capacity and light weight.

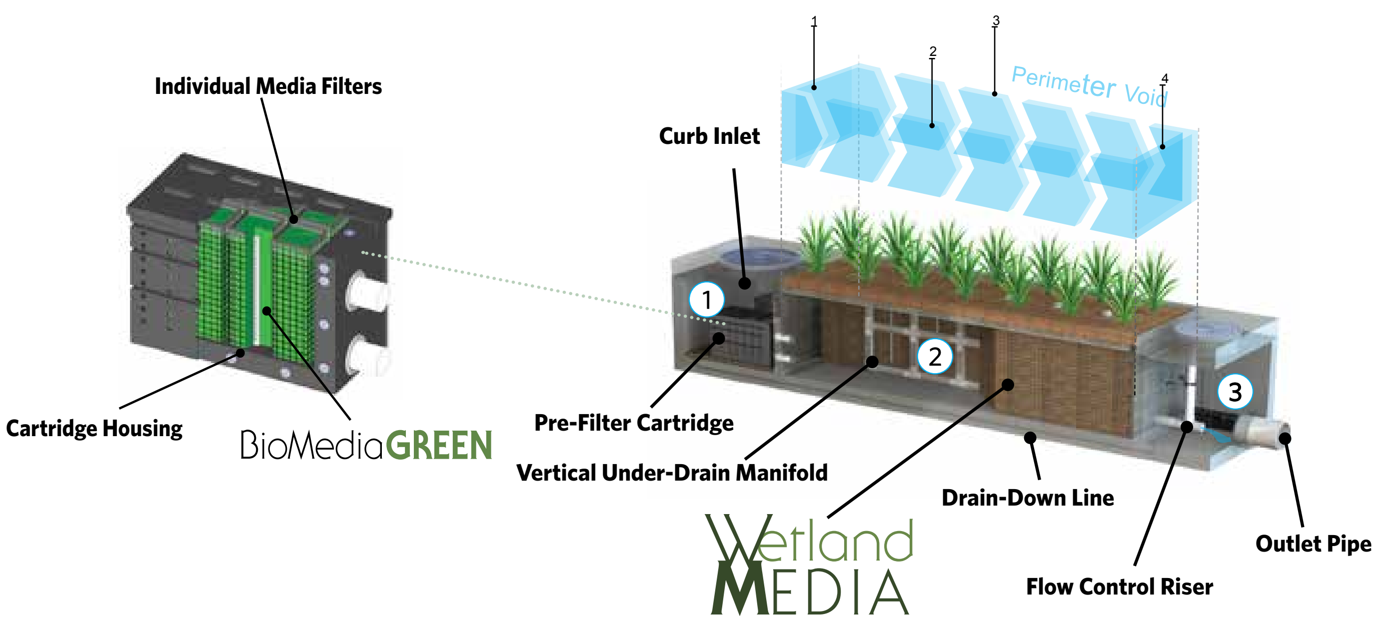
③ Discharge

Flow Control
Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity. Extends the life of the media and improves performance.

Drain-Down Filter
The Drain-Down is an optional feature that completely drains the pre-treatment chamber. Water that drains from the pre-treatment chamber between storm events will be treated.

Top View





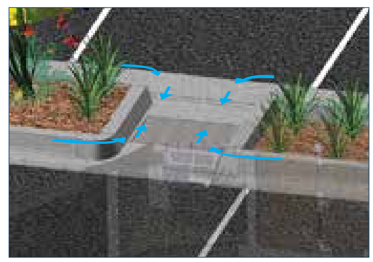
Biofilter Products

Configurations

Curb Type

The Curb Type configuration accepts sheet flow through a curb opening and is commonly used along road ways and parking lots. It can be used in sump or flow by conditions. Length of curb opening varies based on model and size.

Grate Type



The Grate Type configuration offers the same features and benefits as the Curb Type but with a grated/drop inlet above the system's pre-treatment chamber. It has the added benefit of allowing for pedestrian access over the inlet. ADA compliant grates are available to assure easy and safe access. The Grate Type can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.

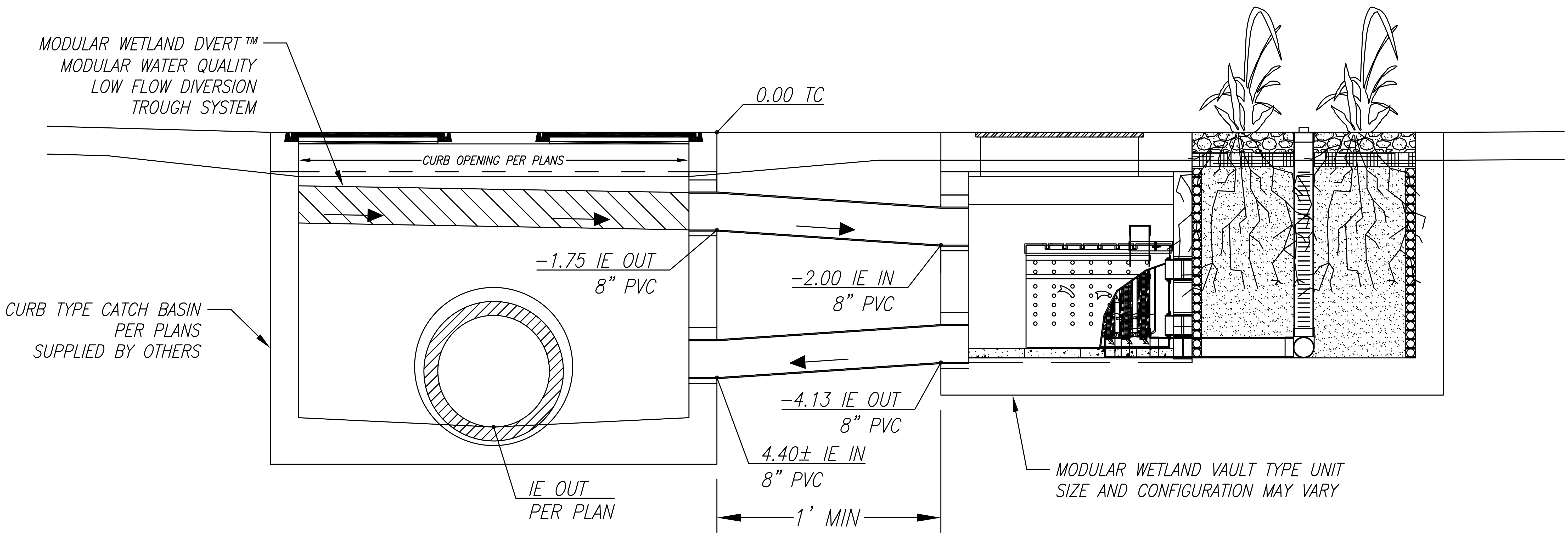
Vault Type

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pre-treatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretention systems. Another benefit of the "pipe in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

Downspout Type

The Downspout Type is a variation of the Vault Type and is designed to accept a vertical downspout pipe from roof top and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter, and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

MODULAR WETLAND SYSTEMS - LINEAR 2.0
STANDARD DVERT ELEVATIONS



TYPICAL ELEVATION VIEW

MODULAR WETLAND SYSTEMS INC. P.O. BOX 869 OCEANSIDE, CA 92049 www.ModularWetlands.com		NAME / DATE	TITLE: MWS LINEAR 2.0 DVERT SETUP
	DRAWN		
	EDITED		
PROPRIETARY AND CONFIDENTIAL THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF MODULAR WETLAND SYSTEMS INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF MODULAR WETLAND SYSTEMS INC. IS PROHIBITED.	COMMENTS:		SIZE / DWG. NO. / REV
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MODULAR WETLANDS™

Advanced ***Stormwater*** *Biofiltration*

MWS Linear

Contents

The Urban Impact

For hundreds of years natural wetlands surrounding our shores have played an integral role as nature's stormwater treatment system. But as our cities grow and develop, these natural wetlands have perished under countless roads, rooftops, and parking lots.

Plant A Wetland

Without natural wetlands our cities are deprived of water purification, flood control, and land stability. Modular Wetlands and the MWS Linear re-establish nature's presence and rejuvenate water ways in urban areas.

MWS Linear

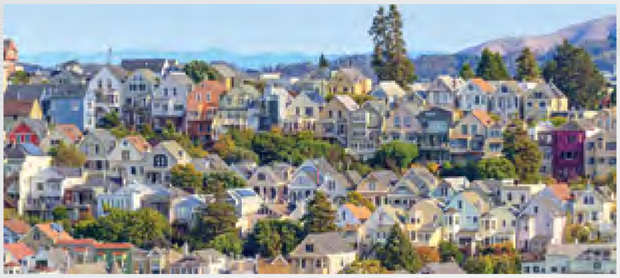
The Modular Wetland System Linear represents a pioneering breakthrough in stormwater technology as the only biofiltration system to utilize patented horizontal flow, allowing for a smaller footprint and higher treatment capacity. While most biofilters use little or no pre-treatment, the MWS Linear incorporates an advanced pre-treatment chamber that includes separation and pre-filter cartridges. In this chamber sediment and hydrocarbons are removed from runoff before it enters the biofiltration chamber, in turn reducing maintenance costs and improving performance.

Applications

The MWS Linear has been successfully used on numerous new construction and retrofit projects. The system's superior versatility makes it beneficial for a wide range of stormwater and waste water applications - treating rooftops, streetscapes, parking lots, and industrial sites.

Industrial

Many states enforce strict regulations for discharges from industrial sites. The MWS Linear has helped various sites meet difficult EPA mandated effluent limits for dissolved metals and other pollutants.



Residential

Low to high density developments can benefit from the versatile design of the MWS Linear. The system can be used in both decentralized LID design and cost-effective end-of-the-line configurations.

Streets

Street applications can be challenging due to limited space. The MWS Linear is very adaptable, and offers the smallest footprint to work around the constraints of existing utilities on retrofit projects.

Parking Lots

Parking lots are designed to maximize space and the MWS Linear's 4 ft. standard planter width allows for easy integration into parking lot islands and other landscape medians.

Commercial

Compared to bioretention systems, the MWS Linear can treat far more area in less space - meeting treatment and volume control requirements.

Mixed Use

The MWS Linear can be installed as a raised planter to treat runoff from rooftops or patios, making it perfect for sustainable "live-work" spaces.

More applications are available on our website: www.ModularWetlands.com/Applications

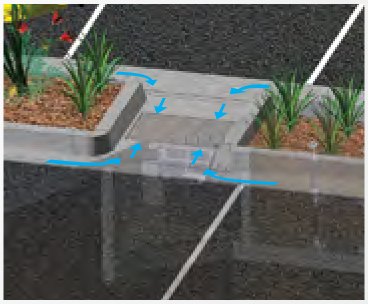
- Agriculture
- Reuse
- Low Impact Development
- Waste Water


Configurations

The MWS Linear is the preferred biofiltration system of Civil Engineers across the country due to its versatile design. This highly versatile system has available "pipe-in" options on most models, along with built-in curb or grated inlets for simple integration into your stormdrain design.

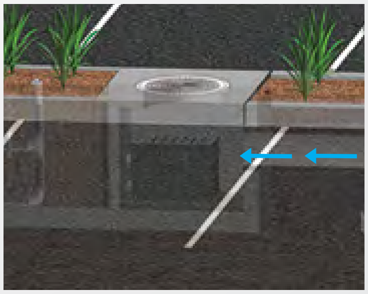
Curb Type

The *Curb Type* configuration accepts sheet flow through a curb opening and is commonly used along road ways and parking lots. It can be used in sump or flow by conditions. Length of curb opening varies based on model and size.



Grate Type

The *Grate Type* configuration offers the same features and benefits as the *Curb Type* but with a grated/drop inlet above the systems pre-treatment chamber. It has the added benefit of allowing for pedestrian access over the inlet. ADA compliant grates are available to assure easy and safe access. The *Grate Type* can also be used in scenarios where runoff needs to be intercepted on both sides of landscape islands.



Vault Type

The system's patented horizontal flow biofilter is able to accept inflow pipes directly into the pre-treatment chamber, meaning the MWS Linear can be used in end-of-the-line installations. This greatly improves feasibility over typical decentralized designs that are required with other biofiltration/bioretention systems. Another benefit of the "pipe in" design is the ability to install the system downstream of underground detention systems to meet water quality volume requirements.

Downspout Type

The *Downspout Type* is a variation of the *Vault Type* and is designed to accept a vertical downspout pipe from roof top and podium areas. Some models have the option of utilizing an internal bypass, simplifying the overall design. The system can be installed as a raised planter and the exterior can be stuccoed or covered with other finishes to match the look of adjacent buildings.

Advantages & Operation

The MWS Linear is the most efficient and versatile biofiltration system on the market, and the only system with horizontal flow which improves performance, reduces footprint, and minimizes maintenance. Figure-1 and Figure-2 illustrate the invaluable benefits of horizontal flow and the multiple treatment stages.

Featured Advantages

- Horizontal Flow Biofiltration
- Greater Filter Surface Area
- Pre-Treatment Chamber
- Patented Perimeter Void Area
- Flow Control
- No Depressed Planter Area

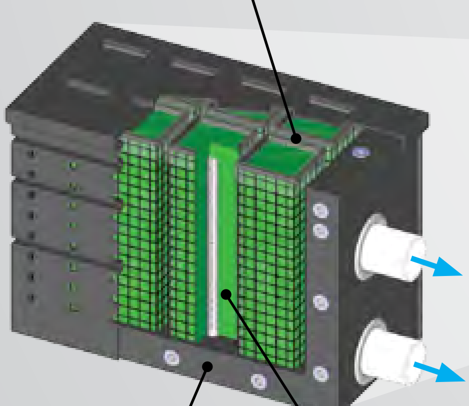
1 Pre-Treatment

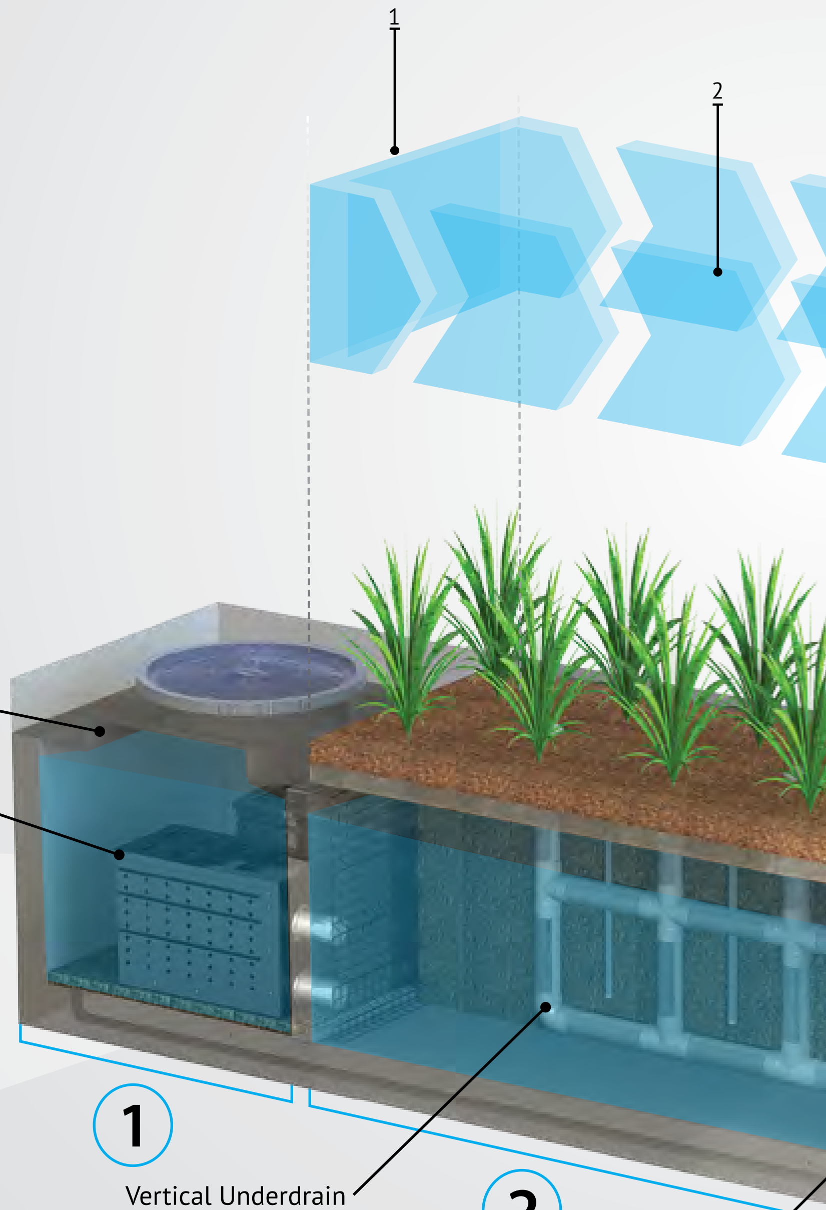
Separation

- Trash, sediment, and debris are separated before entering the pre-filter cartridges
- Designed for easy maintenance access

Pre-Filter Cartridges

- Over 25 ft^2 of surface area per cartridge
- Utilizes BioMediaGREEN filter material
- Removes over 80% of TSS & 90% of hydrocarbons
- Prevents pollutants that cause clogging from migrating to the biofiltration chamber





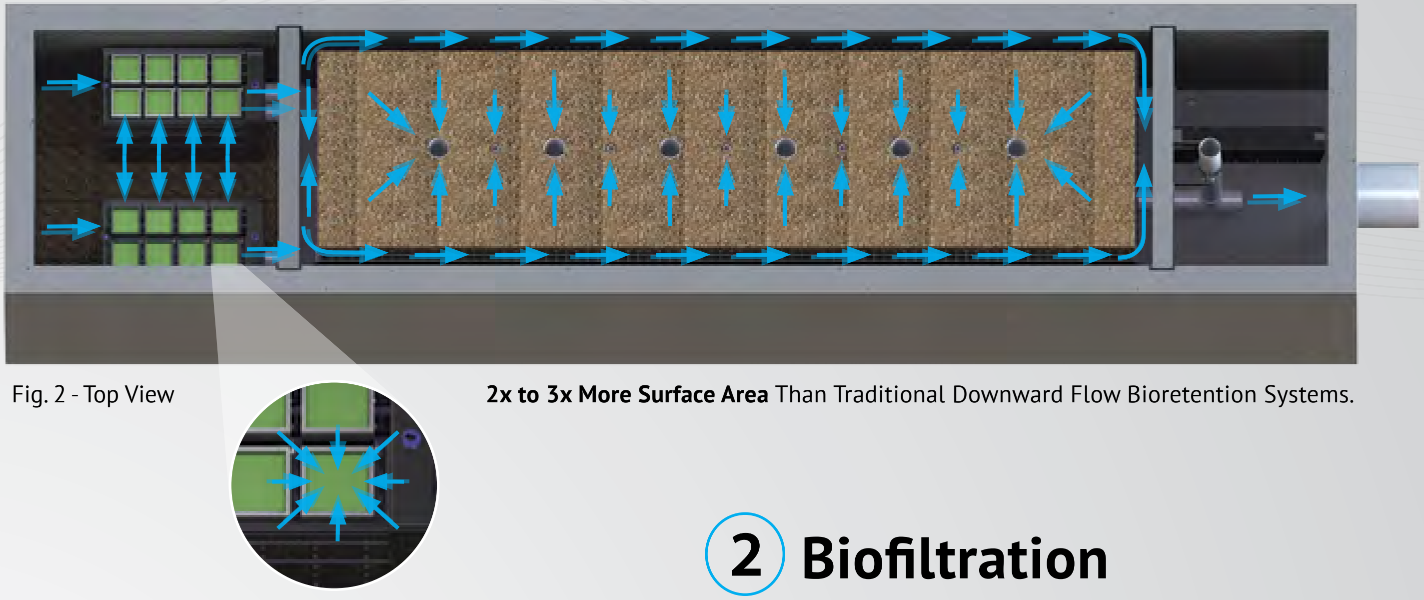


Fig. 2 - Top View

2x to 3x More Surface Area Than Traditional Downward Flow Bioretention Systems.

2 Biofiltration

Horizontal Flow

- Less clogging than downward flow biofilters
- Water flow is subsurface
- Improves biological filtration

Patented Perimeter Void Area

- Vertically extends void area between the walls and the WetlandMEDIA on all four sides.
- Maximizes surface area of the media for higher treatment capacity

WetlandMEDIA

- Contains no organics and removes phosphorus
- Greater surface area and 48% void space
- Maximum evapotranspiration
- High ion exchange capacity and light weight

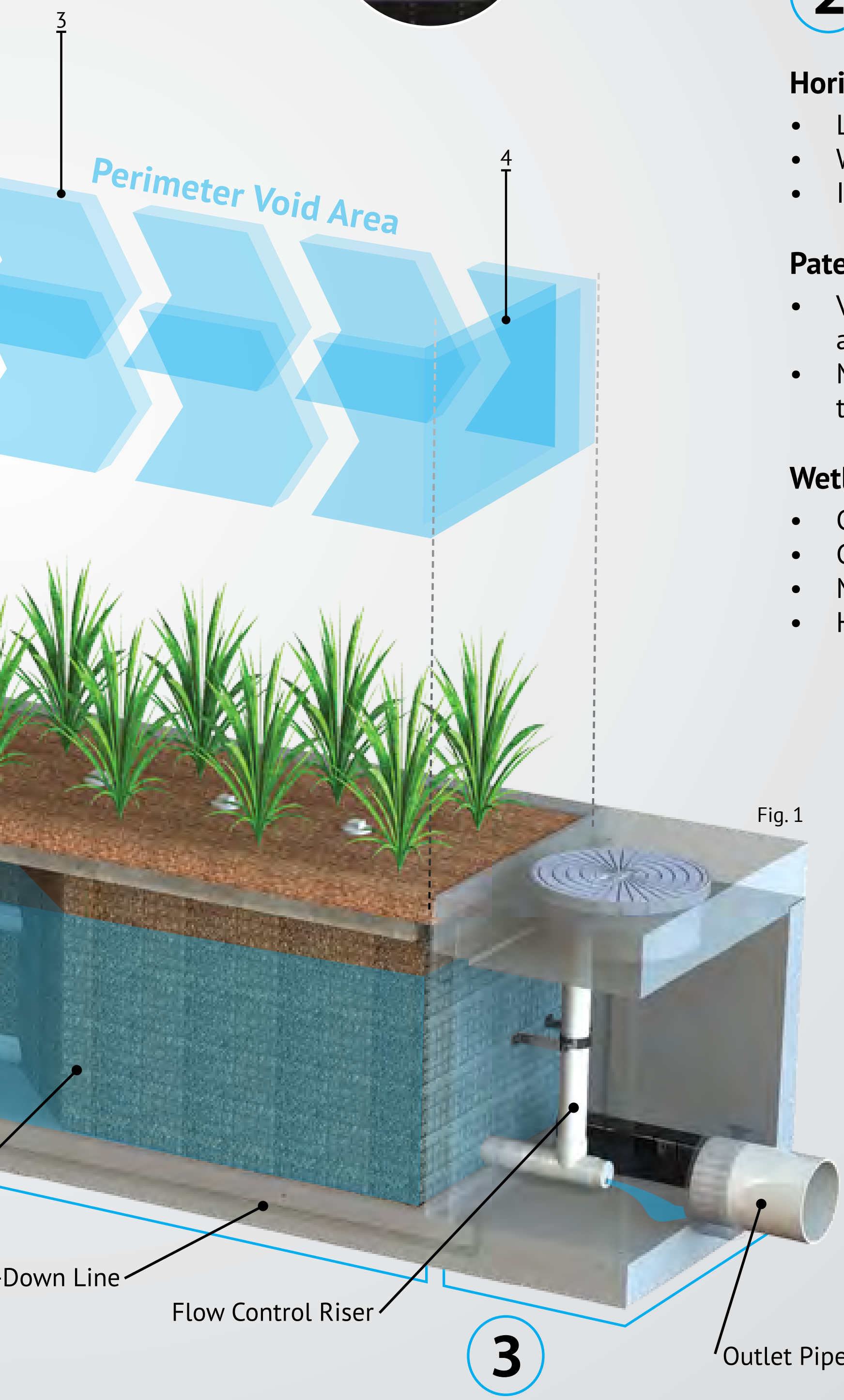


Fig. 1

3 Discharge

Flow Control

- Orifice plate controls flow of water through WetlandMEDIA to a level lower than the media's capacity.
- Extends the life of the media and improves performance

Drain-Down Filter

- The Drain-Down is an optional feature that completely drains the pre-treatment chamber
- Water that drains from the pre-treatment chamber between storm events will be treated

Orientations

Side-By-Side

The *Side-By-Side* orientation places the pre-treatment and discharge chamber adjacent to one another with the biofiltration chamber running parallel on either side. This minimizes the system length, providing a highly compact footprint. It has been proven useful in situations such as streets with directly adjacent sidewalks, as half of the system can be placed under that sidewalk. This orientation also offers internal bypass options as discussed below.

End-To-End

The *End-To-End* orientation places the pre-treatment and discharge chambers on opposite ends of the biofiltration chamber therefore minimizing the width of the system to 5 ft (outside dimension). This orientation is perfect for linear projects and street retrofits where existing utilities and sidewalks limit the amount of space available for installation. One limitation of this orientation is bypass must be external.

Bypass

Internal Bypass Weir (Side-by-Side Only)

The *Side-By-Side* orientation places the pre-treatment and discharge chambers adjacent to one another allowing for integration of internal bypass. The wall between these chambers can act as a bypass weir when flows exceed the system's treatment capacity, thus allowing bypass from the pre-treatment chamber directly to the discharge chamber.

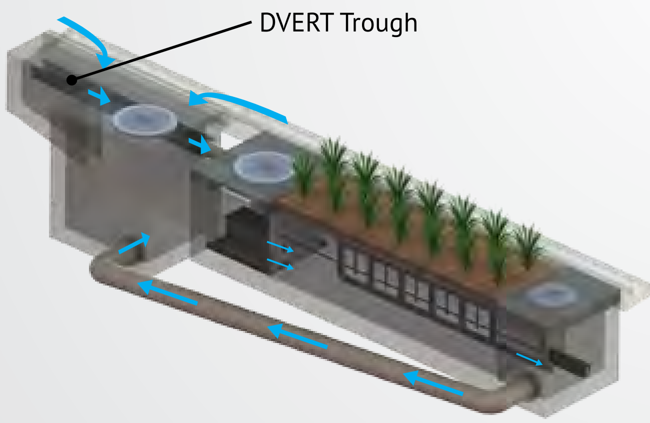
External Diversion Weir Structure

This traditional offline diversion method can be used with the MWS Linear in scenarios where runoff is being piped to the system. These simple and effective structures are generally configured with two outflow pipes. The first is a smaller pipe on the upstream side of the diversion weir - to divert low flows over to the MWS Linear for treatment. The second is the main pipe that receives water once the system has exceeded treatment capacity and water flows over the weir.

Flow By Design

This method is one in which the system is placed just upstream of a standard curb or grate inlet to intercept the first flush. Higher flows simply pass by the MWS Linear and into the standard inlet downstream.

DVERT Low Flow Diversion



This simple yet innovative diversion trough can be installed in existing or new curb and grate inlets to divert the first flush to the MWS Linear via pipe. It works similar to a rain gutter and is installed just below the opening into the inlet. It captures the low flows and channels them over to a connecting pipe exiting out the wall of the inlet and leading to the MWS Linear. The DVERT is perfect for retrofit and green street applications that allows the MWS Linear to be installed anywhere space is available.

Performance

The MWS Linear continues to outperform other treatment methods with superior pollutant removal for TSS, heavy metals, nutrients, hydrocarbons and bacteria. Since 2007 the MWS Linear has been field tested on numerous sites across the country. With it's advanced pre-treatment chamber and innovative horizontal flow biofilter, the system is able to effectively remove pollutants through a combination of physical, chemical, and biological filtration processes. With the same biological processes found in natural wetlands, the MWS Linear harnesses natures ability to process, transform, and remove even the most harmful pollutants.

Approvals

The MWS Linear has successfully met years of challenging technical reviews and testing from some of the most prestigious and demanding agencies in the nation, and perhaps the world.

WA

Washington State DOE Approved

The MWS Linear is approved for General Use Level Designation (GULD) for Basic, Enhanced, and Phosphorus treatment at 1 gpm/ft^2 loading rate. The highest performing BMP on the market for all main pollutant categories.

TSS	Total Phosphorus	Ortho Phosphorus	Nitrogen	Dissolved Zinc	Dissolved Copper	Total Zinc	Total Copper	Motor Oil
85%	64%	67%	45%	66%	38%	69%	50%	95%

VA

DEQ Assignment

The Virginia Department of Environmental Quality assigned the MWS Linear, the highest phosphorus removal rating for manufactured treatment devices to meet the new Virginia Stormwater Management Program (VSMP) Technical Criteria.

MA

MASTEP Evaluation

The University of Massachusetts at Amherst – Water Resources Research Center, issued a technical evaluation report noting removal rates up to 84% TSS, 70% Total Phosphorus, 68.5% Total Zinc, and more.

RI

Rhode Island DEM Approved

Approved as an authorized BMP and noted to achieve the following minimum removal efficiencies: 85% TSS, 60% Pathogens, 30% Total Phosphorus for discharges to freshwater systems, and 30% Total Nitrogen for discharges to saltwater or tidal systems.

Flow Based Sizing

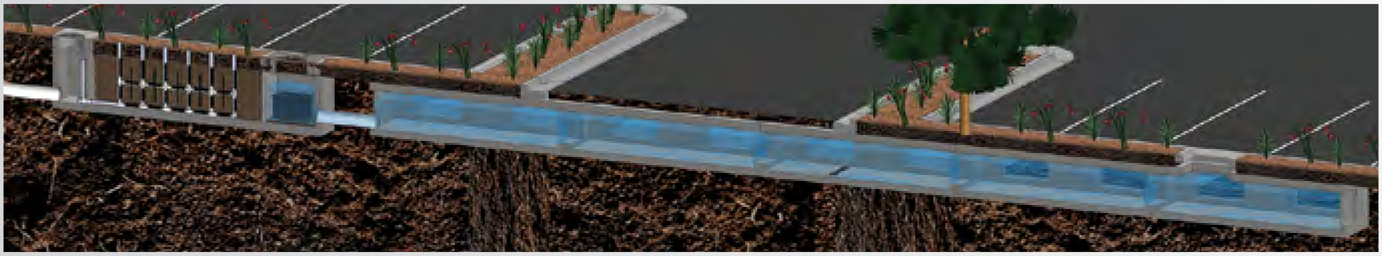
The MWS Linear can be used in stand alone applications to meet treatment flow requirements. Since the MWS Linear is the only biofiltration system that can accept inflow pipes several feet below the surface it can be used not only in decentralized design applications but also as a large central end-of-the-line application for maximum feasibility.

Treatment Flow Sizing Table

Model #	Dimensions	WetlandMedia Surface Area	Treatment Flow Rate (cfs)
MWS-L-4-4	4' x 4'	23 ft^2	0.052
MWS-L-4-6	4' x 6'	32 ft^2	0.073
MWS-L-4-8	4' x 8'	50 ft^2	0.115
MWS-L-4-13	4' x 13'	63 ft^2	0.144
MWS-L-4-15	4' x 15'	76 ft^2	0.175
MWS-L-4-17	4' x 17'	90 ft^2	0.206
MWS-L-4-19	4' x 19'	103 ft^2	0.237
MWS-L-4-21	4' x 21'	117 ft^2	0.268
MWS-L-8-8	8' x 8'	100 ft^2	0.230
MWS-L-8-12	8' x 12'	151 ft^2	0.346
MWS-L-8-16	8' x 16'	201 ft^2	0.462

Volume Based Sizing

Many states require treatment of a water quality volume and do not offer the option of flow based design. The MWS Linear and its unique horizontal flow makes it the only biofilter that can be used in volume based design installed downstream of ponds, detention basins, and underground storage systems.



Treatment Volume Sizing Table

Model #	Treatment Capacity (cu. ft.) @ 24-Hour Drain Down	Treatment Capacity (cu. ft.) @ 48-Hour Drain Down
MWS-L-4-4	1140	2280
MWS-L-4-6	1600	3200
MWS-L-4-8	2518	5036
MWS-L-4-13	3131	6261
MWS-L-4-15	3811	7623
MWS-L-4-17	4492	8984
MWS-L-4-19	5172	10345
MWS-L-4-21	5853	11706
MWS-L-8-8	5036	10072
MWS-L-8-12	7554	15109
MWS-L-8-16	10073	20145

Installation

The MWS Linear is simple, easy to install, and has a space efficient design that offers lower excavation and installation costs compared to traditional tree-box type systems. The structure of the system resembles pre-cast catch basin or utility vaults and is installed in a similar fashion.

The system is delivered fully assembled for quick installation. Generally, the structure can be unloaded and set in place in 15 minutes. Our experienced team of field technicians are available to supervise installations and provide technical support.

Maintenance

Reduce your maintenance costs, man hours, and materials with the MWS Linear. Unlike other biofiltration systems that provide no pre-treatment, the MWS Linear is a self-contained treatment train which incorporates simple and effective pre-treatment.

Maintenance requirements for the biofilter itself are almost completely eliminated, as the pre-treatment chamber removes and isolates trash, sediments, and hydrocarbons. What's left is the simple maintenance of an easily accessible pre-treatment chamber that can be cleaned by hand or with a standard vac truck. Only periodic replacement of low-cost media in the pre-filter cartridges is required for long term operation and there is absolutely no need to replace expensive biofiltration media.

Plant Selection

Abundant plants, trees, and grasses bring value and an aesthetic benefit to any urban setting, but those in the MWS Linear do even more - they increase pollutant removal. What's not seen, but very important, is that below grade the stormwater runoff/flow is being subjected to nature's secret weapon: a dynamic physical, chemical, and biological process working to break down and remove non-point source pollutants. The flow rate is controlled in the MWS Linear, giving the plants more "contact time" so that pollutants are more successfully decomposed, volatilized and incorporated into the biomass of The MWS Linear's micro/macro flora and fauna.

A wide range of plants are suitable for use in the MWS Linear, but selections vary by location and climate. View suitable plants by selecting the list relative to your project location's hardy zone.

Please visit www.ModularWetlands.com/Plants for more information and various plant lists.

MWS Linear 2.0 Flow Based Sizing Calculations - *State of California*

Model #	Physical Depth of Model from TC, FS, TC to INVERT OUT	Wetland Perimiter (ft)	**Wetland Chamber Max HGL Height (ft)	Wetland Surface Area (sq ft)	Treatment Capacity for Flow Based Design **FLOW DESIGN**	
					GPM	CFS
MWS-L-4-4	4.13'	6.7	3.40	22.78	**23.46**	**0.052**
MWS-L-4-6	4.13'	9.4	3.40	31.96	**32.92**	**0.073**
MWS-L-4-8	4.13'	14.8	3.40	50.32	**51.83**	**0.115**
MWS-L-4-13	4.13'	18.4	3.40	62.56	**64.44**	**0.144**
MWS-L-4-15	4.13'	22.4	3.40	76.16	**78.44**	**0.175**
MWS-L-4-17	4.13'	26.4	3.40	89.76	**92.45**	**0.206**
MWS-L-4-19	4.13'	30.4	3.40	103.36	**106.46**	**0.237**
MWS-L-4-21	4.13'	34.4	3.40	116.96	**120.47**	**0.268**
MWS-L-8-12	4.13'	44.4	3.40	150.96	**155.49**	**0.346**
MWS-L-8-16	4.13'	59.2	3.40	201.28	**207.32**	**0.462**

Shallow or Deeper Units Available. Change in Height Will Affect Treatment Capacity

** Not the physical height of the unit but the max HGL in the system at peak treatment flow rate

Based on loading rate of 100 in/hr or 1.03 gpm/sq ft

MODULAR WETLANDS

Modular Wetland Systems, Inc. **www.modularwetlands.com**

info@modularwetlands.com **P: 760-433-7640** **2972 San Luis Rey Rd, Oceanside CA 92058**

MWS Linear 2.0 Volume Based Sizing Calculations - *All States*

Model #	Physical Depth of Model from TC, FS, TC to INVERT OUT	Wetland Perimiter (ft)	**Wetland Chamber Max HGL Height (ft)	Wetland Surface Area (sq ft)	Treatment Capacity for Volume Based Design **VOLUME DESIGN**	
					24 Hour Drain Down	48 Hour Drain Down
MWS-L-4-4	4.13'	6.7	3.40	22.78	**1139.96**	**2279.93**
MWS-L-4-6	4.13'	9.4	3.40	31.96	**1599.35**	**3198.71**
MWS-L-4-8	4.13'	14.8	3.40	50.32	**2518.13**	**5036.26**
MWS-L-4-13	4.13'	18.4	3.40	62.56	**3130.65**	**6261.30**
MWS-L-4-15	4.13'	22.4	3.40	76.16	**3811.22**	**7622.45**
MWS-L-4-17	4.13'	26.4	3.40	89.76	**4491.80**	**8983.60**
MWS-L-4-19	4.13'	30.4	3.40	103.36	**5172.37**	**10344.75**
MWS-L-4-21	4.13'	34.4	3.40	116.96	**5852.95**	**11705.90**
MWS-L-8-12	4.13'	44.4	3.40	150.96	**7554.39**	**15108.78**
MWS-L-8-16	4.13'	59.2	3.40	201.28	**10072.52**	**20145.04**
MWS-L-10-20	4.13'	88.8	3.40	301.92	**15108.78**	**30217.56**

Shallow or Deeper Units Available. Change in Height Will Affect Treatment Capacity

** Not the physical height of the unit but the max HGL in the system at peak treatment flow rate

Based on loading rate of 25 in/hr or 0.26 gpm/sq ft

info@modularwetlands.com **P: 760-433-7640** **2972 San Luis Rey Rd, Oceanside CA 92058**

Modular Wetland Sizing Guide: The Homestead

Modular Wetland Size	Modular Wetland allowable Q (cfs)	Assumed Impervious Percentage	Intensity (in/hr)	Composite Runoff Factor	Allowable Drainage Area (AC)
MWS-L-4-4	0.052	90%	0.20	0.72	0.29
MWS-L-4-6	0.073	90%	0.20	0.72	0.51
MWS-L-4-8	0.115	90%	0.20	0.72	0.80
MWS-L-4-13	0.144	90%	0.20	0.72	1.00
MWS-L-4-15	0.175	90%	0.20	0.72	1.22
MWS-L-4-17	0.206	90%	0.20	0.72	1.44
MWS-L-4-19	0.237	90%	0.20	0.72	1.65
MWS-L-4-21	0.268	90%	0.20	0.72	1.87
MWS-L-6-8	0.147	90%	0.20	0.72	1.02
MWS-L-8-8	0.230	90%	0.20	0.72	1.60
MWS-L-8-12	0.346	90%	0.20	0.72	2.41
MWS-L-8-16	0.462	90%	0.20	0.72	3.22
MWS-L-8-20	0.577	90%	0.20	0.72	4.02
MWS-L-8-24	0.693	90%	0.20	0.72	4.83

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern

The proposed development disturbs more than one acre and all downstream conveyance channels to Cucamonga Creek lower reach, which ultimately discharges into Prado Dam. This is an adequate sump that is regularly maintained to ensure design flow capacity. Therefore, the proposed development is HCOC compliant and is not subject to mitigate for hydromodification.

Appendix 8: Source Control

Pollutant Sources/Source Control Checklist

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

How to use this worksheet (also see instructions in Section G of the WQMP Template):

1. Review Column 1 and identify which of these potential sources of stormwater pollutants apply to your site. Check each box that applies.
2. Review Column 2 and incorporate all of the corresponding applicable BMPs in your WQMP Exhibit.
3. Review Columns 3 and 4 and incorporate all of the corresponding applicable permanent controls and operational BMPs in your WQMP. Use the format shown in Table G.1on page 23 of this WQMP Template. Describe your specific BMPs in an accompanying narrative, and explain any special conditions or situations that required omitting BMPs or substituting alternative BMPs for those shown here.

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ A. **On-site storm drain inlets**	☒ **Locations of inlets.**	☒ **Mark all inlets with the words "Only Rain Down the Storm Drain" or similar. Catch Basin Markers may be available from the Riverside County Flood Control and Water Conservation District, call 951.955.1200 to verify.**	☒ **Maintain and periodically repaint or replace inlet markings.** ☒ **Provide stormwater pollution prevention information to new site owners, lessees, or operators.** ☒ **See applicable operational BMPs in Fact Sheet SC-44, "Drainage System Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** ☒ **Include the following in lease agreements: "Tenant shall not allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drains."**
❑ B. **Interior floor drains and elevator shaft sump pumps**		❑ **State that interior floor drains and elevator shaft sump pumps will be plumbed to sanitary sewer.**	❑ **Inspect and maintain drains to prevent blockages and overflow.**
❑ C. **Interior parking garages**		❑ **State that parking garage floor drains will be plumbed to the sanitary sewer.**	❑ **Inspect and maintain drains to prevent blockages and overflow.**

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE …	… THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ D1. **Need for future indoor & structural pest control**		❑ **Note building design features that discourage entry of pests.**	❑ **Provide Integrated Pest Management information to owners, lessees, and operators.**
❑ D2. **Landscape/ Outdoor Pesticide Use**	❑ **Show locations of native trees or areas of shrubs and ground cover to be undisturbed and retained.** ❑ **Show self-retaining landscape areas, if any.** ❑ **Show stormwater treatment and hydrograph modification management BMPs. (See instructions in Chapter 3, Step 5 and guidance in Chapter 5.)**	**State that final landscape plans will accomplish all of the following.** ❑ **Preserve existing native trees, shrubs, and ground cover to the maximum extent possible.** ❑ **Design landscaping to minimize irrigation and runoff, to promote surface infiltration where appropriate, and to minimize the use of fertilizers and pesticides that can contribute to stormwater pollution.** ❑ **Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions.** ❑ **Consider using pest-resistant plants, especially adjacent to hardscape.** ❑ **To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.**	❑ **Maintain landscaping using minimum or no pesticides.** ❑ **See applicable operational BMPs in "What you should know for…..Landscape and Gardening"** at http://rcflood.org/stormwater/**Error! Hyperlink reference not valid.** ❑ **Provide IPM information to new owners, lessees and operators.**

S T O R M W A T E R   P O L L U T A N T   S O U R C E S / S O U R C E   C O N T R O L   C H E C K L I S T

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ E. **Pools, spas, ponds, decorative fountains, and other water features.**	❑ **Show location of water feature and a sanitary sewer cleanout in an accessible area within 10 feet. (Exception: Public pools must be plumbed according to County Department of Environmental Health Guidelines.)**	**If the Co-Permittee requires pools to be plumbed to the sanitary sewer, place a note on the plans and state in the narrative that this connection will be made according to local requirements.**	❑ **See applicable operational BMPs in** "Guidelines for Maintaining Your Swimming Pool, Jacuzzi and Garden Fountain" at http://rcflood.org/stormwater/
❑ F. **Food service**	❑ **For restaurants, grocery stores, and other food service operations, show location (indoors or in a covered area outdoors) of a floor sink or other area for cleaning floor mats, containers, and equipment.** ❑ **On the drawing, show a note that this drain will be connected to a grease interceptor before discharging to the sanitary sewer.**	❑ **Describe the location and features of the designated cleaning area.** ❑ **Describe the items to be cleaned in this facility and how it has been sized to insure that the largest items can be accommodated.**	❑ **See the brochure, "**The Food Service Industry Best Management Practices for: Restaurants, Grocery Stores, Delicatessens and Bakeries" at http://rcflood.org/stormwater/ **Provide this brochure to new site owners, lessees, and operators.**
❑ G. **Refuse areas**	❑ **Show where site refuse and recycled materials will be handled and stored for pickup. See local municipal requirements for sizes and other details of refuse areas.** ❑ **If dumpsters or other receptacles are outdoors, show how the designated area will be covered, graded, and paved to prevent run-on and show locations of berms to prevent runoff from the area.** ❑ **Any drains from dumpsters, compactors, and tallow bin areas shall be connected to a grease removal device before discharge to sanitary sewer.**	❑ **State how site refuse will be handled and provide supporting detail to what is shown on plans.** ❑ **State that signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.**	❑ **State how the following will be implemented:** **Provide adequate number of receptacles. Inspect receptacles regularly; repair or replace leaky receptacles. Keep receptacles covered. Prohibit/prevent dumping of liquid or hazardous wastes. Post "no hazardous materials" signs. Inspect and pick up litter daily and clean up spills immediately. Keep spill control materials available on-site. See Fact Sheet SC-34, "Waste Handling and Disposal" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ H. **Industrial processes.**	☒ **Show process area.**	☒ **If industrial processes are to be located on site, state: "All process activities to be performed indoors. No processes to drain to exterior or to storm drain system."**	☒ **See Fact Sheet SC-10, "Non-Stormwater Discharges" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com** See the brochure "Industrial & Commercial Facilities Best Management Practices for: Industrial, Commercial Facilities" at http://rcflood.org/stormwater/

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ I. **Outdoor storage of equipment or materials. (See rows J and K for source control measures for vehicle cleaning, repair, and maintenance.)**	❑ **Show any outdoor storage areas, including how materials will be covered. Show how areas will be graded and bermed to prevent run-on or run-off from area.** ❑ **Storage of non-hazardous liquids shall be covered by a roof and/or drain to the sanitary sewer system, and be contained by berms, dikes, liners, or vaults.** ❑ **Storage of hazardous materials and wastes must be in compliance with the local hazardous materials ordinance and a Hazardous Materials Management Plan for the site.**	**Include a detailed description of materials to be stored, storage areas, and structural features to prevent pollutants from entering storm drains.** **Where appropriate, reference documentation of compliance with the requirements of Hazardous Materials Programs for:** ▪ **Hazardous Waste Generation** ▪ **Hazardous Materials Release Response and Inventory** ▪ **California Accidental Release (CalARP)** ▪ **Aboveground Storage Tank** ▪ **Uniform Fire Code Article 80 Section 103(b) & (c) 1991** ▪ **Underground Storage Tank** **www.cchealth.org/groups/hazmat/**	❑ **See the Fact Sheets SC-31, "Outdoor Liquid Container Storage" and SC-33, "Outdoor Storage of Raw Materials " in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ J. **Vehicle and Equipment Cleaning**	❑ **Show on drawings as appropriate:** **(1) Commercial/industrial facilities having vehicle/equipment cleaning needs shall either provide a covered, bermed area for washing activities or discourage vehicle/equipment washing by removing hose bibs and installing signs prohibiting such uses.** **(2) Multi-dwelling complexes shall have a paved, bermed, and covered car wash area (unless car washing is prohibited on-site and hoses are provided with an automatic shut-off to discourage such use).** **(3) Washing areas for cars, vehicles, and equipment shall be paved, designed to prevent run-on to or runoff from the area, and plumbed to drain to the sanitary sewer.** **(4) Commercial car wash facilities shall be designed such that no runoff from the facility is discharged to the storm drain system. Wastewater from the facility shall discharge to the sanitary sewer, or a wastewater reclamation system shall be installed.**	❑ **If a car wash area is not provided, describe any measures taken to discourage on-site car washing and explain how these will be enforced.**	**Describe operational measures to implement the following (if applicable):** ❑ **Washwater from vehicle and equipment washing operations shall not be discharged to the storm drain system.** Refer to "Outdoor Cleaning Activities and Professional Mobile Service Providers" for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/ ❑**Car dealerships and similar may rinse cars with water only.**

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ K. **Vehicle/Equipment Repair and Maintenance**	❑ **Accommodate all vehicle equipment repair and maintenance indoors. Or designate an outdoor work area and design the area to prevent run-on and runoff of stormwater.** ❑ **Show secondary containment for exterior work areas where motor oil, brake fluid, gasoline, diesel fuel, radiator fluid, acid-containing batteries or other hazardous materials or hazardous wastes are used or stored. Drains shall not be installed within the secondary containment areas.** ❑ **Add a note on the plans that states either (1) there are no floor drains, or (2) floor drains are connected to wastewater pretreatment systems prior to discharge to the sanitary sewer and an industrial waste discharge permit will be obtained.**	❑ **State that no vehicle repair or maintenance will be done outdoors, or else describe the required features of the outdoor work area.** ❑ **State that there are no floor drains or if there are floor drains, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.** ❑ **State that there are no tanks, containers or sinks to be used for parts cleaning or rinsing or, if there are, note the agency from which an industrial waste discharge permit will be obtained and that the design meets that agency's requirements.**	**In the Stormwater Control Plan, note that all of the following restrictions apply to use the site:** ❑ **No person shall dispose of, nor permit the disposal, directly or indirectly of vehicle fluids, hazardous materials, or rinsewater from parts cleaning into storm drains.** ❑ **No vehicle fluid removal shall be performed outside a building, nor on asphalt or ground surfaces, whether inside or outside a building, except in such a manner as to ensure that any spilled fluid will be in an area of secondary containment. Leaking vehicle fluids shall be contained or drained from the vehicle immediately.** ❑ **No person shall leave unattended drip parts or other open containers containing vehicle fluid, unless such containers are in use or in an area of secondary containment.** Refer to "Automotive Maintenance & Car Care Best Management Practices for Auto Body Shops, Auto Repair Shops, Car Dealerships, Gas Stations and Fleet Service Operations". Brochure can be found at http://rcflood.org/stormwater/ Refer to Outdoor Cleaning Activities and Professional Mobile Service Providers for many of the Potential Sources of Runoff Pollutants categories below. Brochure can be found at http://rcflood.org/stormwater/

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ L. **Fuel Dispensing Areas**	❑ **Fueling areas[6] shall have impermeable floors (i.e., portland cement concrete or equivalent smooth impervious surface) that are: a) graded at the minimum slope necessary to prevent ponding; and b) separated from the rest of the site by a grade break that prevents run-on of stormwater to the maximum extent practicable.** ❑ **Fueling areas shall be covered by a canopy that extends a minimum of ten feet in each direction from each pump. [Alternative: The fueling area must be covered and the cover's minimum dimensions must be equal to or greater than the area within the grade break or fuel dispensing area[1].] The canopy [or cover] shall not drain onto the fueling area.**		❑ **The property owner shall dry sweep the fueling area routinely.** ❑ **See the Fact Sheet SD-30 , "Fueling Areas" in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

[6] **The fueling area shall be defined as the area extending a minimum of 6.5 feet from the corner of each fuel dispenser or the length at which the hose and nozzle assembly may be operated plus a minimum of one foot, whichever is greater.**

S T O R M W A T E R   P O L L U T A N T   S O U R C E S / S O U R C E   C O N T R O L   C H E C K L I S T

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ M. **Loading Docks**	☒ **Show a preliminary design for the loading dock area, including roofing and drainage. Loading docks shall be covered and/or graded to minimize run-on to and runoff from the loading area. Roof downspouts shall be positioned to direct stormwater away from the loading area. Water from loading dock areas shall be drained to the sanitary sewer, or diverted and collected for ultimate discharge to the sanitary sewer.** ☒ **Loading dock areas draining directly to the sanitary sewer shall be equipped with a spill control valve or equivalent device, which shall be kept closed during periods of operation.** ☒ **Provide a roof overhang over the loading area or install door skirts (cowling) at each bay that enclose the end of the trailer.**		☒ **Move loaded and unloaded items indoors as soon as possible.** ☒ **See Fact Sheet SC-30, "Outdoor Loading and Unloading," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**

STORMWATER POLLUTANT SOURCES/SOURCE CONTROL CHECKLIST

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
❑ N. **Fire Sprinkler Test Water**		❑ **Provide a means to drain fire sprinkler test water to the sanitary sewer.**	❑ **See the note in Fact Sheet SC-41, "Building and Grounds Maintenance," in the CASQA Stormwater Quality Handbooks at www.cabmphandbooks.com**
O. **Miscellaneous Drain or Wash Water or Other Sources** ❑ **Boiler drain lines** ❑ **Condensate drain lines** ❑ **Rooftop equipment** ❑ **Drainage sumps** ❑ **Roofing, gutters, and trim.** ❑ **Other sources**		❑ **Boiler drain lines shall be directly or indirectly connected to the sanitary sewer system and may not discharge to the storm drain system.** ❑ **Condensate drain lines may discharge to landscaped areas if the flow is small enough that runoff will not occur. Condensate drain lines may not discharge to the storm drain system.** ❑ **Rooftop equipment with potential to produce pollutants shall be roofed and/or have secondary containment.** ❑ **Any drainage sumps on-site shall feature a sediment sump to reduce the quantity of sediment in pumped water.** ❑ **Avoid roofing, gutters, and trim made of copper or other unprotected metals that may leach into runoff.** ❑ **Include controls for other sources as specified by local reviewer.**	

IF THESE SOURCES WILL BE ON THE PROJECT SITE ...	... THEN YOUR WQMP SHOULD INCLUDE THESE SOURCE CONTROL BMPs, AS APPLICABLE		
1 Potential Sources of Runoff Pollutants	2 Permanent Controls—Show on WQMP Drawings	3 Permanent Controls—List in WQMP Table and Narrative	4 Operational BMPs—Include in WQMP Table and Narrative
☒ P. **Plazas, sidewalks, and parking lots.**			☒ **Sweep plazas, sidewalks, and parking lots regularly to prevent accumulation of litter and debris. Collect debris from pressure washing to prevent entry into the storm drain system. Collect washwater containing any cleaning agent or degreaser and discharge to the sanitary sewer not to a storm drain.**

Appendix 9: O&M

Operation and Maintenance Plan and Documentation of Finance, Maintenance and Recording Mechanisms

Exhibit B

Inspection and Maintenance Form

BMP DEVICE			INSPECTION ITEMS			MAINTENANCE ITEMS		NOTES:
Filterra Unit	Inspection Date	Inspector's Name	Debris, Trash, & Mulch at surface (list if any)	Inspect Filterra Unit and internal components for damage and obstructions (list below)	Filter Media Evaluation	Replace Mulch	Evaluate Healthiness of Plant	Manufacturer's Rec. Inspection Rate (2 times/year)
Modular Wetlands								

Note:

Refer to manufacturer's recommended maintenance schedule.
Contact Kristar or Drainage Protection Service (888)950-8826

The Homestead

Operation and Maintenance Plan

2019

I. Inspection and Maintenance Log

BMP INSPECTION & MAINTENANCE LOG
THE HOMESTEAD

Today's Date: ______________________________

Name of Person Performing Activity (Printed): ______________________________

Signature: ______________________________

BMP Name (As Shown in O&M Plan)	Brief Description of Implementation, Maintenance, and Inspection Activity Performed	Date
Modular Wetland		

II. Updates, Revisions, and Errata

This page is left intentionally blank to allow for updates and revisions to be added.

III. Responsibility of Maintenance

A. General

A copy of the operation and maintenance agreement has been included as an attachment to the Operation and Maintenance (O&M) Plan:

The following party is responsible for the operation and maintenance of all LID BMPs and source control BMPs within the private property at The Homestead Project:

The Homestead, LLC
280 Newport Center Drive, Suite 240
Newport Beach, CA 92660

The responsible party shall serve or designate a corporate officer authorized to negotiate and execute any contracts that might be necessary for future changes to operation and maintenance of the LID BMPs or implement remedial measures if problems occur.

Employees or contractors who will report to the designated contact and are responsible for conducting Stormwater BMP operation and maintenance procedures within this document. All pertinent forms of educational materials for those personnel that will be maintaining the proposed BMPs have been included in Appendix 9.

Designated Respondent in case of off-hours maintenance problem:

____
Designated Respondent Printed Name/Title

____
Phone Number

Note: Updated contact information must be provided to the Permittee immediately whenever a property is sold or transferred and whenever designated individuals or contractors change.

WQMP Implementation and Funding Responsibility

This project-specific WQMP has been prepared for the Costanzo Investments by Kimley-Horn and Associates, Inc. for the Raising Cane's Temecula project. This document is intended to provide guidance for proper BMP implementation and on-going maintenance for the Project BMP facilities.

The undersigned shall be responsible for the implementation of this O&M Plan and ensure that this document is amended as appropriate to reflect up-to-date conditions at the site. The O&M plan will be reviewed by maintenance and service employees, outside contractors, or any other persons having responsibility from implementation portions of the O&M plan. At least one copy of this O&M Plan and WQMP will be maintained at the project site or project office in perpetuity.

The undersigned is authorized to certify and to approve implementation of this O&M Plan and WQMP. The undersigned is aware that implementation of this O&M Plan and WQMP is enforceable under the City of Temecula Water Quality Ordinance. If the undersigned transfers interest in the subject property, the undersigned shall notify the successor their responsibility to implement the O&M Plan and WQMP. It is still the responsibility of the owner to maintain the LID BMPs in accordance with the O&M Plan until that responsibility is formally transferred.

The funding source for operation and maintenance of each BMP identified in the project-specific WQMP shall be the responsibility of MJPA until responsibility is transferred. The owner/operator recognizes that a source of funding is required to support the ongoing operation and maintenance of BMPs, and that funding will continue for the life of the project. By certifying the final project specific WQMP, the Project applicant is certifying that the funding responsibilities have been addressed and will be transferred to future owners as deemed necessary.

____

Owner's /Responsible Party Signature

____

Owner's /Responsible Party Printed Name

____

Owner's /Responsible Party Title or Position

____Date

B. Staff Training Program

All staff will undergo training to learn about the stormwater treatment mechanism and proper maintenance of the LID BMPs. Training will be required for all persons responsible for maintenance of the roadside BMPs. Due to the location of the BMPs along the roadway, safety training for maintenance personnel will be required. Documentation and records of each staff (contractor or personal) member who has received training shall be recorded in the log below.

BMP STAFF TRAINING
THE HOMESTEAD

Today's Date: ___________________________________

Name of Person Performing Activity (Printed): ___________________________________

Signature: ___________________________________

Staff Name	Date	Brief Description of training received

IV. Summary of Drainage Management Areas and BMPs

DMAs DA-1, DA-2, and DA-3 includes several proposed industrial buildings and adjacent hardscape. Each DMA will drain to several Modular Wetland Biofiltration BMPs before discharging to the proposed storm drain in Limonite Ave. The Project Conditions Hydrology Map showing the proposed improvements can be found in Appendix 1.

V. Stormwater BMP Design Documentation

This section of the O&M Manual is designated for As-Builts of each stormwater BMP and Manufacturer's data, manuals and maintenance requirements.

VI. Maintenance Schedule or Matrix

A. Maintenance Schedule for each Facility with Specific requirements

Pervious/Landscaped Areas: Open space areas shall be kept free of trash and debris. All trimming, pruning, and removal of fallen organic material from plants, shrubs, and trees are to be collected per an established landscape maintenance plan and disposed in the appropriate location or transported to a green-waste collection facility. The planting materials are to remain as indicated on the approved set of landscape planting plans. Additional actions should be taken to ensure that the surface flow paths, storm drain outlet and inlet in the area are cleared of debris or vegetation obstructions.

Pavement: Impervious areas draining to the project BMPs shall be kept free of trash, debris, and other environmentally hazardous material at all times. Remove and dispose of these materials immediately.

Irrigation Systems: Water conservation is to be maintained at all times per the approved irrigation plans. Monitoring of the irrigation system should be provided at least twice monthly or as necessary to ensure that appropriate watering levels are maintained as well as to verify that no piping or irrigation heads are leaking. Any debris, sediment, mineral and grit deposits should be removed from the irrigation system at regular intervals to provide consistent watering.

Storm Drain System: Inlets, outlets, cleanouts, manholes, and pipelines are to be inspected quarterly and after each storm event or according to an existing maintenance program. All parts of the system are to be periodically cleaned to ensure that the system works properly during any storm event. All hardscape, landscape, parking, and driveway areas shall be kept clean, sanitary and free from any accumulation of debris, sediments and waste materials that could enter the storm drain system.

Bioretention facility: The Bioretention Facility area shall be inspected for erosion, dead vegetation, soggy soils, or standing water. The use of fertilizers and pesticides on the plants inside the Infiltration Facility should be minimized. Keep adjacent landscape areas maintained, remove clippings from landscape maintenance activities, remove trash and debris, replace damaged grass and/or plants, and replace surface mulch/cobble as needed to maintain a 2 to 3-inch soil cover. Facilities should be inspected for ponding after storm events.

BMP Maintenance Matrix

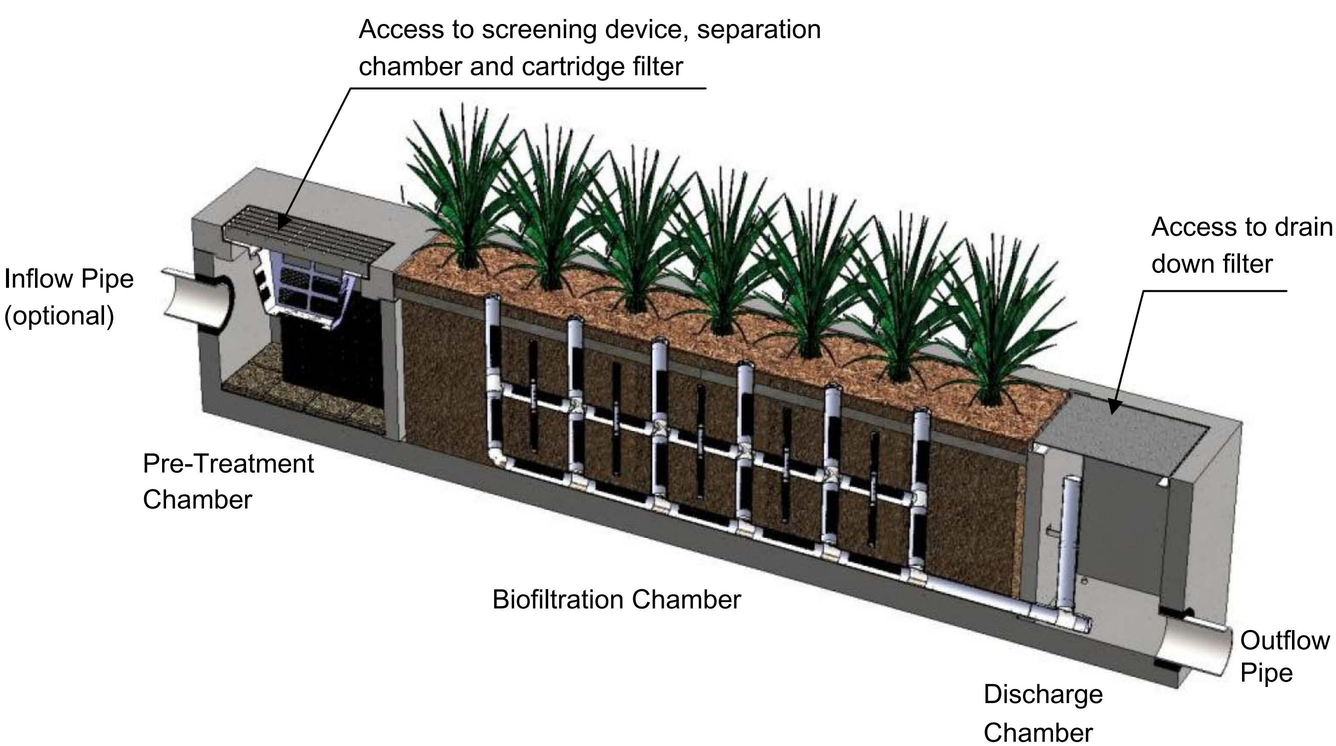
BMP Requiring Maintenance	Responsible Party	Visual Inspection Frequency	Inspection Location	Maintenance Frequency	Maintenance Requirements
Pervious/Landscaped Areas	Owner	Twice Monthly or according to an established maintenance schedule.	Throughout the pervious cover areas.	At least twice monthly or according to the established maintenance schedule	(See above)
Irrigation Systems	Owner	Twice Monthly or according to an established maintenance schedule.	Throughout the landscaped areas within site.	As necessary based on observations made during inspection or per maintenance schedule.	(See above)
Storm Drain System	Owner	Quarterly and after storms.	Locations are identified in the WQMP Appendix 2.	As necessary based on observations made during inspection.	(See above)
Pavement	Owner	Weekly or according to an established maintenance schedule.	Parking Lot.	At least twice monthly or immediately following the visual observation of any adverse conditions.	(See above)
Bioretention Facility	Owner	Twice Monthly and after storm events, or according to an established maintenance schedule.	Location shown on the WQMP site plan in Appendix 1.	Twice Monthly and after storm events, or according to an established maintenance schedule.	(See above)

Maintenance Guidelines for Modular Wetland System - Linear

Maintenance Summary

- o Remove Trash from Screening Device – average maintenance interval is 6 to 12 months.
    - *(5 minute average service time).*
- o Remove Sediment from Separation Chamber – average maintenance interval is 12 to 24 months.
    - *(10 minute average service time).*
- o Replace Cartridge Filter Media – average maintenance interval 12 to 24 months.
    - *(10-15 minute per cartridge average service time).*
- o Replace Drain Down Filter Media – average maintenance interval is 12 to 24 months.
    - *(5 minute average service time).*
- o Trim Vegetation – average maintenance interval is 6 to 12 months.
    - *(Service time varies).*

System Diagram



Maintenance Procedures

Screening Device

1. Remove grate or manhole cover to gain access to the screening device in the Pre-Treatment Chamber. Vault type units do not have screening device. Maintenance can be performed without entry.
2. Remove all pollutants collected by the screening device. Removal can be done manually or with the use of a vacuum truck. The hose of the vacuum truck will not damage the screening device.
3. Screening device can easily be removed from the Pre-Treatment Chamber to gain access to separation chamber and media filters below. Replace grate or manhole cover when completed.

Separation Chamber

1. Perform maintenance procedures of screening device listed above before maintaining the separation chamber.
2. With a pressure washer spray down pollutants accumulated on walls and cartridge filters.
3. Vacuum out Separation Chamber and remove all accumulated pollutants. Replace screening device, grate or manhole cover when completed.

Cartridge Filters

1. Perform maintenance procedures on screening device and separation chamber before maintaining cartridge filters.
2. Enter separation chamber.
3. Unscrew the two bolts holding the lid on each cartridge filter and remove lid.
4. Remove each of 4 to 8 media cages holding the media in place.
5. Spray down the cartridge filter to remove any accumulated pollutants.
6. Vacuum out old media and accumulated pollutants.
7. Reinstall media cages and fill with new media from manufacturer or outside supplier. Manufacturer will provide specification of media and sources to purchase.
8. Replace the lid and tighten down bolts. Replace screening device, grate or manhole cover when completed.

Drain Down Filter

1. Remove hatch or manhole cover over discharge chamber and enter chamber.
2. Unlock and lift drain down filter housing and remove old media block. Replace with new media block. Lower drain down filter housing and lock into place.
3. Exit chamber and replace hatch or manhole cover.

Maintenance Notes

1. Following maintenance and/or inspection, it is recommended the maintenance operator prepare a maintenance/inspection record. The record should include any maintenance activities performed, amount and description of debris collected, and condition of the system and its various filter mechanisms.

2. The owner should keep maintenance/inspection record(s) for a minimum of five years from the date of maintenance. These records should be made available to the governing municipality for inspection upon request at any time.

3. Transport all debris, trash, organics and sediments to approved facility for disposal in accordance with local and state requirements.

4. Entry into chambers may require confined space training based on state and local regulations.

5. No fertilizer shall be used in the Biofiltration Chamber.

6. Irrigation should be provided as recommended by manufacturer and/or landscape architect. Amount of irrigation required is dependent on plant species. Some plants may require irrigation.

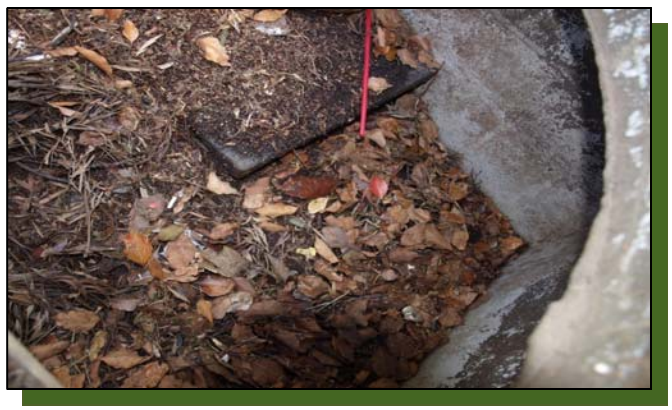
Maintenance Procedure Illustration

Screening Device

The screening device is located directly under the manhole or grate over the Pre-Treatment Chamber. It's mounted directly underneath for easy access and cleaning. Device can be cleaned by hand or with a vacuum truck.

Separation Chamber

The separation chamber is located directly beneath the screening device. It can be quickly cleaned using a vacuum truck or by hand. A pressure washer is useful to assist in the cleaning process.



Cartridge Filters

The cartridge filters are located in the Pre-Treatment chamber connected to the wall adjacent to the biofiltration chamber. The cartridges have removable tops to access the individual media filters. Once the cartridge is open media can be easily removed and replaced by hand or a vacuum truck.

Drain Down Filter

The drain down filter is located in the Discharge Chamber. The drain filter unlocks from the wall mount and hinges up. Remove filter block and replace with new block.

Trim Vegetation

Vegetation should be maintained in the same manner as surrounding vegetation and trimmed as needed. No fertilizer shall be used on the plants. Irrigation per the recommendation of the manufacturer and or landscape architect. Different types of vegetation requires different amounts of irrigation.

Inspection Form

Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Inspection Report
Modular Wetlands System

Project Name ____________________

Project Address ____________________
(city) (Zip Code)

Owner / Management Company ____________________

Contact ____________________ Phone (   )   –

Inspector Name ____________________ Date ___/___/_____ Time ________ AM / PM

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition ____________________ Additional Notes ____________________

For Office Use Only
(Reviewed By)
(Date) Office personnel to complete section to the left.

Inspection Checklist

Modular Wetland System Type (Curb, Grate or UG Vault): __________ Size (22', 14' or etc.): __________

Structural Integrity:	**Yes**	**No**	**Comments**
Damage to pre-treatment access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Damage to discharge chamber access cover (manhole cover/grate) or cannot be opened using normal lifting pressure?			
Does the MWS unit show signs of structural deterioration (cracks in the wall, damage to frame)?			
Is the inlet/outlet pipe or drain down pipe damaged or otherwise not functioning properly?			
Working Condition:			
Is there evidence of illicit discharge or excessive oil, grease, or other automobile fluids entering and clogging the unit?			
Is there standing water in inappropriate areas after a dry period?			
Is the filter insert (if applicable) at capacity and/or is there an accumulation of debris/trash on the shelf system?			
Does the depth of sediment/trash/debris suggest a blockage of the inflow pipe, bypass or cartridge filter? If yes specify which one in the comments section. Note depth of accumulation in in pre-treatment chamber.			Depth:
Does the cartridge filter media need replacement in pre-treatment chamber and/or discharge chamber?			Chamber:
Any signs of improper functioning in the discharge chamber? Note issues in comments section.			
Other Inspection Items:			
Is there an accumulation of sediment/trash/debris in the wetland media (if applicable)?			
Is it evident that the plants are alive and healthy (if applicable)? Please note Plant Information below.			
Is there a septic or foul odor coming from inside the system?			

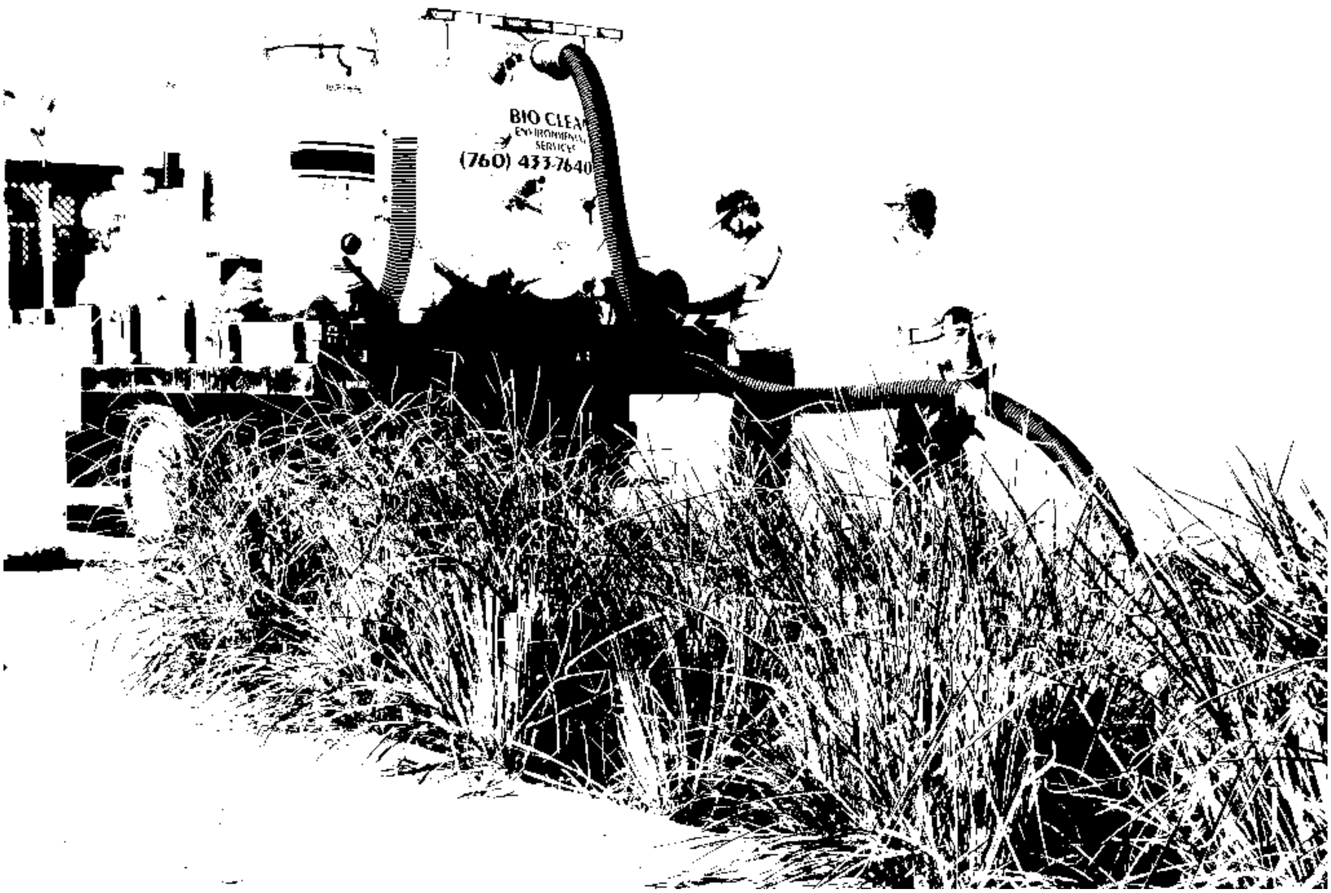
Waste:	**Yes**	**No**
Sediment / Silt / Clay		
Trash / Bags / Bottles		
Green Waste / Leaves / Foliage		

Recommended Maintenance	
No Cleaning Needed	
Schedule Maintenance as Planned	
Needs Immediate Maintenance	

Plant Information	
Damage to Plants	
Plant Replacement	
Plant Trimming	

Additional Notes:

Maintenance Report



Modular Wetland System, Inc.
P. 760.433-7640
F. 760-433-3176
E. Info@modularwetlands.com

www.modularwetlands.com

Cleaning and Maintenance Report
Modular Wetlands System

Project Name

Project Address

(city) (Zip Code)

Owner / Management Company

Contact

Phone ( ) –

Inspector Name

Date / /

Time AM / PM

For Office Use Only
(Reviewed By)
(Date) Office personnel to complete section to the left.

Type of Inspection ☐ Routine ☐ Follow Up ☐ Complaint ☐ Storm

Storm Event in Last 72-hours? ☐ No ☐ Yes

Weather Condition

Additional Notes

Site Map #	GPS Coordinates of Insert	Manufacturer / Description / Sizing	Trash Accumulation	Foliage Accumulation	Sediment Accumulation	Total Debris Accumulation	Condition of Media 25/50/75/100 (will be changed @ 75%)	Operational Per Manufactures' Specifications (If not, why?)
	Lat: Long:	MWS Catch Basins						
		MWS Sedimentation Basin						
		Media Filter Condition						
		Plant Condition						
		Drain Down Media Condition						
		Discharge Chamber Condition						
		Drain Down Pipe Condition						
		Inlet and Outlet Pipe Condition						

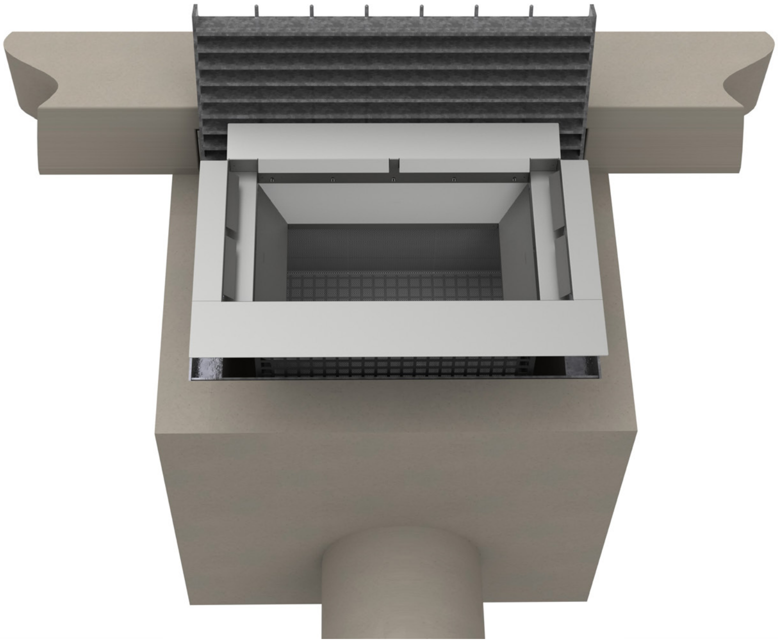
Comments:

Oldcastle Precast®

FLOGARD +PLUS®

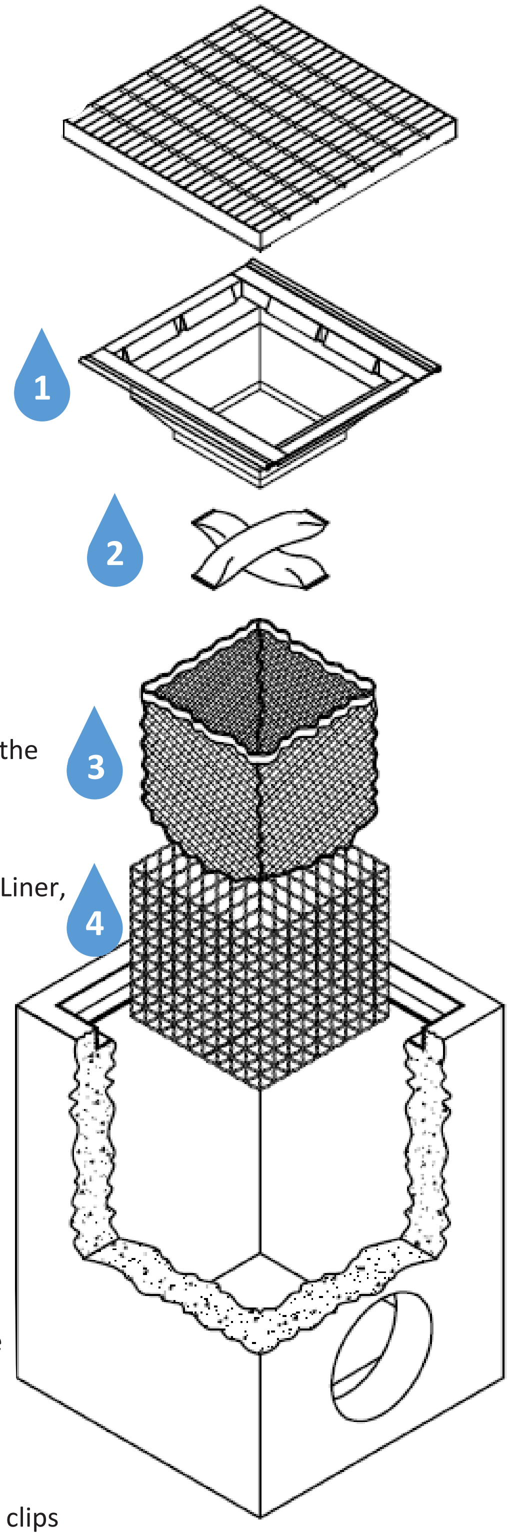
Replacement & Repair

Instruction Manual



Stormwater

FloGard Plus Replacement and Repair



Parts of the FloGard Plus Inlet Filter-

1. FloGard Stainless Steel Support Frame
2. Fossil Rock Absorbent Pouches
3. Liner
4. GeoGrid Support Basket & Cable

* Grate and Basin NOT INCLUDED

Disassembly:

1. Clear FloGard of any existing debris by hand or vacuum.
2. Unclip and remove the Fossil Rock pouches from the inside Liner.
3. Lift the FloGard from the catch basin.
4. Using a slotted screw driver, carefully pry open the metal tabs holding the GeoGrid and Cable in place. Separate the GeoGrid and Liner from the FloGard frame.
5. Unclip the Liner from the inside of the GeoGrid. If you are reusing the Liner, rinse thoroughly with water and inspect for tears. (If torn, mend with stainless steel wire or replace the Liner).
6. Rinse and inspect the GeoGrid Basket and the reinforcing cable. (If torn, mend with stainless steel wire or replace the GeoGrid).
7. Rinse and inspect the Stainless Steel FloGard frame.

Reassembly:

1. Fully expand the GeoGrid Basket and orient to the FloGard frame. Hook cable and GeoGrid to the FloGard frame metal tabs and close the tabs using slotted screwdriver. Move around the FloGard until all tabs are closed and GeoGrid is secured to the Frame.
2. Expand and orient the Liner, locating the clips at each corner and side. Push the Liner through the center of the FloGard frame and secure the clips to the GeoGrid Basket close to the top support cable. Push the Liner to expand inside of the basket.
3. Clip new Fossil Rock Rubberizer pouches to the inside of the Liner.
4. Lower FloGard back into the basin, replace grate.

FLOGARD +PLUS®

OUR MARKETS

BUILDING STRUCTURES

COMMUNICATIONS

WATER

ENERGY

TRANSPORTATION

Trained Contractor and Personnel Log

Stormwater Management Training Log and Documentation

Project Name: _

WDID #: ______

Stormwater Management Topic: (check as appropriate)

☐ Erosion Control ☐ Sediment Control

☐ Wind Erosion Control ☐ Tracking Control

☐ Non-Stormwater Management ☐ Waste Management and Materials Pollution Control

☐ Stormwater Sampling ☐ Other (explain)

Specific Training Objective: ____

Location: _____ Date: __ _

Instructor:_____ Telephone: ____

Course Length (hours):

Attendee Roster (Attach additional forms if necessary)

Name	Company	Phone

As needed, add proof of external training (e.g., course completion certificates, credentials for QSP, QSD).

Appendix 10: Educational Materials

BMP Fact Sheets, Maintenance Guidelines and Other End-User BMP Information

A Citizen's Guide to Understanding Stormwater

After the Storm

For more information contact:

or visit
www.epa.gov/npdes/stormwater
www.epa.gov/nps

United States Environmental Protection Agency

EPA 833-B-03-002

January 2003

Internet Address (URL) • HTTP://www.epa.gov
Recycled/Recyclable • Printed With Vegetable Oil Based Inks on 100% Postconsumer, Process Chlorine Free Recycled Paper

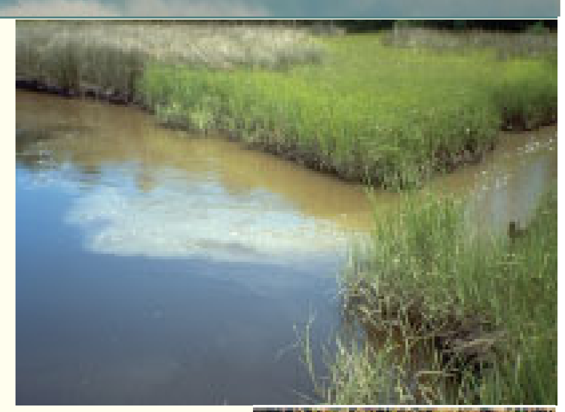
What is stormwater runoff?

Stormwater runoff occurs when precipitation from rain or snowmelt flows over the ground. Impervious surfaces like driveways, sidewalks, and streets prevent stormwater from naturally soaking into the ground.

Why is stormwater runoff a problem?

Stormwater can pick up debris, chemicals, dirt, and other pollutants and flow into a storm sewer system or directly to a lake, stream, river, wetland, or coastal water. Anything that enters a storm sewer system is discharged untreated into the waterbodies we use for swimming, fishing, and providing drinking water.

The effects of pollution



Polluted stormwater runoff can have many adverse effects on plants, fish, animals, and people.

- Sediment can cloud the water and make it difficult or impossible for aquatic plants to grow. Sediment also can destroy aquatic habitats.
- Excess nutrients can cause algae blooms. When algae die, they sink to the bottom and decompose in a process that removes oxygen from the water. Fish and other aquatic organisms can't exist in water with low dissolved oxygen levels.
- Bacteria and other pathogens can wash into swimming areas and create health hazards, often making beach closures necessary.

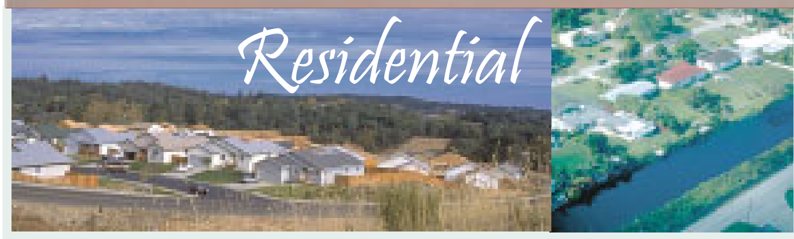
- Debris—plastic bags, six-pack rings, bottles, and cigarette butts—washed into waterbodies can choke, suffocate, or disable aquatic life like ducks, fish, turtles, and birds.
- Household hazardous wastes like insecticides, pesticides, paint, solvents, used motor oil, and other auto fluids can poison aquatic life. Land animals and people can become sick or die from eating diseased fish and shellfish or ingesting polluted water.

- Polluted stormwater often affects drinking water sources. This, in turn, can affect human health and increase drinking water treatment costs.

Stormwater Pollution Solutions

Education is essential to changing people's behavior. Signs and markers near storm drains warn residents that pollutants entering the drains will be carried untreated into a local waterbody.

Residential



Recycle or properly dispose of household products that contain chemicals, such as insecticides, pesticides, paint, solvents, and used motor oil and other auto fluids. Don't pour them onto the ground or into storm drains.

Lawn care

Excess fertilizers and pesticides applied to lawns and gardens wash off and pollute streams. In addition, yard clippings and leaves can wash into storm drains and contribute nutrients and organic matter to streams.

- Don't overwater your lawn. Consider using a soaker hose instead of a sprinkler.
- Use pesticides and fertilizers sparingly. When use is necessary, use these chemicals in the recommended amounts. Use organic mulch or safer pest control methods whenever possible.
- Compost or mulch yard waste. Don't leave it in the street or sweep it into storm drains or streams.
- Cover piles of dirt or mulch being used in landscaping projects.

Auto care

Washing your car and degreasing auto parts at home can send detergents and other contaminants through the storm sewer system. Dumping automotive fluids into storm drains has the same result as dumping the materials directly into a waterbody.

- Use a commercial car wash that treats or recycles its wastewater, or wash your car on your yard so the water infiltrates into the ground.
- Repair leaks and dispose of used auto fluids and batteries at designated drop-off or recycling locations.

Septic systems

Leaking and poorly maintained septic systems release nutrients and pathogens (bacteria and viruses) that can be picked up by stormwater and discharged into nearby waterbodies. Pathogens can cause public health problems and environmental concerns.

- Inspect your system every 3 years and pump your tank as necessary (every 3 to 5 years).
- Don't dispose of household hazardous waste in sinks or toilets.

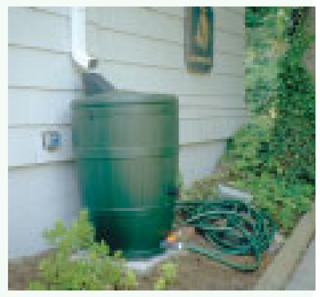
Pet waste

Pet waste can be a major source of bacteria and excess nutrients in local waters.

- When walking your pet, remember to pick up the waste and dispose of it properly. Flushing pet waste is the best disposal method. Leaving pet waste on the ground increases public health risks by allowing harmful bacteria and nutrients to wash into the storm drain and eventually into local waterbodies.

Residential landscaping

Permeable Pavement—Traditional concrete and asphalt don't allow water to soak into the ground. Instead these surfaces rely on storm drains to divert unwanted water. Permeable pavement systems allow rain and snowmelt to soak through, decreasing stormwater runoff.



Rain Barrels—You can collect rainwater from rooftops in mosquito-proof containers. The water can be used later on lawn or garden areas.

Rain Gardens and Grassy Swales—Specially designed areas planted with native plants can provide natural places for rainwater to collect and soak into the ground. Rain from rooftop areas or paved areas can be diverted into these areas rather than into storm drains.

Vegetated Filter Strips—Filter strips are areas of native grass or plants created along roadways or streams. They trap the pollutants stormwater picks up as it flows across driveways and streets.

Commercial

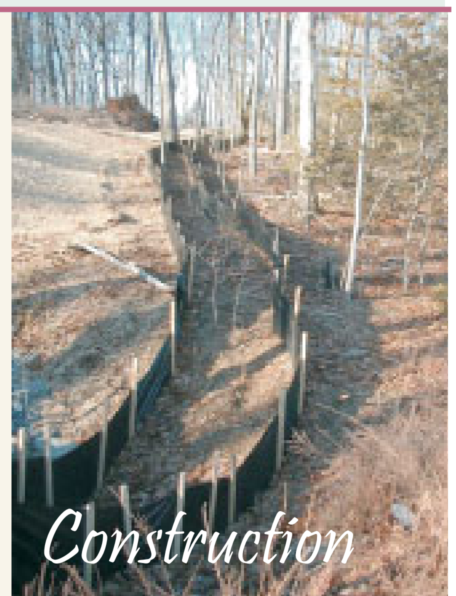
Dirt, oil, and debris that collect in parking lots and paved areas can be washed into the storm sewer system and eventually enter local waterbodies.

- Sweep up litter and debris from sidewalks, driveways and parking lots, especially around storm drains.
- Cover grease storage and dumpsters and keep them clean to avoid leaks.
- Report any chemical spill to the local hazardous waste cleanup team. They'll know the best way to keep spills from harming the environment.

Construction

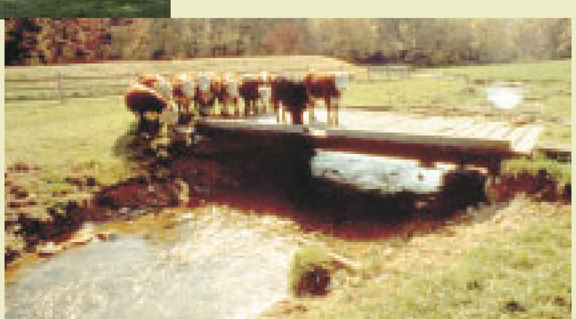
Erosion controls that aren't maintained can cause excessive amounts of sediment and debris to be carried into the stormwater system. Construction vehicles can leak fuel, oil, and other harmful fluids that can be picked up by stormwater and deposited into local waterbodies.

- Divert stormwater away from disturbed or exposed areas of the construction site.
- Install silt fences, vehicle mud removal areas, vegetative cover, and other sediment and erosion controls and properly maintain them, especially after rainstorms.
- Prevent soil erosion by minimizing disturbed areas during construction projects, and seed and mulch bare areas as soon as possible.



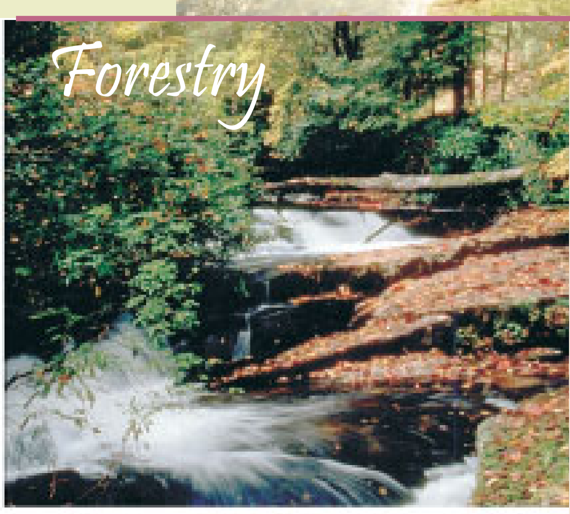
Agriculture

Lack of vegetation on streambanks can lead to erosion. Overgrazed pastures can also contribute excessive amounts of sediment to local waterbodies. Excess fertilizers and pesticides can poison aquatic animals and lead to destructive algae blooms. Livestock in streams can contaminate waterways with bacteria, making them unsafe for human contact.



- Keep livestock away from streambanks and provide them a water source away from waterbodies.
- Store and apply manure away from waterbodies and in accordance with a nutrient management plan.
- Vegetate riparian areas along waterways.
- Rotate animal grazing to prevent soil erosion in fields.
- Apply fertilizers and pesticides according to label instructions to save money and minimize pollution.

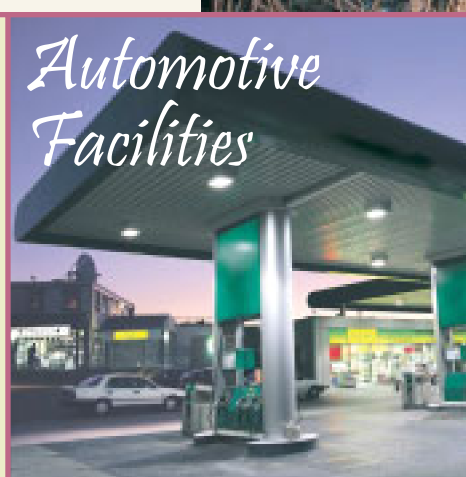
Forestry



Improperly managed logging operations can result in erosion and sedimentation.

- Conduct preharvest planning to prevent erosion and lower costs.
- Use logging methods and equipment that minimize soil disturbance.
- Plan and design skid trails, yard areas, and truck access roads to minimize stream crossings and avoid disturbing the forest floor.
- Construct stream crossings so that they minimize erosion and physical changes to streams.
- Expedite revegetation of cleared areas.

Automotive Facilities



Uncovered fueling stations allow spills to be washed into storm drains. Cars waiting to be repaired can leak fuel, oil, and other harmful fluids that can be picked up by stormwater.

- Clean up spills immediately and properly dispose of cleanup materials.
- Provide cover over fueling stations and design or retrofit facilities for spill containment.
- Properly maintain fleet vehicles to prevent oil, gas, and other discharges from being washed into local waterbodies.
- Install and maintain oil/water separators.

Riverside County Stormwater Program Members

City of Banning
(951) 922-3105

City of Beaumont
(951) 769-8520

City of Calimesa
(909) 795-9801

City of Canyon Lake
(951) 244-2955

City of Cathedral City
(760) 770-0340

City of Coachella
(760) 398-3502

City of Corona
(951) 736-2447

City of Desert Hot Springs
(760) 329-6411

City of Eastvale
(951) 361-0900

City of Hemet
(951) 765-2300

City of Indian Wells
(760) 346-2489

City of Indio
(760) 391-4000

City of Jurupa Valley
(951) 332-6464

City of Lake Elsinore
(951) 674-3124

City of La Quinta
(760) 777-7000

City of Menifee
(951) 672-6777

City of Moreno Valley
(951) 413-3000

City of Murrieta
(951) 304-2489

City of Norco
(951) 270-5607

City of Palm Desert
(760) 346-0611

City of Palm Springs
(760) 323-8299

City of Perris
(951) 943-6100

City of Rancho Mirage
(760) 324-4511

City of Riverside
(951) 826-5311

City of San Jacinto
(951) 487-7330

City of Temecula
(951) 694-6444

City of Wildomar
(951) 677-7751

Coachella Valley Water District
(760) 398-2651

County of Riverside
(951) 955-1000

Riverside County Flood Control District
(951) 955-1200

Stormwater Pollution

What you should know for...

Industrial & Commercial Facilities

Best Management Practices (BMPS) for:

- Industrial Facilities
- Commercial Facilities

YOU can prevent Stormwater Pollution following these practices...

Industrial and Commercial Facilities

The Riverside County Stormwater Program has identified a number of Best Management Practices (BMPs) for Industrial and Commercial Facilities. These BMPs control and reduce stormwater pollutants from reaching our storm drain system and ultimately our local water bodies. City and County ordinances require businesses to use these BMPs to protect our water quality. Local cities and the County are required to verify implementation of these BMPs by performing regular facility inspections.

Prohibited Discharges

Discontinue all non-stormwater discharges to the storm drain system. It is *prohibited* to discharge any chemicals, paints, debris, wastes or wastewater into the gutter, street or storm drain.

Outdoor Storage BMPs

- Install covers and secondary containment areas for all hazardous materials and wastes stored outdoors in accordance with County and/or City standards.
- Keep all temporary waste containers covered, at all times when not in use.
- Sweep outdoor areas instead of using a hose or pressure washer.
- Move all process operations including vehicle/equipment maintenance inside of the building or under a covered and contained area.
- Wash equipment and vehicles in a contained and covered wash bay which is closed-loop or connected to a clarifier sized to local standards and discharged to a sanitary sewer or take them to a commercial car wash.

Spills and Clean Up BMPs

- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep up the area.
- Clean up spills immediately when they occur, using dry clean up methods such as absorbent materials or sweep followed by proper disposal of materials.
- Always have a spill kit available near chemical loading dock doors and vehicle maintenance and fueling areas.
- Follow your Business Emergency Plan, as filed with the local Fire Department.
- Report all prohibited discharges and non-implementation of BMPs to your local Stormwater Coordinator as listed on the back of this pamphlet.
- Report hazardous materials spills to 951-358-5055 or call after hours to 951-782-2973 or, if an emergency, call the Fire Department's Haz Mat Team at 911.

Plastic Manufacturing Facilities BMPs

AB 258 requires plastic product manufacturers to use BMPs, such as safe storage and clean-up procedures to prevent plastic pellets (nurdles) from entering the waterway. The plastic pellets are released into the environment during transporting, packaging and processing and migrate to waterways through the storm drain system. AB 258 will help protect fish and wildlife from the hazards of plastic pollution.

Training BMPs

As prescribed by your City and County Stormwater Ordinance(s), train employees in spill procedures and prohibit non-stormwater discharges to the storm drain system. Applicable BMP examples can be found at www.cabmphandbooks.com.

Permitting

Stormwater discharges associated with specific categories for industrial facilities are regulated by the State Water Resources Control Board through an Industrial Stormwater General Permit. A copy of this General Permit and application forms are available at: www.waterboards.ca.gov, select stormwater then the industrial quick link.

To report illegal dumping or for more information on stormwater pollution prevention call: 1-800-506-2555 or e-mail us at: fcnpdes@rcflood.org.

Landscaping and garden maintenance activities can be major contributors to water pollution. Soils, yard wastes, over-watering and garden chemicals become part of the urban runoff mix that winds its way through streets, gutters and storm drains before entering lakes, rivers, streams, etc. Urban runoff pollution contaminates water and harms aquatic life!

In Riverside County, report illegal discharges into the storm drain, call
1-800-506-2555
"Only Rain Down the Storm Drain"

Important Links:

Riverside County Household Hazardous Waste Collection Information
1-800-304-2226 or www.rivcowm.org

Riverside County Backyard Composting Program
1-800-366-SAVE

Integrated Pest Management (IPM) Solutions
www.ipm.ucdavis.edu

California Master Gardener Programs
www.mastergardeners.org
www.camastergardeners.ucdavis.edu

California Native Plant Society
www.cnps.org

The Riverside County "Only Rain Down the Storm Drain" Pollution Prevention Program gratefully acknowledges Orange County's Storm Water Program for their contribution to this brochure.

...Only Rain Down ...the Storm Drain

What you should know for...
Landscape and Gardening

Best Management tips for:

- Professionals
- Novices
- Landscapers
- Gardeners
- Cultivators

Tips for Landscape & Gardening

This brochure will help you to get the most of your lawn and gardening efforts and keep our waterways clean. Clean waterways provide recreation, establish thriving fish habitats, secure safe sanctuaries for wildlife, and add beauty to our communities. NEVER allow gardening products or waste water to enter the street, gutter or storm drain.

General Landscaping Tips

- Protect stockpiles and materials from wind and rain by storing them under tarps or secured plastic sheeting.
- Prevent erosion of slopes by planting fast-growing, dense ground covering plants. These will shield and bind the soil.

- Plant native vegetation to reduce the amount of water, fertilizers and pesticides applied to the landscape.
- Never apply pesticides or fertilizers when rain is predicted within the next 48 hours.

Garden & Lawn Maintenance

- Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro-spray systems. Periodically inspect and fix leaks and misdirected sprinklers.
- Do not rake or blow leaves, clippings or pruning waste into the street, gutter or storm drain. Instead, dispose of green waste by composting, hauling it to a permitted landfill, or recycling it through your city's program.

- Consider recycling your green waste and adding "nature's own fertilizer" to your lawn or garden.
- Read labels and use only as directed. Do not over-apply pesticides or fertilizers. Apply to spots as needed, rather than blanketing an entire area.
- Store pesticides, fertilizers and other chemicals in a dry covered area to prevent exposure that may result in the deterioration of containers and packaging.
- Rinse empty pesticide containers and re-use rinse water as you would use the product. Do not dump rinse water down storm drains or sewers. Dispose of empty containers in the trash.
- When available, use non-toxic alternatives to traditional pesticides, and use pesticides specifically designed to control the pest you are targeting.
- Try natural long-term common sense solutions first. Integrated Pest Management (IPM) can provide landscaping guidance and solutions, such as:
  - **Physical Controls** - Try hand picking, barriers, traps or caulking holes to control weeds and pests.
  - **Biological Controls** - Use predatory insects to control harmful pests.
  - **Chemical Controls** - Check out www.ipm.ucdavis.edu before using chemicals. Remember, all chemicals should be used cautiously and in moderation.
- If fertilizer is spilled, sweep up the spill before irrigating. If the spill is liquid, apply an absorbent material such as cat litter, and then sweep it up and dispose of it in the trash.
- Take unwanted pesticides to a Household Waste Collection Center to be recycled.
- *Dumping toxics into the street, gutter or storm drain is illegal!*

www.bewaterwise.com Great water conservation tips and drought tolerant garden designs.

www.ourwaterourworld.com Learn how to safely manage home and garden pests.

Additional information can also be found on the back of this brochure.

Helpful telephone numbers and links:

Riverside County Stormwater Protection Partners

Flood Control District	(951) 955-1200
County of Riverside	(951) 955-1000
City of Banning	(951) 922-3105
City of Beaumont	(951) 769-8520
City of Calimesa	(909) 795-9801
City of Canyon Lake	(951) 244-2955
Cathedral City	(760) 770-0327
City of Coachella	(760) 398-4978
City of Corona	(951) 736-2447
City of Desert Hot Springs	(760) 329-6411
City of Eastvale	(951) 361-0900
City of Hemet	(951) 765-2300
City of Indian Wells	(760) 346-2489
City of Indio	(760) 391-4000
City of Lake Elsinore	(951) 674-3124
City of La Quinta	(760) 777-7000
City of Menifee	(951) 672-6777
City of Moreno Valley	(951) 413-3000
City of Murrieta	(951) 304-2489
City of Norco	(951) 270-5607
City of Palm Desert	(760) 346-0611
City of Palm Springs	(760) 323-8299
City of Perris	(951) 943-6100
City of Rancho Mirage	(760) 324-4511
City of Riverside	(951) 361-0900
City of San Jacinto	(951) 654-7337
City of Temecula	(951) 694-6444
City of Wildomar	(951) 677-7751

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555 or e-mail us at
fcnpdes@rcflood.org

- Riverside County Flood Control and Water Conservation District
  www.rcflood.org

Online resources include:

- California Storm Water Quality Association
  www.casqa.org
- State Water Resources Control Board
  www.waterboards.ca.gov
- Power Washers of North America
  www.thepwna.org

Stormwater Pollution

What you should know for...

Outdoor Cleaning Activities and Professional Mobile Service Providers

Storm drain pollution prevention information for:

- Car Washing / Mobile Detailers
- Window and Carpet Cleaners
- Power Washers
- Waterproofers / Street Sweepers
- Equipment cleaners or degreasers and all mobile service providers

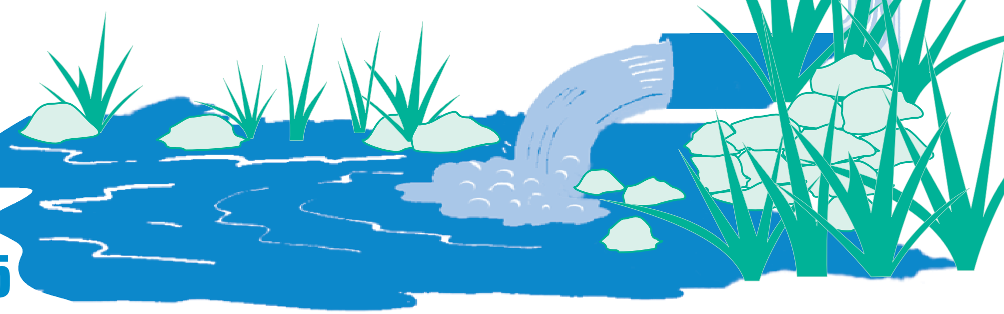
Do you know where street flows actually go?

Storm drains are NOT connected to sanitary sewer systems and treatment plants!

The primary purpose of storm drains is to carry *rain* water away from developed areas to prevent flooding. Pollutants discharged to storm drains are transported directly into rivers, lakes and streams. Soaps, degreasers, automotive fluids, litter and a host of materials are washed off buildings, sidewalks, plazas and parking areas. Vehicles and equipment must be properly managed to prevent the pollution of local waterways.

Unintentional spills by mobile service operators can flow into storm drains and pollute our waterways. **Avoid mishaps.** *Always* have a **Spill Response Kit** on hand to clean up unintentional spills. Only emergency **Mechanical** repairs should be done in City streets, using drip pans for spills. **Plumbing** should be done on private property. Always store chemicals in a leak-proof container and keep covered when not in use. **Window/Power Washing** waste water shouldn't be released into the streets, but should be disposed of in a sanitary sewer, landscaped area or in the soil. Soiled **Carpet Cleaning** wash water should be filtered before being discharged into the sanitary sewer. Dispose of all filter debris properly. **Car Washing/Detailing** operators should wash cars on private property and use a regulated hose nozzle for water flow control and runoff prevention. Capture and dispose of waste water and chemicals properly. Remember, storm drains are for receiving rain water runoff only.

REPORT ILLEGAL STORM DRAIN DISPOSAL
1-800-506-2555



Help Protect Our Waterways!

Use these guidelines for Outdoor Cleaning Activities and Wash Water Disposal

Did you know that disposing of pollutants into the street, gutter, storm drain or body of water is *PROHIBITED* by law and can result in stiff penalties?

Best Management Practices

Waste wash water from Mechanics, Plumbers, Window/Power Washers, Carpet Cleaners, Car Washing and Mobile Detailing activities may contain significant quantities of motor oil, grease, chemicals, dirt, detergents, brake pad dust, litter and other materials.

Best Management Practices, or BMPs as they are known, are guides to prevent pollutants from entering the storm drains. ***Each of us*** can do our part to keep stormwater clean by using the suggested BMPs below:

Simple solutions for both light and heavy duty jobs:

Do...consider dry cleaning methods first such as a mop, broom, rag or wire brush. Always keep a spill response kit on site.

Do...prepare the work area before power cleaning by using sand bags, rubber mats, vacuum booms, containment pads or temporary berms to keep wash water away from the gutters and storm drains.

Do...use vacuums or other machines to remove and collect loose debris or litter before applying water.

Do...obtain the property owner's permission to dispose of ***small amounts*** of power washing waste water on to landscaped, gravel or unpaved surfaces.

Do...check your local sanitary sewer agency's policies on wash water disposal regulations before disposing of wash water into the sewer. (See list on reverse side)

Do...be aware that if discharging to landscape areas, soapy wash water may damage landscaping. Residual wash water may remain on paved surfaces to evaporate. Sweep up solid residuals and dispose of properly. Vacuum booms are another option for capturing and collecting wash water.

Do...check to see if local ordinances prevent certain activities.

Do not let...wash or waste water from sidewalk, plaza or building cleaning go into a street or storm drain.

Report illegal storm drain disposal
Call Toll Free
1-800-506-2555

Using Cleaning Agents

Try using biodegradable/phosphate-free products. They are easier on the environment, but don't confuse them with being toxic free. Soapy water entering the storm drain system can impact the delicate aquatic environment.

When cleaning surfaces with a ***high-pressure washer*** or ***steam cleaner***, additional precautions should be taken to prevent the discharge of pollutants into the storm drain system. These two methods of surface cleaning can loosen additional material that can contaminate local waterways.

Think Water Conservation

Minimize water use by using high pressure, low volume nozzles. Be sure to check all hoses for leaks. Water is a precious resource, don't let it flow freely and be sure to shut it off in between uses.

Screening Wash Water

Conduct thorough dry cleanup before washing exterior surfaces, such as buildings and decks ***with loose paint***, sidewalks or plaza areas. Keep debris from entering the storm drain after cleaning by first passing the wash water through a "20 mesh" or finer screen to catch the solid materials, then dispose of the mesh in a refuse container. Do not let the remaining wash water enter a street, gutter or storm drain.

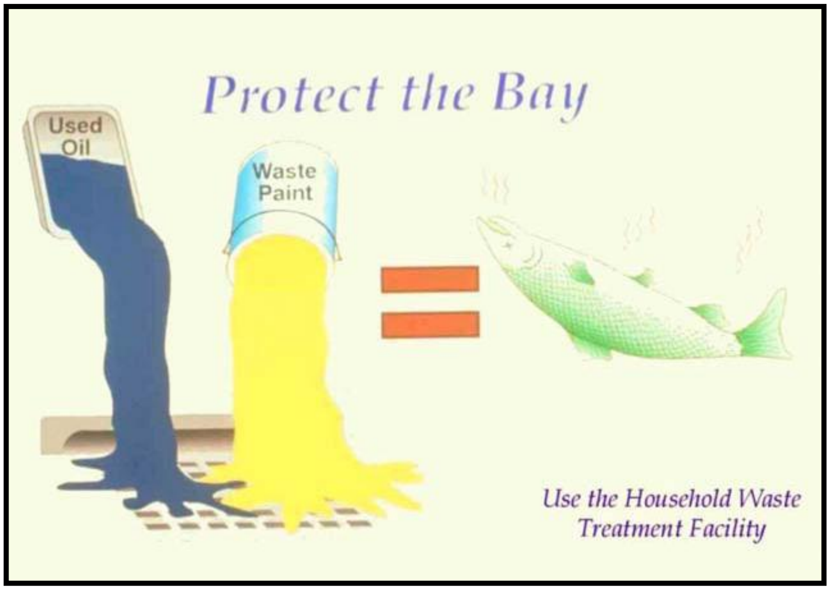
Drain Inlet Protection & Collection of Wash Water

- Prior to any washing, block all storm drains with an impervious barrier such as sandbags or berms, or seal the storm drain with plugs or other appropriate materials.
- Create a containment area with berms and traps or take advantage of a low spot to keep wash water contained.
- Wash vehicles and equipment on grassy or gravel areas so that the wash water can seep into the ground.
- Pump or vacuum up all wash water in the contained area.

Concrete/Coring/Saw Cutting and Drilling Projects

Protect any down-gradient inlets by using dry activity techniques whenever possible. If water is used, minimize the amount of water used during the coring/drilling or saw cutting process. Place a barrier of sandbags and/or absorbent berms to protect the storm drain inlet or watercourse. Use a shovel or wet vacuum to remove the residue from the pavement. Do not wash residue or particulate matter into a storm drain inlet or watercourse.

Non-Stormwater Discharges SC-10



Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

Description

Non-stormwater discharges are those flows that do not consist entirely of stormwater. Some non-stormwater discharges do not include pollutants and may be discharged to the storm drain. These include uncontaminated groundwater and natural springs. There are also some non-stormwater discharges that typically do not contain pollutants and may be discharged to the storm drain with conditions. These include car washing, air conditioner condensate, etc. However there are certain non-stormwater discharges that pose environmental concern. These discharges may originate from illegal dumping or from internal floor drains, appliances, industrial processes, sinks, and toilets that are connected to the nearby storm drainage system. These discharges (which may include: process waste waters, cooling waters, wash waters, and sanitary wastewater) can carry substances such as paint, oil, fuel and other automotive fluids, chemicals and other pollutants into storm drains. They can generally be detected through a combination of detection and elimination. The ultimate goal is to effectively eliminate non-stormwater discharges to the stormwater drainage system through implementation of measures to detect, correct, and enforce against illicit connections and illegal discharges of pollutants on streets and into the storm drain system and creeks.

Approach

Initially the industry must make an assessment of non-stormwater discharges to determine which types must be eliminated or addressed through BMPs. The focus of the following approach is in the elimination of non-stormwater discharges.

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Pollution Prevention

- Ensure that used oil, used antifreeze, and hazardous chemical recycling programs are being implemented. Encourage litter control.

Suggested Protocols

Recommended Complaint Investigation Equipment

- Field Screening Analysis
  - pH paper or meter
  - Commercial stormwater pollutant screening kit that can detect for reactive phosphorus, nitrate nitrogen, ammonium nitrogen, specific conductance, and turbidity
  - Sample jars
  - Sample collection pole
  - A tool to remove access hole covers
- Laboratory Analysis
  - Sample cooler
  - Ice
  - Sample jars and labels
  - Chain of custody forms
- Documentation
  - Camera
  - Notebook
  - Pens
  - Notice of Violation forms
  - Educational materials

General

- Develop clear protocols and lines of communication for effectively prohibiting non-stormwater discharges, especially those that are not classified as hazardous. These are often not responded to as effectively as they need to be.

- Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled or demarcated next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

- See SC44 Stormwater Drainage System Maintenance for additional information.

Illicit Connections
- Locate discharges from the industrial storm drainage system to the municipal storm drain system through review of "as-built" piping schematics.
- Isolate problem areas and plug illicit discharge points.
- Locate and evaluate all discharges to the industrial storm drain system.

Visual Inspection and Inventory
- Inventory and inspect each discharge point during dry weather.
- Keep in mind that drainage from a storm event can continue for a day or two following the end of a storm and groundwater may infiltrate the underground stormwater collection system. Also, non-stormwater discharges are often intermittent and may require periodic inspections.

Review Infield Piping
- A review of the "as-built" piping schematic is a way to determine if there are any connections to the stormwater collection system.
- Inspect the path of floor drains in older buildings.

Smoke Testing
- Smoke testing of wastewater and stormwater collection systems is used to detect connections between the two systems.
- During dry weather the stormwater collection system is filled with smoke and then traced to sources. The appearance of smoke at the base of a toilet indicates that there may be a connection between the sanitary and the stormwater system.

Dye Testing
- A dye test can be performed by simply releasing a dye into either your sanitary or process wastewater system and examining the discharge points from the stormwater collection system for discoloration.

TV Inspection of Drainage System
- TV Cameras can be employed to visually identify illicit connections to the industrial storm drainage system.

Illegal Dumping
- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste.

- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Once a site has been cleaned:

- Post "No Dumping" signs with a phone number for reporting dumping and disposal.
- Landscaping and beautification efforts of hot spots may also discourage future dumping, as well as provide open space and increase property values.
- Lighting or barriers may also be needed to discourage future dumping.
- See fact sheet SC11 Spill Prevention, Control, and Cleanup.

Inspection

- Regularly inspect and clean up hot spots and other storm drainage areas where illegal dumping and disposal occurs.
- Conduct field investigations of the industrial storm drain system for potential sources of non-stormwater discharges.
- Pro-actively conduct investigations of high priority areas. Based on historical data, prioritize specific geographic areas and/or incident type for pro-active investigations.

Reporting

- A database is useful for defining and tracking the magnitude and location of the problem.
- Report prohibited non-stormwater discharges observed during the course of normal daily activities so they can be investigated, contained, and cleaned up or eliminated.
- Document that non-stormwater discharges have been eliminated by recording tests performed, methods used, dates of testing, and any on-site drainage points observed.
- Document and report annually the results of the program.
- Maintain documentation of illicit connection and illegal dumping incidents, including significant conditionally exempt discharges that are not properly managed.

Training

- Training of technical staff in identifying and documenting illegal dumping incidents is required.
- Consider posting the quick reference table near storm drains to reinforce training.
- Train employees to identify non-stormwater discharges and report discharges to the appropriate departments.

- Educate employees about spill prevention and cleanup.

- Well-trained employees can reduce human errors that lead to accidental releases or spills. The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur. Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.

- Determine and implement appropriate outreach efforts to reduce non-permissible non-stormwater discharges.

- Conduct spill response drills annually (if no events occurred to evaluate your plan) in cooperation with other industries.

- When a responsible party is identified, educate the party on the impacts of his or her actions.

Spill Response and Prevention

- See SC11 Spill Prevention Control and Cleanup.

Other Considerations

- Many facilities do not have accurate, up-to-date schematic drawings.

Requirements

Costs (including capital and operation & maintenance)

- The primary cost is for staff time and depends on how aggressively a program is implemented.

- Cost for containment and disposal is borne by the discharger.

- Illicit connections can be difficult to locate especially if there is groundwater infiltration.

- Indoor floor drains may require re-plumbing if cross-connections to storm drains are detected.

Maintenance (including administrative and staffing)

- Illegal dumping and illicit connection violations requires technical staff to detect and investigate them.

Supplemental Information

Further Detail of the BMP

Illegal Dumping

- Substances illegally dumped on streets and into the storm drain systems and creeks include paints, used oil and other automotive fluids, construction debris, chemicals, fresh concrete, leaves, grass clippings, and pet wastes. All of these wastes cause stormwater and receiving water quality problems as well as clog the storm drain system itself.

- Establish a system for tracking incidents. The system should be designed to identify the following:

  - Illegal dumping hot spots

- Types and quantities (in some cases) of wastes

- Patterns in time of occurrence (time of day/night, month, or year)

- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)

- Responsible parties

One of the keys to success of reducing or eliminating illegal dumping is increasing the number of people at the facility who are aware of the problem and who have the tools to at least identify the incident, if not correct it. Therefore, train field staff to recognize and report the incidents.

What constitutes a "non-stormwater" discharge?

- Non-stormwater discharges to the stormwater collection system may include any water used directly in the manufacturing process (process wastewater), air conditioning condensate and coolant, non-contact cooling water, cooling equipment condensate, outdoor secondary containment water, vehicle and equipment wash water, sink and drinking fountain wastewater, sanitary wastes, or other wastewaters.

Permit Requirements

- Facilities subject to stormwater permit requirements must include a certification that the stormwater collection system has been tested or evaluated for the presence of non-stormwater discharges. The State's General Industrial Stormwater Permit requires that non-stormwater discharges be eliminated prior to implementation of the facility's SWPPP.

Performance Evaluation

- Review annually internal investigation results; assess whether goals were met and what changes or improvements are necessary.

- Obtain feedback from personnel assigned to respond to, or inspect for, illicit connections and illegal dumping incidents.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Spill Prevention, Control & Cleanup SC-11

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	
Nutrients	
Trash	
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Many activities that occur at an industrial or commercial site have the potential to cause accidental or illegal spills. Preparation for accidental or illegal spills, with proper training and reporting systems implemented, can minimize the discharge of pollutants to the environment.

Spills and leaks are one of the largest contributors of stormwater pollutants. Spill prevention and control plans are applicable to any site at which hazardous materials are stored or used. An effective plan should have spill prevention and response procedures that identify potential spill areas, specify material handling procedures, describe spill response procedures, and provide spill clean-up equipment. The plan should take steps to identify and characterize potential spills, eliminate and reduce spill potential, respond to spills when they occur in an effort to prevent pollutants from entering the stormwater drainage system, and train personnel to prevent and control future spills.

Approach

Pollution Prevention

- Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

- Develop a Spill Prevention Control and Countermeasure (SPCC) Plan. The plan should include:

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- Description of the facility, owner and address, activities and chemicals present
- Facility map
- Notification and evacuation procedures
- Cleanup instructions
- Identification of responsible departments
- Identify key spill response personnel

■ Recycle, reclaim, or reuse materials whenever possible. This will reduce the amount of process materials that are brought into the facility.

Suggested Protocols (including equipment needs)

Spill Prevention

■ Develop procedures to prevent/mitigate spills to storm drain systems. Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures.

■ If consistent illegal dumping is observed at the facility:

- Post "No Dumping" signs with a phone number for reporting illegal dumping and disposal. Signs should also indicate fines and penalties applicable for illegal dumping.
- Landscaping and beautification efforts may also discourage illegal dumping.
- Bright lighting and/or entrance barriers may also be needed to discourage illegal dumping.

■ Store and contain liquid materials in such a manner that if the tank is ruptured, the contents will not discharge, flow, or be washed into the storm drainage system, surface waters, or groundwater.

■ If the liquid is oil, gas, or other material that separates from and floats on water, install a spill control device (such as a tee section) in the catch basins that collects runoff from the storage tank area.

■ Routine maintenance:

- Place drip pans or absorbent materials beneath all mounted taps, and at all potential drip and spill locations during filling and unloading of tanks. Any collected liquids or soiled absorbent materials must be reused/recycled or properly disposed.
- Store and maintain appropriate spill cleanup materials in a location known to all near the tank storage area; and ensure that employees are familiar with the site's spill control plan and/or proper spill cleanup procedures.
- Sweep and clean the storage area monthly if it is paved, *do not hose down the area to a storm drain.*

- Check tanks (and any containment sumps) daily for leaks and spills. Replace tanks that are leaking, corroded, or otherwise deteriorating with tanks in good condition. Collect all spilled liquids and properly dispose of them.

- Label all containers according to their contents (e.g., solvent, gasoline).
- Label hazardous substances regarding the potential hazard (corrosive, radioactive, flammable, explosive, poisonous).
- Prominently display required labels on transported hazardous and toxic materials (per US DOT regulations).
- Identify key spill response personnel.

Spill Control and Cleanup Activities

- Follow the Spill Prevention Control and Countermeasure Plan.
- Clean up leaks and spills immediately.
- Place a stockpile of spill cleanup materials where it will be readily accessible (e.g., near storage and maintenance areas).
- On paved surfaces, clean up spills with as little water as possible. Use a rag for small spills, a damp mop for general cleanup, and absorbent material for larger spills. If the spilled material is hazardous, then the used cleanup materials are also hazardous and must be sent to a certified laundry (rags) or disposed of as hazardous waste. Physical methods for the cleanup of dry chemicals include the use of brooms, shovels, sweepers, or plows.
- Never hose down or bury dry material spills. Sweep up the material and dispose of properly.
- Chemical cleanups of material can be achieved with the use of adsorbents, gels, and foams. Use adsorbent materials on small spills rather than hosing down the spill. Remove the adsorbent materials promptly and dispose of properly.
- For larger spills, a private spill cleanup company or Hazmat team may be necessary.

Reporting

- Report spills that pose an immediate threat to human health or the environment to the Regional Water Quality Control Board.
- Federal regulations require that any oil spill into a water body or onto an adjoining shoreline be reported to the National Response Center (NRC) at 800-424-8802 (24 hour).
- Report spills to local agencies, such as the fire department; they can assist in cleanup.
- Establish a system for tracking incidents. The system should be designed to identify the following:
  - Types and quantities (in some cases) of wastes
  - Patterns in time of occurrence (time of day/night, month, or year)

- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)

- Responsible parties

Training

- Educate employees about spill prevention and cleanup.

- Well-trained employees can reduce human errors that lead to accidental releases or spills:

  - The employee should have the tools and knowledge to immediately begin cleaning up a spill should one occur.

  - Employees should be familiar with the Spill Prevention Control and Countermeasure Plan.

- Employees should be educated about aboveground storage tank requirements. Employees responsible for aboveground storage tanks and liquid transfers should be thoroughly familiar with the Spill Prevention Control and Countermeasure Plan and the plan should be readily available.

- Train employees to recognize and report illegal dumping incidents.

Other Considerations (Limitations and Regulations)

- State regulations exist for facilities with a storage capacity of 10,000 gallons or more of petroleum to prepare a Spill Prevention Control and Countermeasure (SPCC) Plan (Health & Safety Code Chapter 6.67).

- State regulations also exist for storage of hazardous materials (Health & Safety Code Chapter 6.95), including the preparation of area and business plans for emergency response to the releases or threatened releases.

- Consider requiring smaller secondary containment areas (less than 200 sq. ft.) to be connected to the sanitary sewer, prohibiting any hard connections to the storm drain.

Requirements

Costs (including capital and operation & maintenance)

- Will vary depending on the size of the facility and the necessary controls.

- Prevention of leaks and spills is inexpensive. Treatment and/or disposal of contaminated soil or water can be quite expensive.

Maintenance (including administrative and staffing)

- This BMP has no major administrative or staffing requirements. However, extra time is needed to properly handle and dispose of spills, which results in increased labor costs.

Supplemental Information

Further Detail of the BMP

Reporting

Record keeping and internal reporting represent good operating practices because they can increase the efficiency of the facility and the effectiveness of BMPs. A good record keeping system helps the facility minimize incident recurrence, correctly respond with appropriate cleanup activities, and comply with legal requirements. A record keeping and reporting system should be set up for documenting spills, leaks, and other discharges, including discharges of hazardous substances in reportable quantities. Incident records describe the quality and quantity of non-stormwater discharges to the storm sewer. These records should contain the following information:

- Date and time of the incident
- Weather conditions
- Duration of the spill/leak/discharge
- Cause of the spill/leak/discharge
- Response procedures implemented
- Persons notified
- Environmental problems associated with the spill/leak/discharge

Separate record keeping systems should be established to document housekeeping and preventive maintenance inspections, and training activities. All housekeeping and preventive maintenance inspections should be documented. Inspection documentation should contain the following information:

- The date and time the inspection was performed
- Name of the inspector
- Items inspected
- Problems noted
- Corrective action required
- Date corrective action was taken

Other means to document and record inspection results are field notes, timed and dated photographs, videotapes, and drawings and maps.

Aboveground Tank Leak and Spill Control

Accidental releases of materials from aboveground liquid storage tanks present the potential for contaminating stormwater with many different pollutants. Materials spilled, leaked, or lost from tanks may accumulate in soils or on impervious surfaces and be carried away by stormwater runoff.

The most common causes of unintentional releases are:

- Installation problems
- Failure of piping systems (pipes, pumps, flanges, couplings, hoses, and valves)
- External corrosion and structural failure
- Spills and overfills due to operator error
- Leaks during pumping of liquids or gases from truck or rail car to a storage tank or vice versa

Storage of reactive, ignitable, or flammable liquids should comply with the Uniform Fire Code and the National Electric Code. Practices listed below should be employed to enhance the code requirements:

- Tanks should be placed in a designated area.
- Tanks located in areas where firearms are discharged should be encapsulated in concrete or the equivalent.
- Designated areas should be impervious and paved with Portland cement concrete, free of cracks and gaps, in order to contain leaks and spills.
- Liquid materials should be stored in UL approved double walled tanks or surrounded by a curb or dike to provide the volume to contain 10 percent of the volume of all of the containers or 110 percent of the volume of the largest container, whichever is greater. The area inside the curb should slope to a drain.
- For used oil or dangerous waste, a dead-end sump should be installed in the drain.
- All other liquids should be drained to the sanitary sewer if available. The drain must have a positive control such as a lock, valve, or plug to prevent release of contaminated liquids.
- Accumulated stormwater in petroleum storage areas should be passed through an oil/water separator.

Maintenance is critical to preventing leaks and spills. Conduct routine inspections and:

- Check for external corrosion and structural failure.
- Check for spills and overfills due to operator error.
- Check for failure of piping system (pipes, pumps, flanger, coupling, hoses, and valves).
- Check for leaks or spills during pumping of liquids or gases from truck or rail car to a storage facility or vice versa.

- Visually inspect new tank or container installation for loose fittings, poor welding, and improper or poorly fitted gaskets.

- Inspect tank foundations, connections, coatings, and tank walls and piping system. Look for corrosion, leaks, cracks, scratches, and other physical damage that may weaken the tank or container system.

- Frequently relocate accumulated stormwater during the wet season.

- Periodically conduct integrity testing by a qualified professional.

Vehicle Leak and Spill Control

Major spills on roadways and other public areas are generally handled by highly trained Hazmat teams from local fire departments or environmental health departments. The measures listed below pertain to leaks and smaller spills at vehicle maintenance shops.

In addition to implementing the spill prevention, control, and clean up practices above, use the following measures related to specific activities:

Vehicle and Equipment Maintenance

- Perform all vehicle fluid removal or changing inside or under cover to prevent the run-on of stormwater and the runoff of spills.

- Regularly inspect vehicles and equipment for leaks, and repair immediately.

- Check incoming vehicles and equipment (including delivery trucks, and employee and subcontractor vehicles) for leaking oil and fluids. Do not allow leaking vehicles or equipment onsite.

- Always use secondary containment, such as a drain pan or drop cloth, to catch spills or leaks when removing or changing fluids.

- Immediately drain all fluids from wrecked vehicles.

- Store wrecked vehicles or damaged equipment under cover.

- Place drip pans or absorbent materials under heavy equipment when not in use.

- Use adsorbent materials on small spills rather than hosing down the spill.

- Remove the adsorbent materials promptly and dispose of properly.

- Promptly transfer used fluids to the proper waste or recycling drums. Don't leave full drip pans or other open containers lying around.

- Oil filters disposed of in trashcans or dumpsters can leak oil and contaminate stormwater. Place the oil filter in a funnel over a waste oil recycling drum to drain excess oil before disposal. Oil filters can also be recycled. Ask your oil supplier or recycler about recycling oil filters.

- Store cracked batteries in a non-leaking secondary container. Do this with all cracked batteries, even if you think all the acid has drained out. If you drop a battery, treat it as if it is cracked. Put it into the containment area until you are sure it is not leaking.

Vehicle and Equipment Fueling

- Design the fueling area to prevent the run-on of stormwater and the runoff of spills:
  - Cover fueling area if possible.
  - Use a perimeter drain or slope pavement inward with drainage to a sump.
  - Pave fueling area with concrete rather than asphalt.
- If dead-end sump is not used to collect spills, install an oil/water separator.
- Install vapor recovery nozzles to help control drips as well as air pollution.
- Discourage "topping-off" of fuel tanks.
- Use secondary containment when transferring fuel from the tank truck to the fuel tank.
- Use adsorbent materials on small spills and general cleaning rather than hosing down the area. Remove the adsorbent materials promptly.
- Carry out all Federal and State requirements regarding underground storage tanks, or install above ground tanks.
- Do not use mobile fueling of mobile industrial equipment around the facility; rather, transport the equipment to designated fueling areas.
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Train employees in proper fueling and cleanup procedures.

Industrial Spill Prevention Response

For the purposes of developing a spill prevention and response program to meet the stormwater regulations, facility managers should use information provided in this fact sheet and the spill prevention/response portions of the fact sheets in this handbook, for specific activities. The program should:

- Integrate with existing emergency response/hazardous materials programs (e.g., Fire Department)
- Develop procedures to prevent/mitigate spills to storm drain systems
- Identify responsible departments
- Develop and standardize reporting procedures, containment, storage, and disposal activities, documentation, and follow-up procedures
- Address spills at municipal facilities, as well as public areas

- Provide training concerning spill prevention, response and cleanup to all appropriate personnel

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Stormwater Managers Resource Center http://www.stormwatercenter.net/

Contaminated or Erodible Areas SC-40

Description

Areas within an industrial site that are bare of vegetation or are subject to activities that promote the suppression of vegetation are often subject to erosion. In addition, they may or may not be contaminated from past or current activities. If the area is temporarily bare because of construction, see SC-42, Building Repair, Remodeling, and Construction. Sites with excessive erosion or the potential for excessive erosion should consider employing the soil erosion BMPs identified in the Construction BMP Handbook. Note that this fact sheet addresses soils that are not so contaminated as to exceed hazardous waste criteria (see Title 22 California Code of Regulations for Hazardous Waste Criteria).

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

Preserve natural vegetation whenever possible. See also EC-2, Preservation of Existing Vegetation, in the Construction BMP Handbook.

Suggested Protocols

- Preserve natural vegetation.
- Analyze soil conditions.
- Re-vegetate when necessary.
- Remove contaminated soil.
- Utilize chemical stabilization when needed. See also EC-5, Soil Binders, and EC-13, Polyacrylamide, in the Construction BMP Handbook.
- Use geosynthetic membranes to control erosion if feasible. See also EC-7, Geotextiles and Mats, in the Construction BMP Handbook.

Training

Training is not a significant element of this best management practice.

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	✓
Organics	✓

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Other Considerations

- Disadvantages of preserving natural vegetation or revegetation include:
  - Requires substantial planning to preserve and maintain the existing vegetation
  - May not be cost-effective with high land costs
  - Lack of rainfall, inadequate irrigation and/or poor soils may limit the success of re-vegetated areas
- Disadvantages of chemical stabilization include:
  - Creation of impervious surfaces
  - May cause harmful effects on water quality
  - Is usually more expensive than vegetative cover

Requirements

Costs

Except for preservation of natural vegetation, each of the above solutions can be quite expensive depending upon the size of the area.

Maintenance

Maintenance should be minimal, except possibly if irrigation of vegetation is necessary.

Supplemental Information

Preserving Vegetation to Minimize Erosion

Preserving stabilized areas minimizes erosion potential, protects water quality, and provides aesthetic benefits. The most effective way to control erosion is to preserve existing vegetation. Preservation of natural vegetation provides a natural buffer zone and an opportunity for infiltration of stormwater and capture of pollutants in the soil matrix. This practice can be used as a permanent source control measure.

Vegetation preservation should be incorporated into the site. Preservation requires good site management to minimize the impact of construction when construction is underway and exposure of soils after construction. Proper maintenance is important to ensure healthy vegetation that can control erosion. Different species, soil types, and climatic conditions will require different maintenance activities such as mulching, fertilizing, liming, irrigation, pruning and weed and pest control. Maintenance should be performed regularly especially during construction phases.

The preferred approach is to leave as much native vegetation on-site as possible, thereby reducing or eliminating any erosion problem. However, assuming the site already has contaminated or erodible surface areas, there are four possible courses of action which can be taken:

- The area can be revegetated if it is not in use and therefore not subject to damage from site activities. In as much as the area is already devoid of vegetation, special measures are likely necessary. Lack of vegetation may be due to the lack of water and/or poor soils. The latter can perhaps be solved with fertilization, or the ground may simply be too compacted from prior use. Improving soil conditions may be sufficient to support the recovery of vegetation. Use process wastewater for irrigation if possible. Finally, see the Construction BMP Handbook for further procedures on establishing vegetation.

- Chemical stabilization can be used as an alternate method in areas where temporary seeding practices cannot be used because of season or climate. It can provide immediate, effective, and inexpensive erosion control. Application rates and procedures recommended by the manufacturer should be followed as closely as possible to prevent the products from forming ponds and creating large areas where moisture cannot penetrate the soil. See also EC-5, Soil Binders, and EC-13, Polyacrylamide, in the Construction BMP Handbook for more information. Advantages of chemical stabilization include:

  - Applied easily to the surface
  - Stabilizes areas effectively
  - Provides immediate protection to soils that are in danger of erosion

- Contaminated soils can be removed, however this is a last resort and quite expensive. The level and extent of the contamination must be determined. This determination and removal must comply with State and Federal regulations, permits must be acquired and fees paid.

- Geosynthetics may be used. Geosynthetics include those materials that are designed as an impermeable barrier to contain or control large amounts of liquid or solid matter. Geosynthetics have been developed primarily for use in landfills and surface impoundments, and the technology is well established. There are two general types of geosynthetics: geomembranes (impermeable) and geotextiles (permeable). Geomembranes are composed of one of three types of impermeable materials: elastomers (rubbers), thermoplasics (plastics), or a combination of these two types of materials. See also EC-7, Geotextiles and Mats, in the Construction BMP Handbook for more information. The advantages of these materials include:

  - A variety of compounds are available
  - Sheeting is produced in a factory environment
  - Polymeric membranes are flexible
  - Installation is simple

  Disadvantages include:

  - Chemical resistance must be determined for each application
  - Seaming systems may be a weak link in the system
  - Many materials are subject to attack from biotic, mechanical, or environmental sources

Geotextiles are uncoated synthetic textile products that are not watertight. They are composed of a variety of materials, most commonly polypropylene and polyester. Geotextiles serve five basic functions:

- Filtration
- Drainage
- Separation
- Reinforcement
- Armoring

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Building & Grounds Maintenance SC-41

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	✓
Trash	
Metals	✓
Bacteria	✓
Oil and Grease	
Organics	

Description

Stormwater runoff from building and grounds maintenance activities can be contaminated with toxic hydrocarbons in solvents, fertilizers and pesticides, suspended solids, heavy metals, abnormal pH, and oils and greases. Utilizing the protocols in this fact sheet will prevent or reduce the discharge of pollutants to stormwater from building and grounds maintenance activities by washing and cleaning up with as little water as possible, following good landscape management practices, preventing and cleaning up spills immediately, keeping debris from entering the storm drains, and maintaining the stormwater collection system.

Approach

Reduce potential for pollutant discharge through source control pollution prevention and BMP implementation. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Switch to non-toxic chemicals for maintenance when possible.
- Choose cleaning agents that can be recycled.
- Encourage proper lawn management and landscaping, including use of native vegetation.

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- Encourage use of Integrated Pest Management techniques for pest control.
- Encourage proper onsite recycling of yard trimmings.
- Recycle residual paints, solvents, lumber, and other material as much as possible.

Suggested Protocols

Pressure Washing of Buildings, Rooftops, and Other Large Objects

- In situations where soaps or detergents are used and the surrounding area is paved, pressure washers must use a water collection device that enables collection of wash water and associated solids. A sump pump, wet vacuum or similarly effective device must be used to collect the runoff and loose materials. The collected runoff and solids must be disposed of properly.
- If soaps or detergents are not used, and the surrounding area is paved, wash runoff does not have to be collected but must be screened. Pressure washers must use filter fabric or some other type of screen on the ground and/or in the catch basin to trap the particles in wash water runoff.
- If you are pressure washing on a grassed area (with or without soap), runoff must be dispersed as sheet flow as much as possible, rather than as a concentrated stream. The wash runoff must remain on the grass and not drain to pavement.

Landscaping Activities

- Dispose of grass clippings, leaves, sticks, or other collected vegetation as garbage, or by composting. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures on exposed soils.

Building Repair, Remodeling, and Construction

- Do not dump any toxic substance or liquid waste on the pavement, the ground, or toward a storm drain.
- Use ground or drop cloths underneath outdoor painting, scraping, and sandblasting work, and properly dispose of collected material daily.
- Use a ground cloth or oversized tub for activities such as paint mixing and tool cleaning.
- Clean paintbrushes and tools covered with water-based paints in sinks connected to sanitary sewers or in portable containers that can be dumped into a sanitary sewer drain. Brushes and tools covered with non-water-based paints, finishes, or other materials must be cleaned in a manner that enables collection of used solvents (e.g., paint thinner, turpentine, etc.) for recycling or proper disposal.
- Use a storm drain cover, filter fabric, or similarly effective runoff control mechanism if dust, grit, wash water, or other pollutants may escape the work area and enter a catch basin. This is particularly necessary on rainy days. The containment device(s) must be in place at the beginning of the work day, and accumulated dirty runoff and solids must be collected and disposed of before removing the containment device(s) at the end of the work day.

- If you need to de-water an excavation site, you may need to filter the water before discharging to a catch basin or off-site. If directed off-site, you should direct the water through hay bales and filter fabric or use other sediment filters or traps.
- Store toxic material under cover during precipitation events and when not in use. A cover would include tarps or other temporary cover material.

Mowing, Trimming, and Planting

- Dispose of leaves, sticks, or other collected vegetation as garbage, by composting or at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.
- Use mulch or other erosion control measures when soils are exposed.
- Place temporarily stockpiled material away from watercourses and drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.
- Consider an alternative approach when bailing out muddy water: do not put it in the storm drain; pour over landscaped areas.
- Use hand weeding where practical.

Fertilizer and Pesticide Management

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.
- Use less toxic pesticides that will do the job when applicable. Avoid use of copper-based pesticides if possible.
- Do not use pesticides if rain is expected.
- Do not mix or prepare pesticides for application near storm drains.
- Use the minimum amount needed for the job.
- Calibrate fertilizer distributors to avoid excessive application.
- Employ techniques to minimize off-target application (e.g., spray drift) of pesticides, including consideration of alternative application techniques.
- Apply pesticides only when wind speeds are low.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Irrigate slowly to prevent runoff and then only as much as is needed.
- Clean pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Dispose of empty pesticide containers according to the instructions on the container label.

- Use up the pesticides. Rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.

- Implement storage requirements for pesticide products with guidance from the local fire department and County Agricultural Commissioner. Provide secondary containment for pesticides.

Inspection
- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering and repair leaks in the irrigation system as soon as they are observed.

Training
- Educate and train employees on pesticide use and in pesticide application techniques to prevent pollution.

- Train employees and contractors in proper techniques for spill containment and cleanup.

- Be sure the frequency of training takes into account the complexity of the operations and the nature of the staff.

Spill Response and Prevention
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.

- Place a stockpile of spill cleanup materials, such as brooms, dustpans, and vacuum sweepers (if desired) near the storage area where it will be readily accessible.

- Have employees trained in spill containment and cleanup present during the loading/unloading of dangerous wastes, liquid chemicals, or other materials.

- Familiarize employees with the Spill Prevention Control and Countermeasure Plan.

- Clean up spills immediately.

Other Considerations
Alternative pest/weed controls may not be available, suitable, or effective in many cases.

Requirements
Costs
- Cost will vary depending on the type and size of facility.

- Overall costs should be low in comparison to other BMPs.

Maintenance
Sweep paved areas regularly to collect loose particles. Wipe up spills with rags and other absorbent material immediately, do not hose down the area to a storm drain.

Supplemental Information

Further Detail of the BMP

Fire Sprinkler Line Flushing

Building fire sprinkler line flushing may be a source of non-stormwater runoff pollution. The water entering the system is usually potable water, though in some areas it may be non-potable reclaimed wastewater. There are subsequent factors that may drastically reduce the quality of the water in such systems. Black iron pipe is usually used since it is cheaper than potable piping, but it is subject to rusting and results in lower quality water. Initially, the black iron pipe has an oil coating to protect it from rusting between manufacture and installation; this will contaminate the water from the first flush but not from subsequent flushes. Nitrates, poly-phosphates and other corrosion inhibitors, as well as fire suppressants and antifreeze may be added to the sprinkler water system. Water generally remains in the sprinkler system a long time (typically a year) and between flushes may accumulate iron, manganese, lead, copper, nickel, and zinc. The water generally becomes anoxic and contains living and dead bacteria and breakdown products from chlorination. This may result in a significant BOD problem and the water often smells. Consequently dispose fire sprinkler line flush water into the sanitary sewer. Do not allow discharge to storm drain or infiltration due to potential high levels of pollutants in fire sprinkler line water.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Mobile Cleaners Pilot Program: Final Report. 1997. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Building Repair and Construction SC-42

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Recycle

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

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Description

Modifications are common particularly at large industrial sites. The activity may vary from minor and normal building repair to major remodeling, or the construction of new facilities. These activities can generate pollutants including solvents, paints, paint and varnish removers, finishing residues, spent thinners, soap cleaners, kerosene, asphalt and concrete materials, adhesive residues, and old asbestos installation. Protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants to stormwater from building repair, remodeling, and construction by using soil erosion controls, enclosing or covering building material storage areas, using good housekeeping practices, using safer alternative products, and training employees.

Approach

Pollution Prevention

- Recycle residual paints, solvents, lumber, and other materials to the maximum extent practical.
- Buy recycled products to the maximum extent practical.
- Inform on-site contractors of company policy on these matters and include appropriate provisions in their contract to ensure certain proper housekeeping and disposal practices are implemented.

- Make sure that nearby storm drains are well marked to minimize the chance of inadvertent disposal of residual paints and other liquids.

Suggested Protocols

Repair & Remodeling

- Follow BMPs identified in Construction BMP Handbook.
- Maintain good housekeeping practices while work is underway.
- Keep the work site clean and orderly. Remove debris in a timely fashion. Sweep the area.
- Cover materials of particular concern that must be left outside, particularly during the rainy season.
- Do not dump waste liquids down the storm drain.
- Dispose of wash water, sweepings, and sediments properly.
- Store materials properly that are normally used in repair and remodeling such as paints and solvents.
- Sweep out the gutter or wash the gutter and trap the particles at the outlet of the downspout if when repairing roofs, small particles have accumulated in the gutter. A sock or geofabric placed over the outlet may effectively trap the materials. If the downspout is tight lined, place a temporary plug at the first convenient point in the storm drain and pump out the water with a vactor truck, and clean the catch basin sump where you placed the plug.
- Properly store and dispose waste materials generated from construction activities. See Construction BMP Handbook.
- Clean the storm drain system in the immediate vicinity of the construction activity after it is completed.

Painting

- Enclose painting operations consistent with local air quality regulations and OSHA.
- Local air pollution regulations may, in many areas of the state, specify painting procedures which if properly carried out are usually sufficient to protect water quality.
- Develop paint handling procedures for proper use, storage, and disposal of paints.
- Transport paint and materials to and from job sites in containers with secure lids and tied down to the transport vehicle.
- Test and inspect spray equipment prior to starting to paint. Tighten all hoses and connections and do not overfill paint containers.
- Mix paint indoors before using so that any spill will not be exposed to rain. Do so even during dry weather because cleanup of a spill will never be 100% effective.
- Transfer and load paint and hot thermoplastic away from storm drain inlets.

- Do not transfer or load paint near storm drain inlets.
- Plug nearby storm drain inlets prior to starting painting and remove plugs when job is complete when there is significant risk of a spill reaching storm drains.
- Cover nearby storm drain inlets prior to starting work if sand blasting is used to remove paint.
- Use a ground cloth to collect the chips if painting requires scraping or sand blasting of the existing surface. Dispose the residue properly.
- Cover or enclose painting operations properly to avoid drift.
- Clean the application equipment in a sink that is connected to the sanitary sewer if using water based paints.
- Capture all cleanup-water and dispose of properly.
- Dispose of paints containing lead or tributyl tin and considered a hazardous waste properly.
- Store leftover paints if they are to be kept for the next job properly, or dispose properly.
- Recycle paint when possible. Dispose of paint at an appropriate household hazardous waste facility.

Training
Proper education of off-site contractors is often overlooked. The conscientious efforts of well trained employees can be lost by unknowing off-site contractors, so make sure they are well informed about what they are expected to do.

Spill Response and Prevention
- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible.
- Clean up spills immediately.
- Excavate and remove the contaminated (stained) soil if a spill occurs on dirt.

Limitations
- This BMP is for minor construction only. The State's General Construction Activity Stormwater Permit has more requirements for larger projects. The companion "Construction Best Management Practice Handbook" contains specific guidance and best management practices for larger-scale projects.
- Hazardous waste that cannot be reused or recycled must be disposed of by a licensed hazardous waste hauler.
- Be certain that actions to help stormwater quality are consistent with Cal- and Fed-OSHA and air quality regulations.

Requirements

Costs

These BMPs are generally low to modest in cost.

Maintenance

N/A

Supplemental Information

Further Detail of the BMP

Soil/Erosion Control

If the work involves exposing large areas of soil, employ the appropriate soil erosion and control techniques. See the Construction Best Management Practice Handbook. If old buildings are being torn down and not replaced in the near future, stabilize the site using measures described in SC-40 Contaminated or Erodible Areas.

If a building is to be placed over an open area with a storm drainage system, make sure the storm inlets within the building are covered or removed, or the storm line is connected to the sanitary sewer. If because of the remodeling a new drainage system is to be installed or the existing system is to be modified, consider installing catch basins as they serve as effective "in-line" treatment devices. See Treatment Control Fact Sheet TC-20 Wet Pond/Basin in Section 5 of the New Development and Redevelopment Handbook regarding design criteria. Include in the catch basin a "turn-down" elbow or similar device to trap floatables.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Parking/Storage Area Maintenance SC-43

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	✓
Bacteria	
Oil and Grease	✓
Organics	✓

Description

Parking lots and storage areas can contribute a number of substances, such as trash, suspended solids, hydrocarbons, oil and grease, and heavy metals that can enter receiving waters through stormwater runoff or non-stormwater discharges. The protocols in this fact sheet are intended to prevent or reduce the discharge of pollutants from parking/storage areas and include using good housekeeping practices, following appropriate cleaning BMPs, and training employees.

Approach

The goal of this program is to ensure stormwater pollution prevention practices are considered when conducting activities on or around parking areas and storage areas to reduce potential for pollutant discharge to receiving waters. Successful implementation depends on effective training of employees on applicable BMPs and general pollution prevention strategies and objectives.

Pollution Prevention

- Encourage alternative designs and maintenance strategies for impervious parking lots. (See New Development and Redevelopment BMP Handbook)
- Keep accurate maintenance logs to evaluate BMP implementation.

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Suggested Protocols

General

- Keep the parking and storage areas clean and orderly. Remove debris in a timely fashion.
- Allow sheet runoff to flow into biofilters (vegetated strip and swale) and/or infiltration devices.
- Utilize sand filters or oleophilic collectors for oily waste in low quantities.
- Arrange rooftop drains to prevent drainage directly onto paved surfaces.
- Design lot to include semi-permeable hardscape.
- Discharge soapy water remaining in mop or wash buckets to the sanitary sewer through a sink, toilet, clean-out, or wash area with drain.

Controlling Litter

- Post "No Littering" signs and enforce anti-litter laws.
- Provide an adequate number of litter receptacles.
- Clean out and cover litter receptacles frequently to prevent spillage.
- Provide trash receptacles in parking lots to discourage litter.
- Routinely sweep, shovel, and dispose of litter in the trash.

Surface Cleaning

- Use dry cleaning methods (e.g., sweeping, vacuuming) to prevent the discharge of pollutants into the stormwater conveyance system if possible.
- Establish frequency of public parking lot sweeping based on usage and field observations of waste accumulation.
- Sweep all parking lots at least once before the onset of the wet season.
- Follow the procedures below if water is used to clean surfaces:
  - Block the storm drain or contain runoff.
  - Collect and pump wash water to the sanitary sewer or discharge to a pervious surface. Do not allow wash water to enter storm drains.
  - Dispose of parking lot sweeping debris and dirt at a landfill.
- Follow the procedures below when cleaning heavy oily deposits:
  - Clean oily spots with absorbent materials.
  - Use a screen or filter fabric over inlet, then wash surfaces.

- Do not allow discharges to the storm drain.
- Vacuum/pump discharges to a tank or discharge to sanitary sewer.
- Appropriately dispose of spilled materials and absorbents.

Surface Repair

- Preheat, transfer or load hot bituminous material away from storm drain inlets.
- Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff.
- Cover and seal nearby storm drain inlets where applicable (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal.
- Use only as much water as necessary for dust control, to avoid runoff.
- Catch drips from paving equipment that is not in use with pans or absorbent material placed under the machines. Dispose of collected material and absorbents properly.

Inspection

- Have designated personnel conduct inspections of parking facilities and stormwater conveyance systems associated with parking facilities on a regular basis.
- Inspect cleaning equipment/sweepers for leaks on a regular basis.

Training

- Provide regular training to field employees and/or contractors regarding cleaning of paved areas and proper operation of equipment.
- Train employees and contractors in proper techniques for spill containment and cleanup.

Spill Response and Prevention

- Keep your Spill Prevention Control and Countermeasure (SPCC) Plan up-to-date.
- Place a stockpile of spill cleanup materials where it will be readily accessible or at a central location.
- Clean up fluid spills immediately with absorbent rags or material.
- Dispose of spilled material and absorbents properly.

Other Considerations

Limitations related to sweeping activities at large parking facilities may include high equipment costs, the need for sweeper operator training, and the inability of current sweeper technology to remove oil and grease.

SC-43 Parking/Storage Area Maintenance

Requirements

Costs

Cleaning/sweeping costs can be quite large. Construction and maintenance of stormwater structural controls can be quite expensive as well.

Maintenance

- Sweep parking lot regularly to minimize cleaning with water.
- Clean out oil/water/sand separators regularly, especially after heavy storms.
- Clean parking facilities regularly to prevent accumulated wastes and pollutants from being discharged into conveyance systems during rainy conditions.

Supplemental Information

Further Detail of the BMP

Surface Repair

Apply concrete, asphalt, and seal coat during dry weather to prevent contamination from contacting stormwater runoff. Where applicable, cover and seal nearby storm drain inlets (with waterproof material or mesh) and manholes before applying seal coat, slurry seal, etc. Leave covers in place until job is complete and all water from emulsified oil sealants has drained or evaporated. Clean any debris from these covered manholes and drains for proper disposal. Only use only as much water as is necessary for dust control to avoid runoff.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual http://www.co.clark.wa.us/pubworks/bmpman.pdf

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Pollution from Surface Cleaning Folder. 1996. Bay Area Stormwater Management Agencies Association (BASMAA). http://www.basmaa.org/

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net/

Objectives

- Cover
- Contain
- Educate
- Reduce/Minimize

Targeted Constituents

Sediment	✓
Nutrients	
Trash	✓
Metals	
Bacteria	✓
Oil and Grease	
Organics	

Description

As a consequence of its function, the stormwater conveyance system collects and transports urban runoff and stormwater that may contain certain pollutants. The protocols in this fact sheet are intended to reduce pollutants reaching receiving waters through proper conveyance system operation and maintenance.

Approach

Pollution Prevention

Maintain catch basins, stormwater inlets, and other stormwater conveyance structures on a regular basis to remove pollutants, reduce high pollutant concentrations during the first flush of storms, prevent clogging of the downstream conveyance system, restore catch basins' sediment trapping capacity, and ensure the system functions properly hydraulically to avoid flooding.

Suggested Protocols

Catch Basins/Inlet Structures

- Staff should regularly inspect facilities to ensure compliance with the following:
  - Immediate repair of any deterioration threatening structural integrity.
  - Cleaning before the sump is 40% full. Catch basins should be cleaned as frequently as needed to meet this standard.
  - Stenciling of catch basins and inlets (see SC34 Waste Handling and Disposal).

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- Clean catch basins, storm drain inlets, and other conveyance structures before the wet season to remove sediments and debris accumulated during the summer.

- Conduct inspections more frequently during the wet season for problem areas where sediment or trash accumulates more often. Clean and repair as needed.

- Keep accurate logs of the number of catch basins cleaned.

- Store wastes collected from cleaning activities of the drainage system in appropriate containers or temporary storage sites in a manner that prevents discharge to the storm drain.

- Dewater the wastes if necessary with outflow into the sanitary sewer if permitted. Water should be treated with an appropriate filtering device prior to discharge to the sanitary sewer. If discharge to the sanitary sewer is not allowed, water should be pumped or vacuumed to a tank and properly disposed. Do not dewater near a storm drain or stream.

Storm Drain Conveyance System

- Locate reaches of storm drain with deposit problems and develop a flushing schedule that keeps the pipe clear of excessive buildup.

- Collect and pump flushed effluent to the sanitary sewer for treatment whenever possible.

Pump Stations

- Clean all storm drain pump stations prior to the wet season to remove silt and trash.

- Do not allow discharge to reach the storm drain system when cleaning a storm drain pump station or other facility.

- Conduct routine maintenance at each pump station.

- Inspect, clean, and repair as necessary all outlet structures prior to the wet season.

Open Channel

- Modify storm channel characteristics to improve channel hydraulics, increase pollutant removals, and enhance channel/creek aesthetic and habitat value.

- Conduct channel modification/improvement in accordance with existing laws. Any person, government agency, or public utility proposing an activity that will change the natural (emphasis added) state of any river, stream, or lake in California, must enter into a Steam or Lake Alteration Agreement with the Department of Fish and Game. The developer-applicant should also contact local governments (city, county, special districts), other state agencies (SWRCB, RWQCB, Department of Forestry, Department of Water Resources), and Federal Corps of Engineers and USFWS.

Illicit Connections and Discharges

- Look for evidence of illegal discharges or illicit connections during routine maintenance of conveyance system and drainage structures:

  - Is there evidence of spills such as paints, discoloring, etc?

- Are there any odors associated with the drainage system?

- Record locations of apparent illegal discharges/illicit connections?

- Track flows back to potential dischargers and conduct aboveground inspections. This can be done through visual inspection of upgradient manholes or alternate techniques including zinc chloride smoke testing, fluorometric dye testing, physical inspection testing, or television camera inspection.

- Eliminate the discharge once the origin of flow is established.

■ Stencil or demarcate storm drains, where applicable, to prevent illegal disposal of pollutants. Storm drain inlets should have messages such as "Dump No Waste Drains to Stream" stenciled next to them to warn against ignorant or intentional dumping of pollutants into the storm drainage system.

■ Refer to fact sheet SC-10 Non-Stormwater Discharges.

Illegal Dumping

■ Inspect and clean up hot spots and other storm drainage areas regularly where illegal dumping and disposal occurs.

■ Establish a system for tracking incidents. The system should be designed to identify the following:

- Illegal dumping hot spots

- Types and quantities (in some cases) of wastes

- Patterns in time of occurrence (time of day/night, month, or year)

- Mode of dumping (abandoned containers, "midnight dumping" from moving vehicles, direct dumping of materials, accidents/spills)

- Responsible parties

■ Post "No Dumping" signs in problem areas with a phone number for reporting dumping and disposal. Signs should also indicate fines and penalties for illegal dumping.

■ Refer to fact sheet SC-10 Non-Stormwater Discharges.

Training

■ Train crews in proper maintenance activities, including record keeping and disposal.

■ Allow only properly trained individuals to handle hazardous materials/wastes.

■ Have staff involved in detection and removal of illicit connections trained in the following:

- OSHA-required Health and Safety Training (29 CFR 1910.120) plus annual refresher training (as needed).

- OSHA Confined Space Entry training (Cal-OSHA Confined Space, Title 8 and Federal OSHA 29 CFR 1910.146).

- Procedural training (field screening, sampling, smoke/dye testing, TV inspection).

Spill Response and Prevention

- Investigate all reports of spills, leaks, and/or illegal dumping promptly.

- Clean up all spills and leaks using "dry" methods (with absorbent materials and/or rags) or dig up, remove, and properly dispose of contaminated soil.

- Refer to fact sheet SC-11 Spill Prevention, Control, and Cleanup.

Other Considerations (Limitations and Regulations)

- Clean-up activities may create a slight disturbance for local aquatic species. Access to items and material on private property may be limited. Trade-offs may exist between channel hydraulics and water quality/riparian habitat. If storm channels or basins are recognized as wetlands, many activities, including maintenance, may be subject to regulation and permitting.

- Storm drain flushing is most effective in small diameter pipes (36-inch diameter pipe or less, depending on water supply and sediment collection capacity). Other considerations associated with storm drain flushing may include the availability of a water source, finding a downstream area to collect sediments, liquid/sediment disposal, and prohibition against disposal of flushed effluent to sanitary sewer in some areas.

- Regulations may include adoption of substantial penalties for illegal dumping and disposal.

- Local municipal codes may include sections prohibiting discharge of soil, debris, refuse, hazardous wastes, and other pollutants into the storm drain system.

Requirements

Costs

- An aggressive catch basin cleaning program could require a significant capital and O&M budget.

- The elimination of illegal dumping is dependent on the availability, convenience, and cost of alternative means of disposal. The primary cost is for staff time. Cost depends on how aggressively a program is implemented. Other cost considerations for an illegal dumping program include:

  - Purchase and installation of signs.

  - Rental of vehicle(s) to haul illegally-disposed items and material to landfills.

  - Rental of heavy equipment to remove larger items (e.g., car bodies) from channels.

  - Purchase of landfill space to dispose of illegally-dumped items and material.

- Methods used for illicit connection detection (smoke testing, dye testing, visual inspection, and flow monitoring) can be costly and time-consuming. Site-specific factors, such as the level of impervious area, the density and ages of buildings, and type of land use will determine the level of investigation necessary.

Maintenance

- Two-person teams may be required to clean catch basins with vactor trucks.
- Teams of at least two people plus administrative personnel are required to identify illicit discharges, depending on the complexity of the storm sewer system.
- Arrangements must be made for proper disposal of collected wastes.
- Technical staff are required to detect and investigate illegal dumping violations.

Supplemental Information

Further Detail of the BMP

Storm Drain Flushing

Flushing is a common maintenance activity used to improve pipe hydraulics and to remove pollutants in storm drainage systems. Flushing may be designed to hydraulically convey accumulated material to strategic locations, such as an open channel, another point where flushing will be initiated, or the sanitary sewer and the treatment facilities, thus preventing resuspension and overflow of a portion of the solids during storm events. Flushing prevents "plug flow" discharges of concentrated pollutant loadings and sediments. Deposits can hinder the designed conveyance capacity of the storm drain system and potentially cause backwater conditions in severe cases of clogging.

Storm drain flushing usually takes place along segments of pipe with grades that are too flat to maintain adequate velocity to keep particles in suspension. An upstream manhole is selected to place an inflatable device that temporarily plugs the pipe. Further upstream, water is pumped into the line to create a flushing wave. When the upstream reach of pipe is sufficiently full to cause a flushing wave, the inflated device is rapidly deflated with the assistance of a vacuum pump, thereby releasing the backed up water and resulting in the cleaning of the storm drain segment.

To further reduce impacts of stormwater pollution, a second inflatable device placed well downstream may be used to recollect the water after the force of the flushing wave has dissipated. A pump may then be used to transfer the water and accumulated material to the sanitary sewer for treatment. In some cases, an interceptor structure may be more practical or required to recollect the flushed waters.

It has been found that cleansing efficiency of periodic flush waves is dependent upon flush volume, flush discharge rate, sewer slope, sewer length, sewer flow rate, sewer diameter, and population density. As a rule of thumb, the length of line to be flushed should not exceed 700 feet. At this maximum recommended length, the percent removal efficiency ranges between 65-75% for organics and 55-65% for dry weather grit/inorganic material. The percent removal efficiency drops rapidly beyond that. Water is commonly supplied by a water truck, but fire hydrants can also supply water. To make the best use of water, it is recommended that reclaimed water be used or that fire hydrant line flushing coincide with storm sewer flushing.

References and Resources

California's Nonpoint Source Program Plan http://www.swrcb.ca.gov/nps/index.html

Clark County Storm Water Pollution Control Manual
http://www.co.clark.wa.us/pubworks/bmpman.pdf

Ferguson, B.K. 1991. Urban Stream Reclamation, p. 324-322, Journal of Soil and Water Conservation.

King County Storm Water Pollution Control Manual http://dnr.metrokc.gov/wlr/dss/spcm.htm

Oregon Association of Clean Water Agencies. Oregon Municipal Stormwater Toolbox for Maintenance Practices. June 1998.

Santa Clara Valley Urban Runoff Pollution Prevention Program http://www.scvurppp.org

The Storm Water Managers Resource Center http://www.stormwatercenter.net

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Storm Drain System Cleaning. On line:
http://www.epa.gov/npdes/menuofbmps/poll_16.htm

Landscape Maintenance SC-73

Objectives

- Contain
- Educate
- Reduce/Minimize
- Product Substitution

Targeted Constituents

Sediment	☑
Nutrients	☑
Trash	☑
Metals	
Bacteria	
Oil and Grease	
Organics	
Oxygen Demanding	☑

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Description

Landscape maintenance activities include vegetation removal; herbicide and insecticide application; fertilizer application; watering; and other gardening and lawn care practices. Vegetation control typically involves a combination of chemical (herbicide) application and mechanical methods. All of these maintenance practices have the potential to contribute pollutants to the storm drain system. The major objectives of this BMP are to minimize the discharge of pesticides, herbicides and fertilizers to the storm drain system and receiving waters; prevent the disposal of landscape waste into the storm drain system by collecting and properly disposing of clippings and cuttings, and educating employees and the public.

Approach

Pollution Prevention

- Implement an integrated pest management (IPM) program. IPM is a sustainable approach to managing pests by combining biological, cultural, physical, and chemical tools.
- Choose low water using flowers, trees, shrubs, and groundcover.
- Consider alternative landscaping techniques such as naturescaping and xeriscaping.
- Conduct appropriate maintenance (i.e. properly timed fertilizing, weeding, pest control, and pruning) to help preserve the landscapes water efficiency.

- Consider grass cycling (grass cycling is the natural recycling of grass by leaving the clippings on the lawn when mowing. Grass clippings decompose quickly and release valuable nutrients back into the lawn).

Suggested Protocols

Mowing, Trimming, and Weeding

- Whenever possible use mechanical methods of vegetation removal (e.g mowing with tractor-type or push mowers, hand cutting with gas or electric powered weed trimmers) rather than applying herbicides. Use hand weeding where practical.

- Avoid loosening the soil when conducting mechanical or manual weed control, this could lead to erosion. Use mulch or other erosion control measures when soils are exposed.

- Performing mowing at optimal times. Mowing should not be performed if significant rain events are predicted.

- Mulching mowers may be recommended for certain flat areas. Other techniques may be employed to minimize mowing such as selective vegetative planting using low maintenance grasses and shrubs.

- Collect lawn and garden clippings, pruning waste, tree trimmings, and weeds. Chip if necessary, and compost or dispose of at a landfill (see waste management section of this fact sheet).

- Place temporarily stockpiled material away from watercourses, and berm or cover stockpiles to prevent material releases to storm drains.

Planting

- Determine existing native vegetation features (location, species, size, function, importance) and consider the feasibility of protecting them. Consider elements such as their effect on drainage and erosion, hardiness, maintenance requirements, and possible conflicts between preserving vegetation and the resulting maintenance needs.

- Retain and/or plant selected native vegetation whose features are determined to be beneficial, where feasible. Native vegetation usually requires less maintenance (e.g., irrigation, fertilizer) than planting new vegetation.

- Consider using low water use groundcovers when planting or replanting.

Waste Management

- Compost leaves, sticks, or other collected vegetation or dispose of at a permitted landfill. Do not dispose of collected vegetation into waterways or storm drainage systems.

- Place temporarily stockpiled material away from watercourses and storm drain inlets, and berm or cover stockpiles to prevent material releases to the storm drain system.

- Reduce the use of high nitrogen fertilizers that produce excess growth requiring more frequent mowing or trimming.

- Avoid landscape wastes in and around storm drain inlets by either using bagging equipment or by manually picking up the material.

Irrigation

- Where practical, use automatic timers to minimize runoff.

- Use popup sprinkler heads in areas with a lot of activity or where there is a chance the pipes may be broken. Consider the use of mechanisms that reduce water flow to sprinkler heads if broken.

- Ensure that there is no runoff from the landscaped area(s) if re-claimed water is used for irrigation.

- If bailing of muddy water is required (e.g. when repairing a water line leak), do not put it in the storm drain; pour over landscaped areas.

- Irrigate slowly or pulse irrigate to prevent runoff and then only irrigate as much as is needed.

- Apply water at rates that do not exceed the infiltration rate of the soil.

Fertilizer and Pesticide Management

- Utilize a comprehensive management system that incorporates integrated pest management (IPM) techniques. There are many methods and types of IPM, including the following:

  - Mulching can be used to prevent weeds where turf is absent, fencing installed to keep rodents out, and netting used to keep birds and insects away from leaves and fruit.

  - Visible insects can be removed by hand (with gloves or tweezers) and placed in soapy water or vegetable oil. Alternatively, insects can be sprayed off the plant with water or in some cases vacuumed off of larger plants.

  - Store-bought traps, such as species-specific, pheromone-based traps or colored sticky cards, can be used.

  - Slugs can be trapped in small cups filled with beer that are set in the ground so the slugs can get in easily.

  - In cases where microscopic parasites, such as bacteria and fungi, are causing damage to plants, the affected plant material can be removed and disposed of (pruning equipment should be disinfected with bleach to prevent spreading the disease organism).

  - Small mammals and birds can be excluded using fences, netting, tree trunk guards.

  - Beneficial organisms, such as bats, birds, green lacewings, ladybugs, praying mantis, ground beetles, parasitic nematodes, trichogramma wasps, seed head weevils, and spiders that prey on detrimental pest species can be promoted.

- Follow all federal, state, and local laws and regulations governing the use, storage, and disposal of fertilizers and pesticides and training of applicators and pest control advisors.

- Use pesticides only if there is an actual pest problem (not on a regular preventative schedule).
- Do not use pesticides if rain is expected. Apply pesticides only when wind speeds are low (less than 5 mph).
- Do not mix or prepare pesticides for application near storm drains.
- Prepare the minimum amount of pesticide needed for the job and use the lowest rate that will effectively control the pest.
- Employ techniques to minimize off-target application (e.g. spray drift) of pesticides, including consideration of alternative application techniques.
- Fertilizers should be worked into the soil rather than dumped or broadcast onto the surface.
- Calibrate fertilizer and pesticide application equipment to avoid excessive application.
- Periodically test soils for determining proper fertilizer use.
- Sweep pavement and sidewalk if fertilizer is spilled on these surfaces before applying irrigation water.
- Purchase only the amount of pesticide that you can reasonably use in a given time period (month or year depending on the product).
- Triple rinse containers, and use rinse water as product. Dispose of unused pesticide as hazardous waste.
- Dispose of empty pesticide containers according to the instructions on the container label.

Inspection

- Inspect irrigation system periodically to ensure that the right amount of water is being applied and that excessive runoff is not occurring. Minimize excess watering, and repair leaks in the irrigation system as soon as they are observed.
- Inspect pesticide/fertilizer equipment and transportation vehicles daily.

Training

- Educate and train employees on use of pesticides and in pesticide application techniques to prevent pollution. Pesticide application must be under the supervision of a California qualified pesticide applicator.
- Train/encourage municipal maintenance crews to use IPM techniques for managing public green areas.
- Annually train employees within departments responsible for pesticide application on the appropriate portions of the agency's IPM Policy, SOPs, and BMPs, and the latest IPM techniques.

- Employees who are not authorized and trained to apply pesticides should be periodically (at least annually) informed that they cannot use over-the-counter pesticides in or around the workplace.
- Use a training log or similar method to document training.

Spill Response and Prevention

- Refer to SC-11, Spill Prevention, Control & Cleanup
- Have spill cleanup materials readily available and in a know in location
- Cleanup spills immediately and use dry methods if possible.
- Properly dispose of spill cleanup material.

Other Considerations

- The Federal Pesticide, Fungicide, and Rodenticide Act and California Title 3, Division 6, Pesticides and Pest Control Operations place strict controls over pesticide application and handling and specify training, annual refresher, and testing requirements. The regulations generally cover: a list of approved pesticides and selected uses, updated regularly; general application information; equipment use and maintenance procedures; and record keeping. The California Department of Pesticide Regulations and the County Agricultural Commission coordinate and maintain the licensing and certification programs. All public agency employees who apply pesticides and herbicides in "agricultural use" areas such as parks, golf courses, rights-of-way and recreation areas should be properly certified in accordance with state regulations. Contracts for landscape maintenance should include similar requirements.
- All employees who handle pesticides should be familiar with the most recent material safety data sheet (MSDS) files.
- Municipalities do not have the authority to regulate the use of pesticides by school districts, however the California Healthy Schools Act of 2000 (AB 2260) has imposed requirements on California school districts regarding pesticide use in schools. Posting of notification prior to the application of pesticides is now required, and IPM is stated as the preferred approach to pest management in schools.

Requirements

Costs

Additional training of municipal employees will be required to address IPM techniques and BMPs. IPM methods will likely increase labor cost for pest control which may be offset by lower chemical costs.

Maintenance

Not applicable

Supplemental Information

Further Detail of the BMP

Waste Management

Composting is one of the better disposal alternatives if locally available. Most municipalities either have or are planning yard waste composting facilities as a means of reducing the amount of waste going to the landfill. Lawn clippings from municipal maintenance programs as well as private sources would probably be compatible with most composting facilities

Contractors and Other Pesticide Users

Municipal agencies should develop and implement a process to ensure that any contractor employed to conduct pest control and pesticide application on municipal property engages in pest control methods consistent with the IPM Policy adopted by the agency. Specifically, municipalities should require contractors to follow the agency's IPM policy, SOPs, and BMPs; provide evidence to the agency of having received training on current IPM techniques when feasible; provide documentation of pesticide use on agency property to the agency in a timely manner.

References and Resources

King County Stormwater Pollution Control Manual. Best Management Practices for Businesses. 1995. King County Surface Water Management. July. On-line: http://dnr.metrokc.gov/wlr/dss/spcm.htm

Los Angeles County Stormwater Quality Model Programs. Public Agency Activities http://ladpw.org/wmd/npdes/model_links.cfm

Model Urban Runoff Program: A How-To Guide for Developing Urban Runoff Programs for Small Municipalities. Prepared by City of Monterey, City of Santa Cruz, California Coastal Commission, Monterey Bay National Marine Sanctuary, Association of Monterey Bay Area Governments, Woodward-Clyde, Central Coast Regional Water Quality Control Board. July. 1998.

Orange County Stormwater Program http://www.ocwatersheds.com/StormWater/swp_introduction.asp

Santa Clara Valley Urban Runoff Pollution Prevention Program. 1997 Urban Runoff Management Plan. September 1997, updated October 2000.

United States Environmental Protection Agency (USEPA). 2002. Pollution Prevention/Good Housekeeping for Municipal Operations Landscaping and Lawn Care. Office of Water. Office of Wastewater Management. On-line: http://www.epa.gov/npdes/menuofbmps/poll_8.htm

Efficient Irrigation SD-12

Design Objectives

- ☑ Maximize Infiltration
- ☑ Provide Retention
- ☑ Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- Contain Pollutants
- Collect and Convey

Description
Irrigation water provided to landscaped areas may result in excess irrigation water being conveyed into stormwater drainage systems.

Approach
Project plan designs for development and redevelopment should include application methods of irrigation water that minimize runoff of excess irrigation water into the stormwater conveyance system.

Suitable Applications
Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations
Designing New Installations
The following methods to reduce excessive irrigation runoff should be considered, and incorporated and implemented where determined applicable and feasible by the Permittee:

- Employ rain-triggered shutoff devices to prevent irrigation after precipitation.
- Design irrigation systems to each landscape area's specific water requirements.
- Include design featuring flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.
- Implement landscape plans consistent with County or City water conservation resolutions, which may include provision of water sensors, programmable irrigation times (for short cycles), etc.

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- Design timing and application methods of irrigation water to minimize the runoff of excess irrigation water into the storm water drainage system.
- Group plants with similar water requirements in order to reduce excess irrigation runoff and promote surface filtration. Choose plants with low irrigation requirements (for example, native or drought tolerant species). Consider design features such as:
  - Using mulches (such as wood chips or bar) in planter areas without ground cover to minimize sediment in runoff
  - Installing appropriate plant materials for the location, in accordance with amount of sunlight and climate, and use native plant materials where possible and/or as recommended by the landscape architect
  - Leaving a vegetative barrier along the property boundary and interior watercourses, to act as a pollutant filter, where appropriate and feasible
  - Choosing plants that minimize or eliminate the use of fertilizer or pesticides to sustain growth
- Employ other comparable, equally effective methods to reduce irrigation water runoff.

Redeveloping Existing Installations
Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Other Resources
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Maintenance Bays & Docks SD-31

Design Objectives

- ☐ Maximize Infiltration
- ☐ Provide Retention
- ☐ Slow Runoff
- ☐ Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- ☐ Collect and Convey

Description

Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach

In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications

Appropriate applications include commercial and industrial areas planned for development or redevelopment.

Design Considerations

Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations

Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.
- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.
- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.
- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.
- Other features may be comparable and equally effective.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

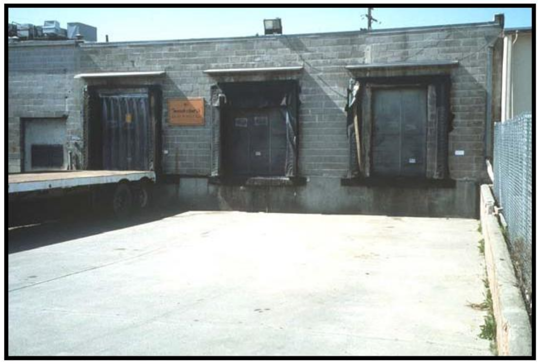
Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.



Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- ☑ Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description
Several measures can be taken to prevent operations at maintenance bays and loading docks from contributing a variety of toxic compounds, oil and grease, heavy metals, nutrients, suspended solids, and other pollutants to the stormwater conveyance system.

Approach
In designs for maintenance bays and loading docks, containment is encouraged. Preventative measures include overflow containment structures and dead-end sumps. However, in the case of loading docks from grocery stores and warehouse/distribution centers, engineered infiltration systems may be considered.

Suitable Applications
Appropriate applications include commercial and industrial areas planned for development or redevelopment.

Design Considerations
Design requirements for vehicle maintenance and repair are governed by Building and Fire Codes, and by current local agency ordinances, and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code requirements.

Designing New Installations
Designs of maintenance bays should consider the following:

- Repair/maintenance bays and vehicle parts with fluids should be indoors; or designed to preclude urban run-on and runoff.
- Repair/maintenance floor areas should be paved with Portland cement concrete (or equivalent smooth impervious surface).

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- Repair/maintenance bays should be designed to capture all wash water leaks and spills. Provide impermeable berms, drop inlets, trench catch basins, or overflow containment structures around repair bays to prevent spilled materials and wash-down waters form entering the storm drain system. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.
- Other features may be comparable and equally effective.

The following designs of loading/unloading dock areas should be considered:

- Loading dock areas should be covered, or drainage should be designed to preclude urban run-on and runoff.
- Direct connections into storm drains from depressed loading docks (truck wells) are prohibited.
- Below-grade loading docks from grocery stores and warehouse/distribution centers of fresh food items should drain through water quality inlets, or to an engineered infiltration system, or an equally effective alternative. Pre-treatment may also be required.
- Other features may be comparable and equally effective.

Redeveloping Existing Installations
Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information
Stormwater and non-stormwater will accumulate in containment areas and sumps with impervious surfaces. Contaminated accumulated water must be disposed of in accordance with applicable laws and cannot be discharged directly to the storm drain or sanitary sewer system without the appropriate permit.

Other Resources
A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Trash Storage Areas SD-32

Design Objectives

- Maximize Infiltration
- Provide Retention
- Slow Runoff
- Minimize Impervious Land Coverage
- Prohibit Dumping of Improper Materials
- ☑ Contain Pollutants
- Collect and Convey

Description

Trash storage areas are areas where a trash receptacle (s) are located for use as a repository for solid wastes. Stormwater runoff from areas where trash is stored or disposed of can be polluted. In addition, loose trash and debris can be easily transported by water or wind into nearby storm drain inlets, channels, and/or creeks. Waste handling operations that may be sources of stormwater pollution include dumpsters, litter control, and waste piles.

Approach

This fact sheet contains details on the specific measures required to prevent or reduce pollutants in stormwater runoff associated with trash storage and handling. Preventative measures including enclosures, containment structures, and impervious pavements to mitigate spills, should be used to reduce the likelihood of contamination.

Suitable Applications

Appropriate applications include residential, commercial and industrial areas planned for development or redevelopment. (Detached residential single-family homes are typically excluded from this requirement.)

Design Considerations

Design requirements for waste handling areas are governed by Building and Fire Codes, and by current local agency ordinances and zoning requirements. The design criteria described in this fact sheet are meant to enhance and be consistent with these code and ordinance requirements. Hazardous waste should be handled in accordance with legal requirements established in Title 22, California Code of Regulation.

Wastes from commercial and industrial sites are typically hauled by either public or commercial carriers that may have design or access requirements for waste storage areas. The design criteria in this fact sheet are recommendations and are not intended to be in conflict with requirements established by the waste hauler. The waste hauler should be contacted prior to the design of your site trash collection areas. Conflicts or issues should be discussed with the local agency.

Designing New Installations

Trash storage areas should be designed to consider the following structural or treatment control BMPs:

- Design trash container areas so that drainage from adjoining roofs and pavement is diverted around the area(s) to avoid run-on. This might include berming or grading the waste handling area to prevent run-on of stormwater.

- Make sure trash container areas are screened or walled to prevent off-site transport of trash.

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- Use lined bins or dumpsters to reduce leaking of liquid waste.
- Provide roofs, awnings, or attached lids on all trash containers to minimize direct precipitation and prevent rainfall from entering containers.
- Pave trash storage areas with an impervious surface to mitigate spills.
- Do not locate storm drains in immediate vicinity of the trash storage area.
- Post signs on all dumpsters informing users that hazardous materials are not to be disposed of therein.

Redeveloping Existing Installations

Various jurisdictional stormwater management and mitigation plans (SUSMP, WQMP, etc.) define "redevelopment" in terms of amounts of additional impervious area, increases in gross floor area and/or exterior construction, and land disturbing activities with structural or impervious surfaces. The definition of " redevelopment" must be consulted to determine whether or not the requirements for new development apply to areas intended for redevelopment. If the definition applies, the steps outlined under "designing new installations" above should be followed.

Additional Information

Maintenance Considerations

The integrity of structural elements that are subject to damage (i.e., screens, covers, and signs) must be maintained by the owner/operator. Maintenance agreements between the local agency and the owner/operator may be required. Some agencies will require maintenance deed restrictions to be recorded of the property title. If required by the local agency, maintenance agreements or deed restrictions must be executed by the owner/operator before improvement plans are approved.

Other Resources

A Manual for the Standard Urban Stormwater Mitigation Plan (SUSMP), Los Angeles County Department of Public Works, May 2002.

Model Standard Urban Storm Water Mitigation Plan (SUSMP) for San Diego County, Port of San Diego, and Cities in San Diego County, February 14, 2002.

Model Water Quality Management Plan (WQMP) for County of Orange, Orange County Flood Control District, and the Incorporated Cities of Orange County, Draft February 2003.

Ventura Countywide Technical Guidance Manual for Stormwater Quality Control Measures, July 2002.

Section 5
Monitoring, Reporting, and Program Evaluation

Monitoring, Reporting, and Evaluation Elements

- Conduct monitoring program
- Conduct record keeping and reporting
- Conduct annual site evaluation
  - Review monitoring information
  - Evaluate BMPs
  - Review and revise the SWPPP as necessary

Conducting a monitoring program, reviewing the monitoring information, evaluating BMPs, and record keeping and reporting are all important elements of the implementation phase of the SWPPP. The success of the SWPPP depends upon the thorough implementation of the monitoring plan and evaluation of the effectiveness of the plan elements once they have been implemented.

5.1 Conduct Monitoring Program

The General Permit requires that a monitoring program be a component of the SWPPP. The program has the following objectives:

- To monitor the quality of the stormwater discharge
- To aid in SWPPP implementation
- To measure the BMP effectiveness

To meet these objectives the monitoring effort has these elements:

- Training
- Visual observations
- Stormwater monitoring
- Authorized non-stormwater discharges

5.1.1 Training

Familiarity with the requirements of the stormwater monitoring plan and competence in the techniques and protocols specified in the plan are essential to ensure that stormwater samples are collected in a manner that meets the goals of the plan, while protecting the health and safety of the monitoring team members. It is recommended that all stormwater monitoring personnel receive training prior to conducting any stormwater monitoring activities. Stormwater monitoring training should include the following basic elements:

- Review of the Monitoring Plan and Health and Safety Plan

- Classroom training session
- Field training and sampling simulation (dry run)
- Annual refresher training

5.1.2 Visual Observations

Visual observations of both stormwater and non-stormwater discharges should be made at all facilities to document the presence of any discolorations, odors, floating and suspended material, oil and grease, etc., and to identify the source of any pollutants and non-stormwater flows. Visual observations should be made under the leadership of the SWPPP Leader, with appropriate members of the Pollution Prevention Team, according to the following schedule:

- All drainage areas within the facility should be checked for the presence of unauthorized non-stormwater discharges on a quarterly basis, during daylight hours, on days with no stormwater discharges.
- All authorized non-stormwater discharges and their sources should be observed quarterly during daylight hours, on days with no stormwater discharges.
- One storm event per month during the wet season (October 1-May 30) should be visually observed during the first hour of discharge at all discharge locations. These observations are only required of stormwater discharges that occur during daylight hours that are preceded by at least three working days without stormwater discharges and that occur during scheduled facility operating hours.

The results of the visual observations should be recorded and include: the date of the observation, locations observed, observations, response taken to eliminate unauthorized non-stormwater discharges, and actions taken to reduce or prevent pollutants from contacting non-stormwater or stormwater discharges. Results are included in the Annual Report.

5.1.3 Stormwater Monitoring

Each facility should either conduct an individual monitoring plan or participate in a group-sampling program. A group-monitoring program may be developed either by an entity representing a group of similar facilities or by a local stormwater agency that holds its own NPDES permit. According to the General Permit, the monitoring plan is to contain the rationale and description of the visual observation methods, location, and frequency; and the analytical methods and corresponding method detection limits used to detect constituents.

Selection of sites for industrial stormwater monitoring will depend on many factors including the following:

Representativeness

It is important to select sites that are representative of typical site operations.

- Runoff from the facility should combine to form a definable runoff stream.

- The runoff stream should represent the full range of activities at the facility.
- Runoff from the facility should not combine with runoff from other sources.
- Adequate flow volume must be available for sample collection.

Personal Safety

Development of a health and safety plan is recommended. Site selection should insure monitoring personnel from the following potential hazards:

- Traffic
- Uneven or slippery footing surface
- Poor night visibility (lighting)

Site Access

Ease of monitoring site access for monitoring personnel and vehicles parking is essential. Also, for sites that require installation of sample collection or flow metering equipment, adequate equipment access for maintenance and monitoring activities must be available.

Equipment Security

Permanently installed monitoring equipment must be located at a site that will minimize potential vandalism and other possible damage.

Adequate Flow Volume

Monitoring sites should be configured such that adequate flow volume is present for sample collection. Hydraulic conditions should be well mixed and free flowing.

Utility Access

If automated monitoring equipment is required, electrical power should be readily available at selected monitoring sites. Additionally, telephone service may be required for off-site station controlling and data transfer.

Stormwater samples should be collected during the first hour of discharge from (1) the first storm event of the wet season, and (2) at least one other storm event in the wet season. If the first event is missed, sampling of two events during the wet season is still required. Furthermore, a justification for failing to sample the first event should be provided in the Annual Report. Sample collection is only required of stormwater discharges that occur during scheduled facility operating hours and that are preceded by at least three working days without stormwater discharge. Sample collection is not required if dangerous weather conditions are present (e.g., flooding, electrical storm, etc.), when stormwater discharges begin after scheduled facility operating hours or when stormwater discharges are not preceded by three working days without discharge. When the required samples are not collected due to these exceptions, an explanation must be provided in the Annual Report. Visual observations and sample collection may be conducted more than one hour after discharge begins if it is determined that the monitoring objectives will be better satisfied. If this occurs, an explanation should be provided in the Annual Report.

Specific sampling and analysis requirements include the following:

- All sampling and sample preservation should be in accordance with the current edition of "Standard Methods for the Examination of Water and Wastewater".

- All monitoring instruments and equipment should be calibrated and maintained in accordance with manufacturers' specifications to ensure accurate measurements.

- All laboratory analyses should be conducted according to test procedures under 40 CFR Part 136, unless other test procedures have been specified by the RWQCB.

- Analyze samples for total suspended solids (TSS), pH, specific conductance, and total organic carbon (TOC). Oil and grease (O&G) may be substituted for TOC.

- Analyze toxic chemicals and other pollutants that are likely to be present in stormwater discharges. Any of these pollutants that are not detected in significant quantities after two consecutive sampling events may be eliminated from future sampling analysis until the pollutant is likely to be present again. (According to the definitions section of the General Permit, "significant quantities" is defined as the volume, concentration, or mass of a pollutant that can cause or threaten to cause pollution, contamination, or nuisance; adversely impact human health or the environment; and/or cause or contribute to a violation of any applicable water quality standards for the receiving water.)

- Other analytical parameters should be included based on the facility's standard industrial classification (see Table D of the General Permit).

Rules to Follow to Reduce Potential Sample Contamination

1. No smoking.
2. Never sample near a running vehicle. Do not park vehicles in immediate sample collection area (even non-running vehicles)
3. Always wear clean, powder-free nitrile gloves when handling composite bottles, lids, sterile grab sample bottles, tubing, or strainers.
4. Never touch the inside surface of a sample bottle or lid, even with gloved hands.
5. Never touch the exposed end of a sampling tube.
6. Never allow the inner surface of a sample bottle, lid, or sampling tube to be contacted by any material other than the sample water.
7. Never allow any object or material to fall into or contact the collected sample water.
8. Avoid allowing rain water to drip from rain gear or other surfaces into sample bottles.
9. Do not eat or drink during sample collection.
10. Do not breathe, sneeze or cough in the direction of an open sample bottle.

In addition to the requirements above, which are outlined in the General Permit, the following procedures are recommended to maximize the ability of sampling personnel to collect samples reliably and with minimal sample contamination.

- Before stormwater samples are collected, personnel must ensure the safety of such activities at each sampling location.

- Select the appropriate sample bottles and equipment for each parameter to be measured. As general guidelines, all sampling equipment and sample bottles used for trace metals determination should be nonmetallic and free from any material that may contain metals. Only high-density plastic or Teflon containers should be used for metals analytical sample storage bottles. All sampling equipment and sample bottles used for trace organics determination should be glass or Teflon. Nutrients and most "conventional" parameters may be sampled using plastic or glass bottles.

- Employ "clean" sampling techniques to minimize potential sources of sample contamination, particularly from trace pollutants. Experience has shown that when clean sampling techniques are used, detected concentrations of constituents tend to be lower.

5.2 Conduct Record Keeping and Reporting

Records of all stormwater monitoring information, inspections and visual observations, certifications, corrective actions and follow-up activities, and copies of all reports should be retained for a period of at least five years. These records should include:

- The date, place, and time of site inspections, sampling, visual observations, and measurements

- The individual(s) who performed the site inspections, sampling, visual observations, and measurements

- Flow measurements or estimates (as required by Section B.6 of the General Permit)

- The date and approximate time of analyses

- The individual who performed the analyses

- Analytical results, method detection limits, and the analytical techniques or methods used

- Quality assurance and quality control records and results

- Non-stormwater discharge inspections and visual observations and stormwater discharge visual observation records

- Visual observations and sample collection exception records

- All calibration and maintenance records of onsite instruments used

- All sampling and analysis exemption and reduction certifications and supporting documentation
- The records of any corrective actions and follow-up activities that resulted from the visual observations

It is also recommended that information regarding the rain event be collected. A nearby recording gage should be identified and used to document the start and stop times and date of precipitation event. Some industries may want to consider installing a recording gage at the monitoring site.

Photographs can be useful. Also keep a record of maintenance activities or any other BMPs that are of an "action" nature. It is easy to demonstrate that a BMP that involves a physical change, such as berming or covering, has been accomplished. But actions that relate to good housekeeping can only be demonstrated by record keeping. Keeping a record of catch basin cleaning, for example, also provides insight into how soon it takes for the catch basin sump to refill.

An Annual Report including the items listed below should be submitted by July 1 of each year to the Executive Officer of the appropriate RWQCB.

- Summary of visual observations and sampling results
- Evaluation of the visual observations and sampling and analysis results
- Documentation that the BMPs in the SWPPP are being implemented and properly maintained as necessary
- Laboratory reports (including detection limits for each analytical parameter)
- The Annual Comprehensive Site Compliance Evaluation Report (as described below)
- Documentation, including the justification, of any deviations from the General Permit requirements (if not already included in the Evaluation Report)
- Records
- Detection limits for each analytical parameter

5.3 Conduct Annual Site Evaluation

All facilities should conduct an annual comprehensive site compliance evaluation. It may be helpful to involve the Pollution Prevention Team (PPT) in this effort (see Section 2). The SWPPP should be revised within 90 days of the evaluation based on the evaluation and the revisions implemented. Evaluations should include the following:

- A review of the results of visual inspections of potential pollutant sources for evidence of, or the potential for, pollutants entering the drainage system

- A review of visual observation records, inspection records, and sampling and analysis results
- A review and evaluation of each BMP to determine whether it is adequate, properly implemented, and maintained
- A review of site activities to ascertain if change has occurred, and if so, whether new or modified BMPs are needed
- A review of the list of significant materials to ascertain if the list has changed, and if so, whether new or modified BMPs are needed
- A review of spills that have occurred over the past 12 months, with a determination of cause(s) and possible solutions, including modified or new BMPs
- A determination of whether each BMP must be modified, replaced, and whether additional BMPs are needed
- An evaluation report

PRELIMINARY GEOTECHNICAL INVESTIGATION AND PERCOLATION TESTING

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

GEOCON
WEST, INC.

GEOTECHNICAL
ENVIRONMENTAL
MATERIALS

PREPARED FOR

THE HOMESTEAD, LLC
NEWPORT BEACH, CALIFORNIA

April 19, 2019
PROJECT NO. T2857-22-01

GEOCON
WEST, INC.
GEOTECHNICAL ■ ENVIRONMENTAL ■ MATERIALS

Project No. T2857-22-01
April 19, 2019

The Homestead, LLC
280 Newport Center Drive, Suite 240
Newport Beach, California 92660

Attention: Mr. Grant Ross

Subject: PRELIMINARY GEOTECHNICAL INVESTIGATION
AND PERCOLATION TESTING
THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

Dear Mr. Ross:

In accordance with your authorization of our Proposal IE-2226 dated August 24, 2018, Geocon West, Inc. (Geocon) herein submits the results of our preliminary geotechnical investigation and percolation testing for the proposed retail development and industrial business park at the northeast corner of Limonite Avenue and Archibald Avenue in Eastvale, California. The geotechnical investigation is being issued as preliminary as portions of the site are inaccessible due to the recent rain and active use of the site by livestock.

The accompanying report presents our findings, conclusions and recommendations pertaining to the geotechnical aspects of the proposed development. Based on the results of this study, it is our opinion the site is considered suitable for the proposed development provided the recommendations of this report are followed.

Should you have any questions regarding this report, or if we may be of further service, please contact the undersigned at your convenience.

Very truly yours,

GEOCON WEST, INC.

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PRELIMINARY GEOTECHNICAL INVESTIGATION AND PERCOLATION TESTING

1. PURPOSE AND SCOPE

This report presents the results of our preliminary geotechnical investigation and percolation testing for the proposed industrial business park located west of Limonite Avenue and Archibald Avenue in Eastvale, California (see *Vicinity Map*, Figure 1). The purpose of the investigation was to evaluate subsurface soil and geologic conditions at the site and, based on the conditions encountered, provide recommendations pertaining to the geotechnical aspects of developing the property as presently proposed.

The scope of our investigation included a review of available historic aerial photographs, subsurface exploration, percolation testing, laboratory testing, engineering analyses, and the preparation of this report. A summary of the information reviewed for this study is presented in the *List of References*.

Our field investigation included the drilling of six small-diameter geotechnical borings and four percolation test borings. Our initial proposed scope included additional borings. However, portions of the site were not accessible due to active use by the livestock, wet soils at the site from recent rains limited access to the drilling equipment, and storm water was ponded in the southwestern portion of the site. An update geotechnical investigation is planned once the site is clear of livestock and the site is accessible to the drilling equipment.

Appendix A presents a discussion of the field investigation, logs of the borings, and percolation test data. The approximate locations of the exploratory borings are presented on the *Geologic Map* (Figure 2). We performed laboratory tests on soil samples obtained from the exploratory borings to evaluate pertinent physical and chemical properties for engineering analysis. The results of the laboratory testing are presented in *Appendix B*.

2. SITE AND PROJECT DESCRIPTION

The site is currently being utilized as a dairy. Residences are in the eastern portion of the site, and the western portion of the site is an open field with a stormwater pond. The general site conditions are shown on Figure 3, *Aerial Photograph*. Based on our review of historic aerial photographs, the site has been utilized for agriculture since at least 1938 and was converted to a dairy in the 1980's or early 1990's (Continental; NETR, 2019).

The area totals approximately 50 acres and is located at latitude 33.9746 and longitude -117.5970. Site grades are relatively level with elevations ranging from approximately 633 feet above mean sea level (MSL) in the southwest corner to 647 feet above MSL in the northeast portion of the site. The property is bounded on the east by Archibald Avenue and on the south by an industrial development. A storm water channel is immediately north and west of the site.

Several stockpiles of soil were observed in the western portion of the site. Manure (organic rich soil) was present in the pen areas and within the western portion of the site. The manure was observed at the ground surface.

Grading plans were not available for our review at the time of this preliminary investigation. The *Conceptual Site Plan* by HP Architecture dated June 21, 2018 was utilized as the base for our *Geologic Map*, Figure 2. The plan indicates four industrial buildings will be constructed in the site, and an extension of Limonite will bisect the site with three buildings to the north and one building south of the roadway. The industrial developments will include associated utility, parking, driveway and flat work improvements. Storm water infiltration structures currently under consideration include one retention basin in the southwest corner, and one retention basin on the eastern portion of the site north of Limonite Avenue.

Based on the site and surrounding grades, we expect that rough grading will result in cuts and fills of up to 10 feet to level the site and fill in the pond. Due to the relatively level topography for the development, graded slopes are expected to be less than 10 feet high. Structural plans were not provided for the buildings; however, we have assumed that the industrial business park will consist of one- or two-story buildings using concrete tilt-up construction. The buildings will likely be supported by shallow foundations with concrete slab-on-grade floors.

Due to the preliminary nature of the design currently, wall and column loads were not available. We expect that column loads for the proposed structures will be up to 100 kips, and wall loads will be up to 10 kips per linear foot. Once the design phase and foundation loading configuration proceeds to a more finalized plan, the recommendations within this report should be reviewed and revised, if necessary.

If project details differ significantly from those described, Geocon should be contacted for review and possible revision to this report.

3. GEOLOGIC SETTING

The site is located within an alluvial fan and flood plain within the southern part of the Chino Basin, that is part of the Corona-Chino Valley crustal block, a major structural low. This crustal block is bounded on the west by the Chino fault and the Chino and San Jose Hills, on the north by the Cucamonga fault zone and the San Gabriel Mountains, on the east by the Rialto-Colton fault, and on the south by the La Sierra and Pedley Hills. This structural low was filled with late Tertiary to early Quaternary non-marine sedimentary deposits derived from the San Gabriel Mountains, the Chino Hills, Puente Hills, and the San Bernardino Mountains via the Santa Ana River, and capped by a relatively thin layer of windblown sand. At depth, the basin consists of impermeable sedimentary and igneous rocks that are exposed at the surface in the surrounding mountains and hills.

Locally, the site is underlain by several hundred feet of young alluvial fan deposits from the San Gabriel Mountains and flood plain deposits from the Santa Ana River to the south, resulting in interlayered fine- and coarse-grained deposits of clays, silts, and sands. No faults are geologically mapped within or adjacent to the site.

4. GEOLOGIC MATERIALS

4.1 General

Based on our field investigation and published geologic maps of the area, the soils underlying the site consist of undocumented artificial fill and young alluvial fan deposits (Morton and Gray, 2002). Undocumented artificial fill was encountered to depths of 3 to 4 feet in the southern portion of the site and is likely present in other areas from the dairy improvements. The site soils are described in detail on the boring logs in *Appendix A*. The soil and geologic units encountered at the site are discussed below.

4.2 Undocumented artificial fill (afu)

Undocumented artificial fill was encountered within Borings B-1, B-5, P-1, and P-2 to depths of 3 to 4 feet within the southern portion of the site. The fill encountered is fine silty sand to silt which is brown to grey, moist and stiff/medium dense. Fill is likely present in other areas of the site that were not explored.

4.3 Young Alluvial Fan Deposits (Qyf_a)

Holocene alluvial fan deposits with interlayered fluvial flood plain deposits were encountered across the site to depths of 51.5 feet. These soils are collectively referred to as young alluvial fan deposits herein for simplicity. The alluvial fan units consist of silty to clayey sands which are moist and generally medium dense. The fluvial deposits are the fine-grained units of silt and clay which are moist to wet and soft to very stiff.

5. GROUNDWATER

Seepage or perched water was encountered within B-2 at 24½ feet below ground surface and in B-4 at a depth of 18¼ feet below the ground surface. Seepage or groundwater were not encountered in the other borings to depths of 30 to 50 feet below ground surface. At the time of our investigation, the stormwater pond in the western portion of the site had standing water. Perched water was not encountered in the borings near the pond but should be expected in the area and along the storm water channel.

Based on data from the California Department of Water Resources, groundwater was reported at depths of greater than 128 feet BGS at a well approximately 0.8 mi east-northeast of the site between 2011 and 2017. It is not uncommon for seepage conditions to develop where none previously existed due to the permeability characteristics of the geologic units encountered. During the rainy season, localized perched water conditions may develop above silt and clay layers that may require special consideration during grading operations. Groundwater elevations are dependent on seasonal precipitation, irrigation, and land use, among other factors, and therefore vary.

6. GEOLOGIC HAZARDS

6.1 Surface Fault Rupture

The numerous faults in southern California include active, potentially active, and inactive faults. The criteria for these major groups are based on criteria developed by the California Geological Survey (CGS, formerly known as CDMG) for the Alquist-Priolo Earthquake Fault Zone Program (Bryant and Hart, 2007). An active fault is one that has had surface displacement within Holocene time (about the last 11,000 years). A potentially active fault has demonstrated surface displacement during Quaternary time (approximately the last 1.6 million years) but has had no known Holocene movement. Faults that have not moved in the last 1.6 million years are considered inactive.

The site is not within a currently established State of California Alquist-Priolo Earthquake Fault Zone (CDC, 2018a) or a Riverside County Fault Hazard Zone for surface fault rupture hazards. No active or potentially active faults with the potential for surface fault rupture are known to pass directly beneath the site. Therefore, the potential for surface rupture due to faulting occurring beneath the site during the design life of the proposed development is considered low. However, the site is in the seismically active southern California region, and could be subjected to moderate to strong ground shaking in the event of an earthquake on one of the many active southern California faults.

The closest active faults to the site are the Chino-Central Avenue fault, located approximately 5.4 miles to the southwest, and the Elsinore Glen Ivy fault, located 8.8 miles south of the site (CDC, 2018b). Faults within a 50-mile radius of the site are listed in Table 6.1.1. Historic earthquakes in southern California of magnitude 6.0 and greater, their magnitude, distance, and direction from the site are listed in Table 6.1.2.

TABLE 6.1.1
Active Faults within 50 Miles of the Site

Fault Name	Maximum Magnitude (Mw)	Geometry (Slip Character)	Slip Rate (mm/yr)	Information Source	Distance from Site (mi)	Direction from Site
Chino Fault	6.7	RL-R-O	1.0	a	4.3	WSW
Elsinore Fault (Glen Ivy North)	6.8	RL-SS	5.0	a	8.8	S
Whittier Fault	6.8	RL-R-O	2.5	a	9.1	SW
Red Hill (Etiwanda Ave)	n/a	n/a	n/a	b	12	NNE
Cucamonga Fault	6.9	R	5.0	a	13	N
San Jacinto Fault (San Bernardino)	6.8	RL-SS	5.0	a	17	NE
San Andreas (San Bernardino Mountains)	7.5	RL-SS	24	a	21	NE
San Jacinto (San Jacinto Valley)	6.9	RL-SS	12	a	24	E
Raymond	6.5	LL-R-O	1.5	a	27	NW
San Jacinto (Casa Loma)	6.9	RL-SS	12	a	28	ESE
Elsinore (Wildomar)	6.8	RL-SS	5.0	a	28	SE
Crafton Hills	n/a	n/a	n/a	b	28	ENE
Newport-Inglewood	7.1	RL-SS	1.0	a	31	SW
Beaumont Plain	n/a	n/a	n/a	b	34	E
North Frontal Thrust	7.2	R	1.0	a	35	NE
San Andreas (Mojave Section)	7.4	RL-SS	30.0	a	36	NNW
Verdugo	6.9	R	0.5	a	38	WNW
Llano	6.1	RO	1.0	a	38	NNW
San Gorgonio Pass	n/a	THRUST	n/a	b	39	E
Palos Verdes	7.3	RS-SS	3.0	a	39	SW
Hollywood	6.4	LL-R-O	1.0	a	40	WNW
Sierra Madre	7.2	R	2.0	a	42	NW
Coronado Bank	7.6	RL-SS	3.0	a	42	SW
San Jacinto (Anza)	7.2	RL-SS	12	a	44	SE
Sierra Madre (San Fernando Section)	6.7	R	2.0	a	45	NW
Redondo Canyon	n/a	n/a	n/a	b	48	WSW
Helendale	7.3	RL-SS	0.6	a	48	NE
Santa Monica	6.6	LL-R-O	1.0	a	48	W

Geometry: BT = blind thrust, LL = left lateral, N = normal, O = oblique, R = reverse, RL = right lateral, SS = strike slip.

Information Sources: a = Cao, T., Bryant, W.A., Rowshandel, B., Branum, D., and Wills, C.J., 2003, The Revised 2002 California Probabilistic Seismic Hazard Maps, including Appendices A, B, and C, dated June; b = online Fault Activity Map of California website, maps.conservation.ca.gov/cgs/fam/, as of 1/2017.

n/a = data not available

TABLE 6.1.2
Historic Earthquake Events with Respect to the Site

Earthquake (Oldest to Youngest)	Date of Earthquake	Magnitude	Distance to Epicenter (Miles)	Direction to Epicenter
San Jacinto	April 21, 1918	6.8	37	ESE
Loma Linda Area	July 22, 1923	6.3	20	E
Long Beach	March 10, 1933	6.4	33	SW
Buck Ridge	March 25, 1937	6.0	86	ESE
Imperial Valley	May 18, 1940	6.9	74	E
Desert Hot Springs	December 4, 1948	6.0	69	E
Arroyo Salada	March 19, 1954	6.4	101	ESE
Borrego Mountain	April 8, 1968	6.5	107	ESE
San Fernando	February 9, 1971	6.6	59	WNW
Joshua Tree	April 22, 1992	6.1	80	E
Landers	June 28, 1992	7.3	74	ENE
Big Bear	June 28, 1992	6.4	50	ENE
Northridge	January 17, 1994	6.7	62	WNW
Hector Mine	October 16, 1999	7.1	93	ENE

6.2 Liquefaction

Liquefaction is a phenomenon in which loose, saturated, relatively cohesionless soil deposits lose shear strength during strong ground motions. Primary factors controlling liquefaction include intensity and duration of ground motion, gradation characteristics of the subsurface soils, in-situ stress conditions, and the depth to groundwater. Liquefaction is typified by a loss of shear strength in the liquefied layers due to rapid increases in pore water pressure generated by earthquake accelerations. Seismically induced settlement may occur whether the potential for liquefaction exists or not.

Liquefaction typically occurs in areas where the soils below the water table are composed of poorly consolidated, fine to medium-grained, primarily sandy soil. In addition to the requisite soil conditions, the ground acceleration and duration of the earthquake must also be of a sufficient level to induce liquefaction.

The site is within an area mapped as having very high liquefaction potential per Riverside County (RCIT, 2018).

As discussed in the Groundwater Section of this report, groundwater is expected in excess of 100 feet below the ground surface, however seepage or perched water was encountered in two of the borings at depths of 18¼ to 24½ feet. The depth of the perched groundwater was used in our liquefaction analysis.

We performed a liquefaction analysis of the soils underlying the site using the spreadsheet template LIQ2_30.WQ1 developed by Thomas F. Blake (1996). This program utilizes the 1996 NCEER method of analysis. The liquefaction potential evaluation was performed by utilizing a magnitude 6.7 earthquake, and the site-specific peak horizontal acceleration for the site. This semi-empirical method is based on a correlation between values of Standard Penetration Test (SPT) resistance

Based on the medium dense to dense consistency of the granular alluvial soils and the relatively cohesive nature of the fine-grained alluvial deposits, the potential for liquefaction and seismic settlement at the site is negligible and not a design consideration. An analysis of the liquefaction potential and seismic induced settlement is included on Figures 4 and 5.

6.3 Expansive Soil

The soils encountered within the site consist of clays, silts, and sands. Laboratory testing results indicate samples of the near surface soils exhibit "very low" expansion potential (expansion index [EI] of 20 or less) with expansion index test results of 0 and 1.

6.4 Hydrocompression

Hydrocompression is the tendency of unsaturated soil structure to collapse upon wetting resulting in the overall settlement of the affected soil and overlying foundations or improvements supported thereon. Potentially compressible soils underlying the site are typically removed and recompacted during remedial site grading. However, if compressible soil is left in-place, a potential for settlement due to hydrocompression of the soil exists. Alluvial soils obtained during our investigation were tested for hydrocompression and exhibited a collapse potential of 0.01 to 0.3 percent when loaded to the expected post-grading pressures.

6.5 Landslides

The site is not located near a hillside. Therefore, landslides are not a design consideration.

6.6 Rock Fall Hazards

Rock falls are not a design consideration due to the lack of natural bedrock slopes above or adjacent to the site.

6.7 Slope Stability

Graded slopes up to 10 feet in height and inclined as steep as 2:1 (horizontal:vertical) are expected at the site. In general, graded fill slopes constructed of on-site soils with gradients of 2:1 (horizontal to vertical) or flatter will possess factors of safety of 1.5 or greater. Geocon should be contacted for additional evaluation is steeper slopes or slopes greater than 10 feet in height are planned for the development.

6.8 Tsunamis and Seiches

A tsunami is a series of long period waves generated in the ocean by a sudden displacement of large volumes of water. Causes of tsunamis include underwater earthquakes, volcanic eruptions, or offshore slope failures. The first order driving force for locally generated tsunamis offshore southern California is expected to be tectonic deformation from large earthquakes (Legg, *et al.*, 2003). The site is located approximately 31 miles from the nearest coastline; therefore, the negligible risk associated with tsunamis is not a design consideration.

A seiche is a run-up of water within a lake or embayment triggered by fault- or landslide-induced ground displacement. The site is not located near or below reservoirs or other standing bodies of water. Therefore, seiche hazard is not a design consideration.

6.9 Organic Rich Soil

Samples of soil tested for organic content indicated that the subsurface site soils have between 1.0 and 3.6 percent organics by weight. Soils with a higher organic content are expected near the ground surface and in stockpiles at the site due to previous agricultural activities and where manure has been mixed with the soils.

7. SITE INFILTRATION

Percolation testing was performed in general accordance with the procedures in *Riverside County Flood Control and Water Conservation District LID BMP, Appendix A* (the Handbook) at locations and depths selected by the design team. The percolation test locations are depicted on the *Geologic Map* (see Figure 2). The percolation tests had to be modified due to the operations of the dairy at the time of our investigation. The sandy soil criteria test had to be halted in percolation tests P-3 and P-4 because of livestock within the test area. The tests were resumed later that day once the dairy was able to relocate the animal.

Approximately 2 inches of gravel was placed at the bottom of each percolation test hole and a 3-inch diameter perforated PVC pipe in silt filter sock was placed atop the gravel. The test locations were pre-saturated prior to testing. Percolation data sheets are presented in *Appendix A* of this report. Calculations to convert the percolation test rate to infiltration test rates are presented in Table 7 below. The Handbook requires a factor of safety of 3 be applied to the values below based on the test method used.

TABLE 7
INFILTRATION TEST RATES FOR PERCOLATION AREAS

Parameter	P-1	P-2	P-3	P-6
Depth (inches)	96.0	96.0	97.0	96.0
Test Type	Modified	Modified	Modified	Modified
Change in head over time: ΔH (inches)	1.7	5.0	1.0	1.1
Average head: Havg (in)	23.2	21.5	24.4	23.6
Time Interval (minutes): Δt (minutes)	30	10	10	10
Radius of test hole: r (inches)	4	4	4	4
Tested Infiltration Rate: It (inches/hour)	0.27	2.58	0.44	0.51

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 General

8.1.1 Soil or geologic conditions were not encountered during the investigation that would preclude the proposed development of the project provided the recommendations presented herein are followed and implemented during design and construction.

8.1.2 Potential geologic hazards at the site include seismic shaking, compressibility of the near surface soils, and organic soils. Based on our investigation and available geologic information, active, potentially active, or inactive faults are not present underlying or trending toward the site.

8.1.3 The undocumented artificial fill and the upper portion of the alluvial soil are not considered suitable for the support of additional compacted fill or settlement-sensitive improvements. Remedial grading of the surficial soil will be required as discussed herein. The existing site soils, except as indicated below, are suitable for re-use as engineered fill provided the recommendations in the *Grading* section of this report are followed.

8.1.4 The manure impacted soils at the site are not suitable for use as compacted fill. The manure impacted soils should be removed from the site as part of the clearing and grubbing operations.

8.1.5 Following removal of the manure impacted soils, our laboratory tests indicate that the subsurface soils to be used as fill contain organic contents between 1.0 and 3.6 percent. Processing of the site soils during grading is expected to result in an average organic content of approximately 2 to 3 percent. Additional compactive effort should be planned during grading to mitigate the settlement potential due to the organic content of the soils at the site.

8.1.6 Perched water was encountered in B-2 at 24½ and in B-4 at 18¼ feet during our subsurface investigation. It is likely that this condition is a result of water from recent precipitation flowing along a silty sand unit and perched on the underlying silt layer. However, based on the variability of the soil types encountered, it is possible that perched water will be encountered at shallower depths, depending on after agricultural irrigation, precipitation during rainy seasons, infiltration from the stormwater pond, and other factors.

8.1.7 Moisture contents are expected to vary based on the season and amount of precipitation. Special handling of the soil should be anticipated, particularly if grading occurs during the rainy season, as drying back of the existing materials should be anticipated prior to their use as fill.

8.1.8 Given the loose or soft consistency of the site soils and high moisture contents, relatively soft soils should be expected in the site excavation walls and bottoms, and subgrade stabilization will be required within site excavations during grading or installation of utilities.

8.1.9 Although most on-site soils consist of silts, clays, silty sands, and sandy silts and clays, some granular material, having little to no cohesion and subject to caving in un-shored excavations, should be expected at the site. It is the responsibility of the contractor to ensure that excavations and trenches are properly shored and maintained in accordance with OSHA rules and regulations to maintain the stability of adjacent existing improvements.

8.1.10 The laboratory tests indicate that the site soils are non-expansive and have a "very low" expansion potential. If medium to highly expansive soils are encountered at the site, they should be exported from the site or selectively graded and placed in the deeper fill areas to allow for the placement of low expansion material at the finish pad grade.

8.1.11 Proper drainage should be maintained in order to preserve the design properties of the fill in the sheet-graded pads and slope areas. Recommendations for site drainage are provided herein.

8.1.12 Changes in the design, location or elevation of improvements, as outlined in this report, should be reviewed by this office. Once grading plans become available, they should be reviewed by this office to evaluate the necessity for review and possible revision of this report.

8.1.13 Recommended grading specifications are provided in Appendix C.

8.2 Soil Characteristics

8.2.1 The near surface site soils encountered in the field investigation are "non-expansive" (Expansion Index [EI] of 20 or less) as defined by 2016 California Building Code (CBC) Section 1803.5.3 with a "Very Low" expansion potential. Table 8.2.1 presents soil classifications based on the EI.

TABLE 8.2.1
SOIL CLASSIFICATION BASED ON EXPANSION INDEX

Expansion Index (EI)	Expansion Classification	2016 CBC Expansion Classification
0 – 20	**Very Low**	**Non-Expansive**
21 – 50	Low	Expansive
51 – 90	Medium	
91 – 130	High	
Greater Than 130	Very High	

8.2.2 Based on the material classifications and laboratory testing, the near surface site soils are generally expected to possess a low expansion potential (EI of 50 or less). Medium to highly expansive soils should not be placed within 4 feet of the proposed foundations, flatwork or paving improvements. Additional testing for expansion potential should be performed once final grades are achieved.

8.2.3 Laboratory testing was performed on samples of the site soils to evaluate the percentage of water-soluble sulfate content. Results indicate that the on-site materials at the locations tested possess a sulfate content of 0.000 to 0.044% (less than 10 to 440 parts per million [ppm]) equating to an exposure class of S0 to concrete structures as defined by 2016 CBC Section 1904.3 and ACI 318. Table 8.2.3 presents a summary of concrete requirements set forth by 2016 CBC Section 1904.3 and ACI 318. The presence of water-soluble sulfates is not a visually discernible characteristic; therefore, other soil samples from the site could yield different concentrations. Additionally, over time landscaping activities (i.e., addition of fertilizers and other soil nutrients) may affect the concentration.

TABLE 8.2.3
REQUIREMENTS FOR CONCRETE
EXPOSED TO SULFATE-CONTAINING SOLUTIONS

Sulfate Exposure Class	Water-Soluble Sulfate Percent by Weight	Cement Type	Maximum Water to Cement Ratio by Weight	Minimum Compressive Strength (psi)
S0	**0.00-0.10**	**--**	**--**	**2,500**
S1	0.10-0.20	II	0.50	4,000
S2	0.20-2.00	V	0.45	4,500
S3	> 2.00	V+ Pozzolan or Slag	0.45	4,500

8.2.4 Laboratory testing indicates the site soils have a minimum electrical resistivity of 320 to 26,000 ohm-cm, possess 40 to 180 parts per million chloride, less than 10 to 440 ppm sulfate, and have a pH of 7.24 and 8.32. As shown in Table 8.2.4 below, the site would be classified as "corrosive" to buried improvements, in accordance with the Caltrans Corrosion Guidelines (Caltrans, 2018) based on the electrical resistivity. Additionally, the site historic and current use is for agriculture and as a dairy farm. Several areas of the site were not accessible for our exploration. The client should anticipate corrosive soils will be encountered on the site, particularly where manure or drainage from the cow pens are present.

TABLE 8.2.4
CALTRANS CORROSION GUIDELINES

Corrosion Exposure	Resistivity (ohm-cm)	Chloride (ppm)	Sulfate (ppm)	pH
Corrosive	<1,100	500 or greater	1,500 or greater	5.5 or less

8.2.5 Geocon does not practice in the field of corrosion engineering. Therefore, further evaluation by a corrosion engineer should be performed if improvements that could be susceptible to corrosion are planned.

8.3 Grading

8.3.1 Grading should be performed in accordance with the *Recommended Grading Specifications* contained in *Appendix C* and the Grading Ordinances of the City of Eastvale.

8.3.2 Prior to commencing grading, a preconstruction conference should be held at the site with the city inspector, owner or developer, grading contractor, civil engineer, and geotechnical engineer in attendance. Special soil handling and/or the grading plans can be discussed at that time.

8.3.3 Site preparation should begin with the removal of deleterious material, manure impacted soils, debris, buried trash, and vegetation. The depth of removal should be such that material exposed in cut areas or soil to be used as fill is relatively free of organic matter and manure. Material generated during stripping and/or site demolition should be exported from the site.

8.3.4 Undocumented fill and alluvium within a 1:1 (h:v) projection of the limits of grading should be removed to expose competent alluvium with a relative compaction of at least 85 percent (ASTM D1557). Removals in the existing fill and alluvium should be expected on the order of 6 to 8 feet below existing grades. The removals should also extend at least 3 feet below the bottom of the planned foundations. Areas of loose, dry, or compressible soils will require deeper excavation and processing prior to fill placement. Removals in pavement and walkway areas should extend at least 3 feet beneath the pavement or flatwork subgrade elevation. The actual depth of removal should be evaluated by the engineering geologist during grading operations. Where over excavation and compaction is to be conducted, the excavations should be extended laterally a minimum distance of 5 feet beyond the building footprint or for a distance equal to the depth of removal, whichever is greater. Patios and building appurtenances should be considered a part of the building footprint when determining the limits of lateral excavation. The bottom of the excavations should be scarified to a depth of at least 1 foot, moisture conditioned as necessary, and properly compacted to 95 percent of the maximum dry density as determined by ASTM 1557.

8.3.5 Geocon should observe the removal bottoms to check the competence at the bottom of the removal. Deeper excavations may be required if dry, loose, or soft materials are present at the base of the removals. Excavation bottoms require written approval by a Geocon representative.

8.3.6 The site soils are expected to have an average organic content on the average of 2 to 3 percent by weight when placed as compacted fill. Riverside County guidelines (RTLMA, 2000) indicate that fill soils should have an organic content of 1 percent or less. To mitigate the potential settlement from the organic soils at the site, fill should be compacted to at least 95 percent of the maximum dry density as determined by ASTM D1557.

8.3.7 The fill placed within 4 feet of proposed foundations should possess a “low” expansion potential (EI of 50 or less).

8.3.8 If perched groundwater, wet, or saturated materials are encountered during remedial grading, extensive drying and mixing with dryer soil will be required. The excavated materials should then be moisture conditioned as necessary to 0 to 2 percent above optimum moisture content prior to placement as compacted fill.

8.3.9 The site should be brought to finish grade elevations with fill compacted in layers. Layers of fill should be no thicker than will allow for adequate bonding and compaction. Fill, including backfill and scarified ground surfaces, should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content as determined by ASTM D 1557. Fill materials placed below optimum moisture content may require additional moisture conditioning prior to placing additional fill.

8.3.10 Where relatively loose, soft, or wet soils are encountered in the site excavations, subgrade stabilization will be required prior to placing fill or installing utilities. Where required, subgrade stabilization can be achieved by over excavating the loose or soft materials and replacing with compacted fill, placing 3-inch diameter rock in the soft bottom and working it into soil until it is stabilized, or placing gravel wrapped in filter fabric at the bottom of the excavation. Where used, gravel should consist of 12 to 18 inches of washed angular ¾ inch gravel atop a filter fabric (Mirafi 500X or equivalent) on the excavation bottom. The filter fabric should be placed in a manner so that the gravel does not have direct contact with the soil. Once the gravel is placed and vibrated to a relatively dense state, a top layer of filter fabric should be placed to cover the gravel. Recommendations for stabilizing excavation bottoms should be based on an evaluation in the field by Geocon at the time of construction.

8.3.11 Import fill (if necessary) should consist of granular materials with a "low" expansion potential (EI of 50 or less), non-corrosive, generally free of deleterious material and contain no rock fragments larger than 6 inches. Geocon should be notified of the import soil source and should perform laboratory testing of import soil to evaluate its suitability prior to its arrival at the site for use as fill material.

8.4 Earthwork Grading Factors

8.4.1 Estimates of shrinkage factors are based on empirical judgments comparing the material in its existing or natural state as encountered in the exploratory excavations to a compacted state. Variations in natural soil density and in compacted fill density render shrinkage value estimates very approximate. As an example, the contractor can compact the fill to a dry density of 95 percent or higher of the laboratory maximum dry density. Thus, the contractor has an approximately 10 percent range of control over the fill volume. Based on our experience with similar site soils, the shrinkage of the undocumented fill and upper portion of the alluvium is expected to be 5 to 10 percent when compacted to at least 95 percent of the laboratory maximum dry density. This estimate is for preliminary quantity estimates only. Due to the variations in the actual shrinkage/bulking factors, a balance area should be provided to accommodate variations.

8.5 Utility Trench Backfill

8.5.1 Utility trenches should be properly backfilled in accordance with the requirements of the City of Eastvale and the latest edition of the *Standard Specifications for Public Works Construction* (Greenbook). The pipes should be bedded with well graded crushed rock or clean sands (Sand Equivalent greater than 30) to a depth of at least one foot over the pipe. The bedding material must be inspected and approved in writing by the Geotechnical Engineer (a representative of Geocon). <u>The use of well graded crushed rock is only</u>

acceptable if used in conjunction with filter fabric to prevent the gravel from having direct contact with soil. The remainder of the trench backfill may be derived from onsite soil or approved import soil, compacted as necessary, until the required compaction is obtained. Backfill of utility trenches should not contain rocks greater than 3 inches in diameter. The use of 2-sack slurry and controlled low strength material (CLSM) are also acceptable as backfill. However, consideration should be given to the possibility of differential settlement where the slurry ends and earthen backfill begins. These transitions should be minimized, and additional stabilization should be considered at these transitions.

8.5.2 Utility trench backfill should be placed in layers no thicker than will allow for adequate bonding and compaction. Utility backfill should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density and moisture conditioned at 0 to 2 percent above optimum moisture content as determined by ASTM D 1557. Backfill materials placed below the recommended moisture content may require additional moisture conditioning prior to placing additional fill.

8.6 Seismic Design Criteria

8.6.1 We used the computer program *U.S. Seismic Design Maps*, provided by the California Office of Statewide Health Planning and Development (OSHPD) to evaluate the seismic design criteria. Table 8.6.1 summarizes site-specific design criteria obtained from the 2016 California Building Code (CBC; Based on the 2015 International Building Code [IBC] and ASCE 7-10), Chapter 16 Structural Design, Section 1613 Earthquake Loads. The short spectral response uses a period of 0.2 second. The building structure and improvements as currently proposed should be designed using a Site Class D in accordance with ASCE 7-10 Section 20.3.1. We evaluated the Site Class based on the discussion in Section 1613.3.2 of the 2016 CBC and Table 20.3-1 of ASCE 7-10 using blow count data presented on the boring logs in *Appendix A*. The values presented in Table 8.6.1 are for the risk-targeted maximum considered earthquake (MCE_R).

TABLE 8.6.1
2016 CBC SEISMIC DESIGN PARAMETERS

Parameter	Value	2016 CBC Reference
Site Class	D	Section 1613.3.2
MCE_R Ground Motion Spectral Response Acceleration – Class B (short), S_S	1.500g	Figure 1613.3.1(1)
MCE_R Ground Motion Spectral Response Acceleration – Class B (1 sec), S_1	0.600g	Figure 1613.3.1(2)
Site Coefficient, F_A	1.0	Table 1613.3.3(1)
Site Coefficient, F_V	1.5	Table 1613.3.3(2)
Site Class Modified MCE_R Spectral Response Acceleration (short), S_{MS}	1.500g	Section 1613.3.3 (Eqn 16-37)
Site Class Modified MCE_R Spectral Response Acceleration (1 sec), S_{M1}	0.900g	Section 1613.3.3 (Eqn 16-38)
5% Damped Design Spectral Response Acceleration (short), S_{DS}	1.000g	Section 1613.3.4 (Eqn 16-39)
5% Damped Design Spectral Response Acceleration (1 sec), S_{D1}	0.600g	Section 1613.3.4 (Eqn 16-40)

8.6.2 Table 8.6.2 presents the mapped maximum considered geometric mean (MCE_G) seismic design parameters for projects located in Seismic Design Categories of D through F in accordance with ASCE 7-10.

TABLE 8.6.2
2016 CBC SITE ACCELERATION DESIGN PARAMETERS

Parameter	Value	ASCE 7-10 Reference
Mapped MCE_G Peak Ground Acceleration, PGA	0.500	Figure 22-7
Site Coefficient, F_{PGA}	1.0	Table 11.8-1
Site Class Modified MCE_G Peak Ground Acceleration, PGA_M	0.500g	Section 11.8.3 (Eqn 11.8-1)

8.6.3 The Maximum Considered Earthquake Ground Motion (MCE) is the level of ground motion that has a 2 percent chance of exceedance in 50 years, with a statistical return period of 2,475 years. According to the 2016 California Building Code and ASCE 7-10, the MCE is to be utilized for the evaluation of liquefaction, lateral spread, and seismic settlements. We understand the intent of the building code is to maintain "Life Safety" during an MCE event.

8.6.4 Deaggregation of the MCE peak ground acceleration was performed using the online *Unified Hazard Tool* (USGS, 2018b) provided by the USGS. The result of the deaggregation analysis indicates that the predominant earthquake contributing to the MCE peak ground acceleration is characterized as a 6.7 magnitude event occurring at a hypocentral distance of 17.3 kilometers from the site

8.6.5 Conformance to the criteria in the above tables for seismic design does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a large earthquake occurs. The primary goal of seismic design is to protect life, not to avoid all damage, since such design may be economically prohibitive.

8.7 Foundation and Concrete Slabs-On-Grade

8.7.1 The foundation recommendations presented herein are for the proposed buildings subsequent to the recommended grading assuming that the buildings are founded in soils with a low expansion potential. If soils with a medium or high expansion potential are placed within 4 feet of finish grade, then Geocon should be contacted for additional recommendations. We understand that future buildings will be supported on conventional shallow foundations with a concrete slab-on-grade deriving support in newly placed engineered fill.

8.7.2 Foundations for the structures may consist of either continuous strip footings and/or isolated spread footings. Conventionally reinforced continuous footings should be at least 18 inches wide and extend at least 18 inches below lowest adjacent pad grade. Isolated spread footings should have a minimum width of 24 inches and should extend at least 18 inches below lowest adjacent pad grade. A wall/column footing dimension detail depicting footing embedment is provided on Figure 6.

8.7.3 From a geotechnical engineering standpoint, concrete slabs-on-grade for the structure should be at least 5 inches thick and be reinforced with No. 4 steel reinforcing bars placed 18 inches on center in both directions. The concrete slab-on-grade recommendations are based on soil support characteristics only. The project structural engineer should evaluate the structural requirements of the concrete slab for supporting equipment and storage loads. A thicker concrete slab may be required for heavier loading conditions. To reduce the effects of differential settlement on the foundation system, thickened slabs and/or an increase in steel reinforcement can provide a benefit to reduce concrete cracking

8.7.4 Following remedial grading, foundations for the buildings may be designed for an allowable soil bearing pressure of 3,000 pounds per square foot (psf) (dead plus live load). The allowable bearing pressure may be increased by one-third for transient loads due to wind or seismic forces.

8.7.5 The maximum expected static settlement for the planned structures supported on conventional foundation systems with the above allowable bearing pressures and deriving support in engineered fill is estimated to be 1 inch and to occur below the heaviest loaded structural element.

8.7.6 Settlement of the foundation system is expected to occur on initial application of loading. Differential settlement is not expected to exceed ½ inch over a horizontal distance of 40 feet.

8.7.7 Once the design and foundation loading configuration proceeds to a more finalized plan, the estimated settlements within this report should be reviewed and revised, if necessary.

8.7.8 Steel reinforcement for continuous footings should consist of at least four No. 4 steel reinforcing bars placed horizontally in the footings, two near the top and two near the bottom. Steel reinforcement for the spread footings should be designed by the project structural engineer.

8.7.9 Foundations near slopes should be deepened such that the bottom outside edge of the footing is at least 7 feet horizontally from the face of the slope.

8.7.10 Foundation excavation bottoms must be observed and approved in writing by the Geotechnical Engineer, prior to placing fill, steel, gravel or concrete.

8.7.11 Slabs that may receive moisture-sensitive floor coverings or may be used to store moisture-sensitive materials should be underlain by a vapor retarder. The vapor retarder design should be consistent with the guidelines presented in the American Concrete Institute's (ACI) Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials (ACI 302.2R-06). The vapor retarder used should be specified by the project architect or developer based on the type of floor covering that will be installed and if the structure will possess a humidity-controlled environment.

8.7.12 The bedding sand thickness should be evaluated by the project foundation engineer, architect, and/or developer. However, we should be contacted to provide recommendations if the bedding sand is thicker than 4 inches. Placement of 3 inches and 4 inches of sand is common practice in southern California for 5-inch and 4-inch thick slabs, respectively. The foundation engineer should provide appropriate concrete mix design criteria and curing measures that may be utilized to assure proper curing of the slab to reduce the potential for rapid moisture loss and subsequent cracking and/or slab curl.

8.7.13 Special subgrade presaturation is not deemed necessary prior to placing concrete; however, the exposed foundation and slab subgrade soil should be moisture conditioned, as necessary, to maintain a moist condition as would be expected in such concrete placement.

8.7.14 The recommendations of this report are intended to reduce the potential for cracking of slabs due to expansive soil (if present), differential settlement of existing soil or soil with varying thicknesses. However, even with the incorporation of the recommendations presented herein, foundations, walls, and slabs-on-grade placed on such conditions may still exhibit some cracking due to soil movement and/or shrinkage. The occurrence of concrete shrinkage cracks is independent of the supporting soil characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, proper concrete placement and curing, and by the placement of crack control joints at periodic intervals, in particular where re-entrant slab corners occur.

8.7.15 Geocon should be consulted to provide additional design parameters as required by the structural engineer.

8.8 Exterior Concrete Flatwork

8.8.1 Exterior concrete flatwork not subject to vehicular traffic should be constructed in accordance with the recommendations herein assuming the subgrade materials possess an Expansion Index of 50 or less. Subgrade soils should be compacted to 95 percent relative compaction. Slab panels should be a minimum of 4 inches thick and when in excess of 8 feet square should be reinforced with No. 3 reinforcing bars spaced 18 inches center-to-center in both directions to reduce the potential for cracking. In addition, concrete flatwork should be provided with crack control joints to reduce and/or control shrinkage cracking. Crack control spacing should be determined by the project structural engineer based upon the slab thickness and intended usage. Criteria of the American Concrete Institute (ACI) should be taken into consideration when establishing crack control spacing.

8.8.2 Even with the incorporation of the recommendations of this report, the exterior concrete flatwork has a potential to experience some uplift due to expansive soil beneath grade or differential settlement. The steel reinforcement should overlap continuously in flatwork to reduce the potential for vertical offsets within flatwork.

8.8.3 Where exterior flatwork abuts the structure at entrant or exit points, the exterior slab should be dowelled into the structure’s foundation stem wall. This recommendation is intended to reduce the potential for differential elevations that could result from differential settlement or minor heave of the flatwork. Dowelling details should be designed by the project structural engineer.

8.8.4 The recommendations presented herein are intended to reduce the potential for cracking of exterior slabs as a result of differential movement. However, even with the incorporation of the recommendations presented herein, slabs-on-grade will still crack. The occurrence of concrete shrinkage cracks is independent of the soil supporting characteristics. Their occurrence may be reduced and/or controlled by limiting the slump of the concrete, the use of crack control joints and proper concrete placement and curing. Crack control joints should be spaced at intervals no greater than 12 feet. Literature provided by the Portland Concrete Association (PCA) and American Concrete Institute (ACI) present recommendations for proper concrete mix, construction, and curing practices, and should be incorporated into project construction.

8.9 Conventional Retaining Walls

8.9.1 The recommendations presented herein are generally applicable to the design of rigid concrete or masonry retaining walls having a maximum height of 10 feet. In the event that walls higher than 10 feet or other types of walls are planned, Geocon should be consulted for additional recommendations.

8.9.2 Retaining walls not restrained at the top and having a level backfill surface should be designed for an active soil pressure equivalent to the pressure exerted by a fluid density of 35 pounds per cubic foot (pcf). Where the backfill will be inclined at no steeper than 2:1 (horizontal to vertical), an active soil pressure of 60 pcf is recommended. These soil pressures assume that the backfill materials within an area bounded by the wall and a 1:1 plane extending upward from the base of the wall possess an EI of 50 or less. For walls where backfill materials do not conform to the criteria herein, Geocon should be consulted for additional recommendations.

8.9.3 Unrestrained walls are those that are allowed to rotate more than 0.001H (where H equals the height of the retaining portion of the wall in feet) at the top of the wall. Where walls are restrained from movement at the top, the walls should be designed for a soil pressure equivalent to the pressure exerted by a fluid density of 55 pcf.

8.9.4 The structural engineer should determine the seismic design category for the project in accordance with Section 1613 of the CBC. If the project possesses a seismic design category of D, E, or F, proposed retaining walls in excess of 6 feet in height should be designed with seismic lateral pressure (Section 1803.5.12 of the 2016 CBC).

8.9.5 A seismic load of 10 pcf should be used for design of walls that support more than 6 feet of backfill in accordance with Section 1803.5.12 of the 2016 CBC. The seismic load is applied as an equivalent fluid pressure along the height of the wall and the calculated loads result in a maximum load exerted at the base of the wall and zero at the top of the wall. This seismic load should be applied in addition to the active earth pressure. The earth pressure is based on half of two-thirds of PGA_M calculated from ASCE 7-10 Section 11.8.3.

8.9.6 Unrestrained walls will move laterally when backfilled and loading is applied. The amount of lateral deflection is dependent on the wall height, the type of soil used for backfill, and loads acting on the wall. The retaining walls and improvements above the retaining walls should be designed to incorporate an appropriate amount of lateral deflection as determined by the structural engineer.

8.9.7 Retaining walls should be provided with a drainage system adequate to prevent the buildup of hydrostatic forces and waterproofed as required by the project architect. The soil immediately adjacent to the backfilled retaining wall should be composed of free draining material completely wrapped in Mirafi 140N (or equivalent) filter fabric for a lateral distance of 1 foot for the bottom two-thirds of the height of the retaining wall. The upper one-third should be backfilled with less permeable compacted fill to reduce water infiltration. Alternatively, a drainage panel, such as a Miradrain 6000 or equivalent, can be placed along the back of the wall. Typical retaining wall drainage details are shown on Figure 7. The use of drainage openings through the base of the wall (weep holes) is not recommended where the seepage could be a nuisance or otherwise adversely affect the property adjacent to the base of the wall. The recommendations herein assume a properly compacted backfill (EI of 50 or less) with no hydrostatic forces or imposed surcharge load. If conditions different than those described are expected or if specific drainage details are desired, Geocon should be contacted for additional recommendations.

8.9.8 Wall foundations should be designed in accordance with the above foundation recommendations.

8.10 Lateral Design

8.10.1 Resistance to lateral loading may be provided by friction acting at the base of foundations, slabs and by passive earth pressure. A passive pressure exerted by an equivalent fluid weight of 325 pounds per cubic foot (pcf) with a maximum earth pressure of 3,250 psf should be used for the design of footings or shear keys poured neat against newly compacted fill. The allowable passive pressure assumes a horizontal surface extending at least 5 feet, or three times the surface generating the passive pressure, whichever is greater. The upper 12 inches of material in areas not protected by floor slabs or pavement should not be included in design for passive resistance.

8.10.2 If friction is to be used to resist lateral loads, an allowable coefficient of friction between newly compacted fill soil and concrete of 0.35 should be used for design. When combining passive pressure and friction for lateral resistance, the passive component should be reduced by one-third.

8.11 Pavement Design

8.11.1 The final pavement design should be based on R-value testing of soils at the subgrade following grading at the site. Streets should be designed in accordance with the city of Eastvale and Riverside County *Standard Drawings and Specifications* when final Traffic Indices and R-Value test results of subgrade soil are completed. Roadway classifications and traffic indices are based on Riverside County Standard No. 114. The civil engineer should evaluate the final traffic index for the pavements. Laboratory testing indicated that the site soils possess an R-value of 55 and 70. For the preliminary analysis, we have used an R-value of 50, the maximum allowed by Caltrans. Preliminary flexible pavement sections are presented in Table 8.11.1. We have included TI's for areas within the industrial business park as well as Limonite Avenue. Geocon should be contacted for additional recommendations if other traffic loading is appropriate for the roadways.

TABLE 8.11.1
PRELIMINARY FLEXIBLE PAVEMENT SECTIONS

Road Classification/Use	Assumed Traffic Index	Assumed Subgrade R-Value	Asphalt Concrete (inches)	Aggregate Base (inches)
Local Street/Parking Areas/Light Duty Vehicles	5.5	50	3.5	6.0
Enhanced Local Street/Moderate Traffic	6.5	50	4.0	6.0
Industrial Collector/Heavy Truck Areas	8.0	50	5.0	6.0
Major Highway	9.0	50	5.5	6.5
Arterial Highway	9.5	50	6.0	7.0

8.11.2 The upper 12 inches of the subgrade soil should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content beneath pavement sections.

8.11.3 The crushed aggregated base and asphalt concrete materials should conform to Section 200-2.2 and Section 203-6, respectively, of the Greenbook and the County of Riverside Standard Drawings and Specifications. Base materials should be compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content. Asphalt concrete should be compacted to a density of 95 percent of the laboratory Hveem density in accordance with ASTM D 2726.

8.11.4 Where prefabricated concrete pavers (80 mm thick) will be used in site roadways and parking areas, it is acceptable from a geotechnical standpoint to construct the pavers over 1 inch of sand underlain by a properly prepared subgrade and aggregate base per the following table. The aggregate base should be compacted to at least 95 percent relative compaction as evaluated by ASTM D 1557 (latest edition). Pavers should be constructed in accordance with the manufacture's guidelines.

TABLE 8.11.4
PAVER DESIGN SECTIONS

Road Classification/Use	Estimated Traffic Index (TI)	Prefabricated Concrete Paver (inches)	Class 2 Aggregate Base (inches)
Local Street/Parking Areas/Light Duty Vehicles	5.5	3⅛	6

8.11.5 Where concrete pavers will be placed in pedestrian walkway areas, and will not be subject to vehicle loading, the inclusion of a 4-inch thick layer of base over properly compacted subgrade underlying the pavers is acceptable from a geotechnical standpoint.

8.11.6 Where different pavement sections are to be constructed adjacent to each other, we recommend that consideration be given to the use of deepened base sections to maintain a uniform base thickness and avoid stepped cuts for placement of base material. This condition is expected to occur across the transition across the areas of asphalt paving and prefabricated pavers.

8.11.7 A rigid Portland cement concrete (PCC) pavement section should be placed in driveway aprons and cross gutters. We calculated the rigid pavement section in general conformance with the procedure recommended by the American Concrete Institute report ACI 330R Guide for Design and Construction of Concrete Parking Lots using the parameters presented in Table 8.11.7.

TABLE 8.11.7
RIGID PAVEMENT DESIGN PARAMETERS

Design Parameter	Design Value
Modulus of subgrade reaction, k	150 pci
Modulus of rupture for concrete, M_R	550 psi
Traffic Category, TC	A, B, C and D
Average daily truck traffic, ADTT	10, 25, 100 and 700

8.11.8 Based on the criteria presented herein, the PCC pavement sections should have a minimum thickness as presented in Table 8.11.8.

TABLE 8.11.8
RIGID PAVEMENT RECOMMENDATIONS

Location	Portland Cement Concrete (inches)
Car Parking Areas and Access Lanes (TC=A)	5.0
Entrance and Service Lanes (TC=B)	6.0
Moderate Truck Traffic (TC=C)	6.5
Bus Stops and Heavy Truck Traffic (TC=D)	7.5

8.11.9 The PCC pavement should be placed over subgrade soil that is compacted to a dry density of at least 95 percent of the laboratory maximum dry density at 0 to 2 percent above optimum moisture content. This pavement section is based on a minimum concrete compressive strength of approximately 3,000 psi (pounds per square inch). Base material will not be required beneath concrete improvements.

8.11.10 A thickened edge or integral curb should be constructed on the outside of concrete slabs subjected to wheel loads. The thickened edge should be 1.2 times the slab thickness or a minimum thickness of 2 inches, whichever results in a thicker edge, and taper back to the recommended slab thickness 4 feet behind the face of the slab (e.g., a 9-inch-thick slab would have an 11-inch-thick edge). Reinforcing steel will not be necessary within the concrete for geotechnical purposes with the possible exception of dowels at construction joints as discussed herein.

8.11.11 In order to control the location and spread of concrete shrinkage cracks, crack-control joints (weakened plane joints) should be included in the design of the concrete pavement slab in accordance with the referenced ACI report.

8.11.12 Performance of the pavements is highly dependent on providing positive surface drainage away from the edge of the pavement. Ponding of water on or adjacent to the pavement surfaces will likely result in pavement distress and subgrade failure. Drainage from landscaped areas should be directed to controlled drainage structures. Landscape areas adjacent to the edge of asphalt pavements are not recommended due to the potential for surface or irrigation water to infiltrate the underlying permeable aggregate base and cause distress. Where such a condition cannot be avoided, consideration should be given to incorporating measures that will significantly reduce the potential for subsurface water migration into the aggregate base. If planter islands are planned, the perimeter curb should extend at least 6 inches below the level of the base materials.

8.12 Temporary Excavations

8.12.1 Excavations on the order of 5 to 15 feet in vertical height are expected during grading operations and utility installation. The contractor's competent person should evaluate the necessity for lay back of vertical cut areas. Vertical excavations up to 5 feet may be attempted where loose soils or caving sands are not present, and where not surcharged by existing structures or vehicle/construction equipment loads.

8.12.2 Vertical excavations greater than 5 feet will require sloping measures in order to provide a stable excavation. We expect that sufficient space is available to complete the majority of the required earthwork for this project using sloping measures. If necessary, compound excavation, slot-cutting, and or shoring recommendations will be provided in an addendum.

8.12.3 Where sufficient space is available, temporary unsurcharged embankments may be sloped back at a uniform 1.5:1 (h:v) slope gradient or flatter. A uniform slope does not have a vertical portion.

8.12.4 Where sloped embankments are utilized, the top of the slope should be barricaded to prevent vehicles and storage loads at the top of the slope within a horizontal distance equal to the height of the slope. If the temporary construction embankments are to be maintained during the rainy season, berms are suggested along the tops of the slopes where necessary to prevent runoff water from entering the excavation and eroding the slope faces. The contractor's personnel should inspect the soil exposed in the cut slopes during excavation so that modifications of the slopes can be made if variations in the soil conditions occur. Excavations should be stabilized within 30 days of initial excavation.

8.13 Site Drainage and Moisture Protection

8.13.1 Proper site drainage is critical to reduce the potential for differential soil movement, erosion and subsurface seepage. Under no circumstances should water be allowed to pond adjacent to footings. The site should be graded and maintained such that surface drainage is directed away from structures in accordance with 2016 CBC 1804.4 or other applicable standards. In addition, surface drainage should be directed away from the top of slopes into swales or other controlled drainage devices. Roof and pavement drainage should be directed into conduits that carry runoff away from the proposed structure.

8.13.2 Underground utilities should be leak free. Utility and irrigation lines should be checked periodically for leaks, and detected leaks should be repaired promptly. Detrimental soil movement could occur if water is allowed to infiltrate the soil for prolonged periods of time.

8.13.3 Landscaping planters adjacent to paved areas are not recommended due to the potential for surface or irrigation water to infiltrate the pavement's subgrade and base course. We recommend that area drains be used to collect excess irrigation water and transmit it to drainage structures or impervious above-grade planter boxes. In addition, where landscaping is planned adjacent to the pavement, we recommend construction of a cutoff wall along the edge of the pavement that extends at least 6 inches below the bottom of the base material.

8.13.4 If not properly constructed, there is a potential for distress to improvements and properties located hydrologically down gradient or adjacent to infiltration areas. Factors such as the amount of water to be detained, its residence time, and soil permeability have an important effect on seepage transmission and the potential adverse impacts that may occur if the storm water management features are not properly designed and constructed. We have not performed a hydrogeology study at the site. Down-gradient and adjacent structures may be subjected to seeps, movement of foundations and slabs, or other impacts as a result of water infiltration.

8.14 Plan Review

8.14.1 Geocon should be provided the opportunity to review the grading and structural/foundation plans for the project prior to final submittal, to verify that the plans have been prepared in substantial conformance with the recommendations of this report. Additional analyses may be required after review of the project plans.

LIMITATIONS AND UNIFORMITY OF CONDITIONS

1. The recommendations of this report pertain only to the site investigated and are based upon the assumption that the soil conditions do not deviate from those disclosed in the investigation. If any variations or undesirable conditions are encountered during construction, or if the proposed construction will differ from that anticipated herein, Geocon should be notified so that supplemental recommendations can be given. The evaluation or identification of the potential presence of hazardous materials was not part of the scope of services provided by Geocon.

2. This report is issued with the understanding that it is the responsibility of the owner, or of their representative, to ensure that the information and recommendations contained herein are brought to the attention of the architect and engineer for the project and incorporated into the plans, and the necessary steps are taken to see that the contractor and subcontractors carry out such recommendations in the field.

3. The findings of this report are valid as of the date of this report. However, changes in the conditions of a property can occur with the passage of time, whether they are due to natural processes or the works of man on this or adjacent properties. In addition, changes in applicable or appropriate standards may occur, whether they result from legislation or the broadening of knowledge. Accordingly, the findings of this report may be invalidated wholly or partially by changes outside our control. Therefore, this report is subject to review and should not be relied upon after a period of three years.

4. The firm that performed the geotechnical investigation for the project should be retained to provide testing and observation services during construction to provide continuity of geotechnical interpretation and to check that the recommendations presented for geotechnical aspects of site development are incorporated during site grading, construction of improvements, and excavation of foundations. If another geotechnical firm is selected to perform the testing and observation services during construction operations, that firm should prepare a letter indicating their intent to assume the responsibilities of project geotechnical engineer of record. A copy of the letter should be provided to the regulatory agency for their records. In addition, that firm should provide revised recommendations concerning the geotechnical aspects of the proposed development, or a written acknowledgement of their concurrence with the recommendations presented in our report. They should also perform additional analyses deemed necessary to assume the role of Geotechnical Engineer of Record.

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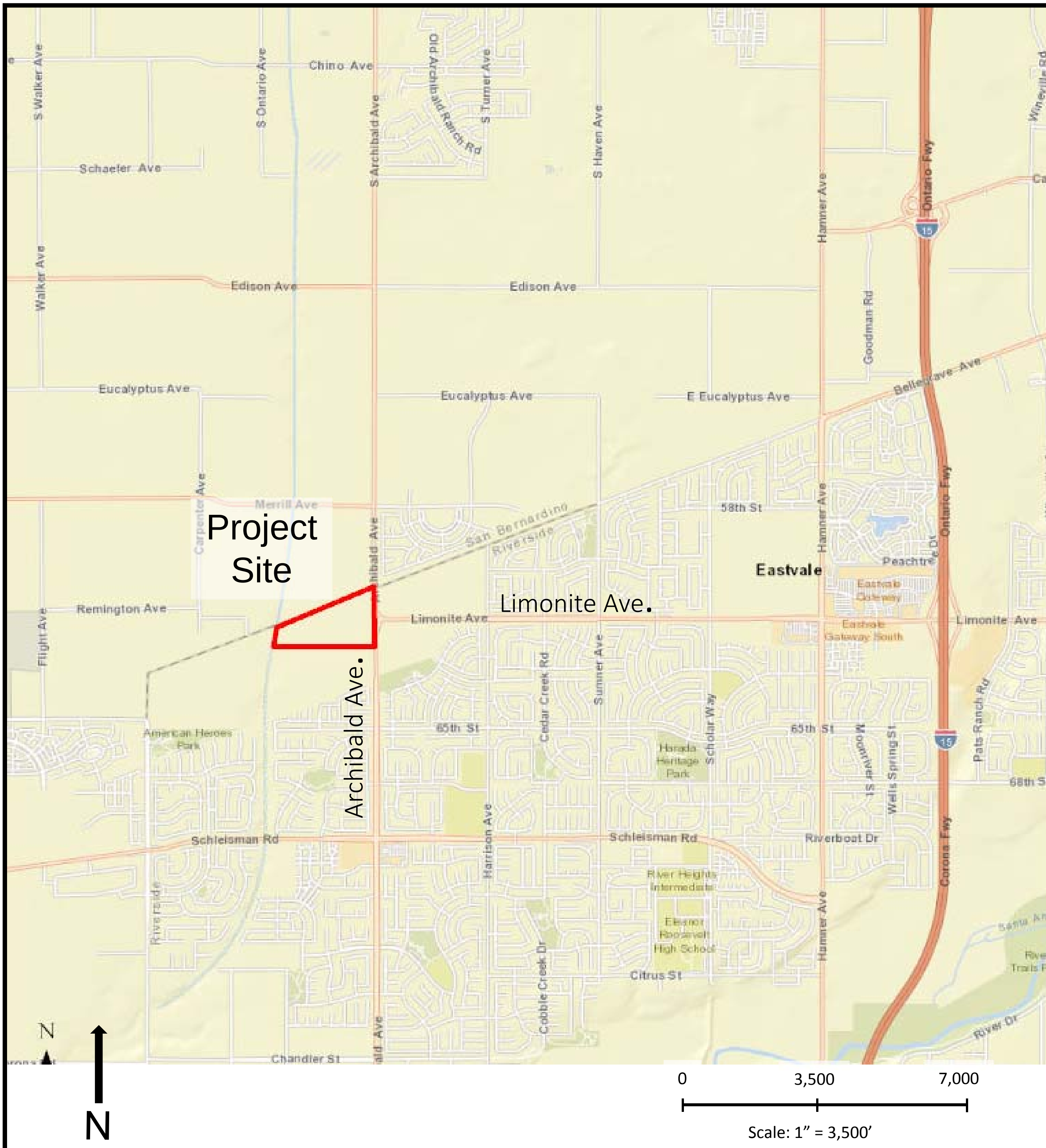

VICINITY MAP

GEOCON
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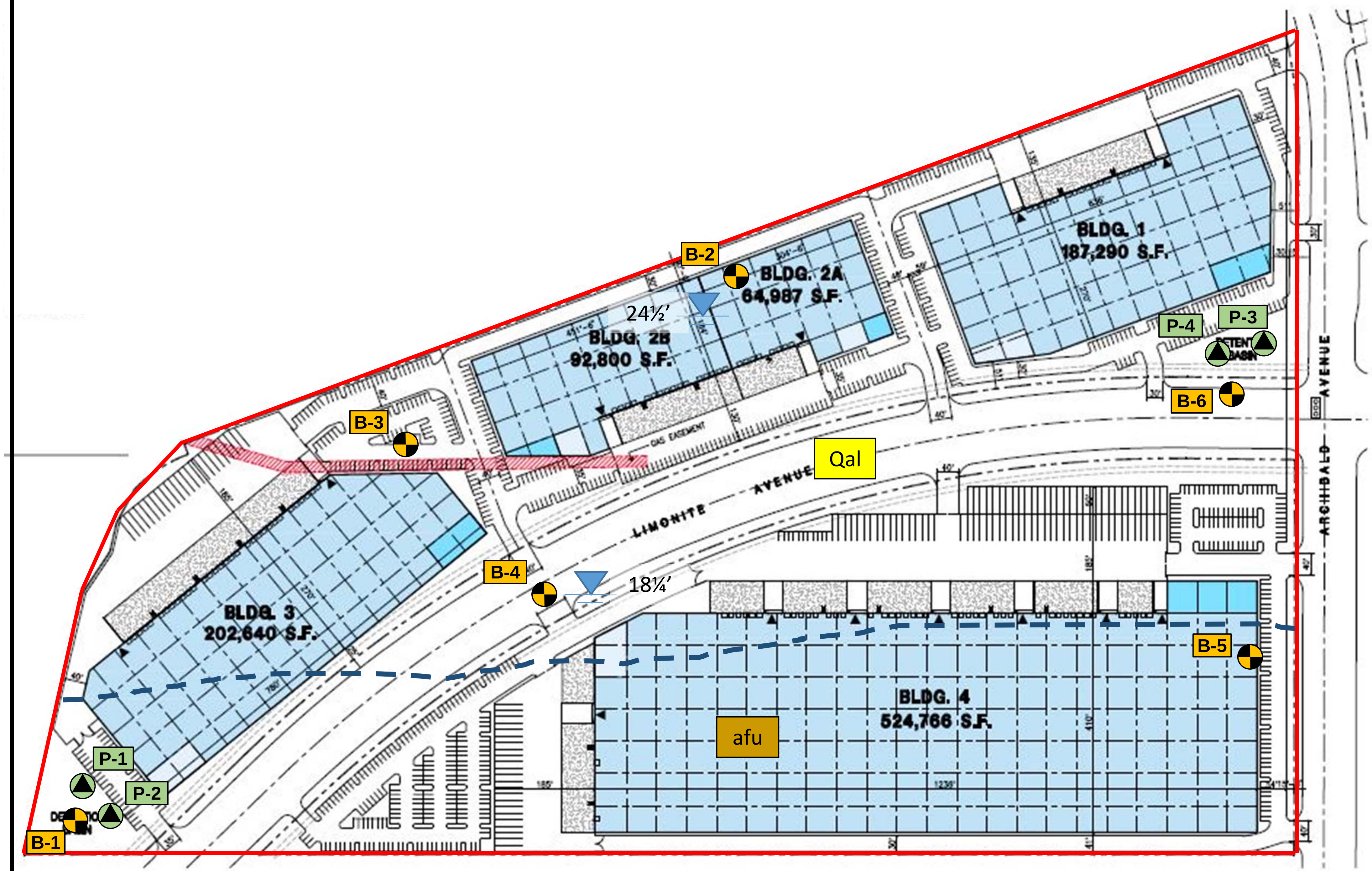
THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

DF		

APRIL, 2019	PROJECT NO. T2857-22-01	FIG. 1



GEOCON LEGEND

Locations are approximate

.... PROJECT BOUNDARY

.... INFERRED GEOLOGIC CONTACT

B-5 .... BORING LOCATION

P-4 .... PERCOLATION TEST LOCATION

afu .... UNDOCUMENTED FILL

Qyfa .... ALLUVIUM

.... PERCHED GROUNDWATER OR SEEPAGE DEPTH

N

0 200 400

SCALE 1" = 200'

SOURCE: HPA ARCHITECTURE, *CONCEPTUAL SITE PLAN, SCHEME 4 – PHASE 2*, DATED JUNE 21, 2018.

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GEOLOGIC MAP

THE HOMESTEAD BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

DF			APRIL, 2019	PROJECT NO. T2857-22-01	FIG. 2

GEOCON LEGEND

Locations are approximate

……. PROJECT BOUNDARY

N

0 200 400

SCALE 1" = 200'

SOURCE: GOOGLE EARTH PRO IMAGERY, DATED MARCH, 2017.

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AERIAL PHOTOGRAPH

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

DF			APRIL, 2019	PROJECT NO. T2857-22-01	FIG. 3

GEOCON

Project : The Homestead
File No. : T2857-22-01
Boring : B-2 & B-5

LIQUEFACTION SETTLEMENT ANALYSIS
MAXIMUM CONSIDERED EARTHQUAKE

(SATURATED SAND AT INITIAL LIQUEFACTION CONDITION)

NCEER (1996) METHOD
EARTHQUAKE INFORMATION:

Earthquake Magnitude:	6.73
PGA_M (g):	0.500
Calculated Mag.Wtg.Factor:	0.762
Historic High Groundwater:	18.0
Groundwater @ Exploration:	24.0

DEPTH TO BASE	BLOW COUNT N	WET DENSITY (PCF)	TOTAL STRESS O (TSF)	EFFECT STRESS O' (TSF)	REL. DEN. Dr (%)	ADJUST BLOWS (N1)60	Tav/σ'_o	LIQUEFACTION SAFETY FACTOR	Volumetric Strain [e_{15}} (%)	EQ. SETTLE. Pe (in.)
1	13	127	0.032	0.032	82	39	0.325	--	0.00	0.00
2	13	127	0.095	0.095	82	39	0.325	--	0.00	0.00
3	13	127	0.159	0.159	82	39	0.325	--	0.00	0.00
4	13	127	0.222	0.222	82	39	0.325	--	0.00	0.00
5	13	127	0.286	0.286	82	38	0.325	--	0.00	0.00
6	24	127	0.349	0.349	106	60	0.325	--	0.00	0.00
7	24	127	0.413	0.413	106	55	0.325	--	0.00	0.00
8	18	127	0.476	0.476	86	41	0.325	--	0.00	0.00
9	18	127	0.540	0.540	86	39	0.325	--	0.00	0.00
10	18	127	0.603	0.603	86	38	0.325	--	0.00	0.00
11	11	130	0.668	0.668	64	25	0.325	--	0.00	0.00
12	11	130	0.733	0.733	64	24	0.325	--	0.00	0.00
13	11	130	0.798	0.798	64	23	0.325	--	0.00	0.00
14	11	130	0.863	0.863	64	23	0.325	--	0.00	0.00
15	36	130	0.928	0.928	106	60	0.325	--	0.00	0.00
16	36	130	0.993	0.993	106	58	0.325	--	0.00	0.00
17	36	130	1.058	1.058	106	57	0.325	--	0.00	0.00
18	36	130	1.123	1.107	106	55	0.330	Non-Liq.	0.00	0.00
19	22	130	1.188	1.141	78	38	0.338	Non-Liq.	0.00	0.00
20	22	130	1.253	1.175	78	37	0.347	Non-Liq.	0.00	0.00
21	22	130	1.318	1.208	78	36	0.354	Non-Liq.	0.00	0.00
22	22	130	1.383	1.242	78	35	0.362	Non-Liq.	0.00	0.00
23	22	130	1.448	1.276	78	35	0.369	Non-Liq.	0.00	0.00
24	22	130	1.513	1.310	78	34	0.375	Non-Liq.	0.00	0.00
25	22	130	1.578	1.344	78	34	0.382	Non-Liq.	0.00	0.00
26	38	130	1.643	1.377	99	53	0.388	Non-Liq.	0.00	0.00
27	38	130	1.708	1.411	99	52	0.393	Non-Liq.	0.00	0.00
28	38	130	1.773	1.445	99	52	0.399	Non-Liq.	0.00	0.00
29	38	130	1.838	1.479	99	51	0.404	Non-Liq.	0.00	0.00
30	19	130	1.903	1.513	68	33	0.409	Non-Liq.	0.00	0.00
31	19	130	1.968	1.546	68	32	0.414	Non-Liq.	0.00	0.00
32	19	130	2.033	1.580	68	32	0.418	Non-Liq.	0.00	0.00
33	19	130	2.098	1.614	68	32	0.422	Non-Liq.	0.00	0.00
34	19	130	2.163	1.648	68	32	0.427	Non-Liq.	0.00	0.00
35	19	130	2.228	1.682	68	31	0.431	Non-Liq.	0.00	0.00
36	19	130	2.293	1.715	65	31	0.434	Non-Liq.	0.00	0.00
37	19	130	2.358	1.749	65	31	0.438	Non-Liq.	0.00	0.00
38	19	130	2.423	1.783	65	31	0.442	Non-Liq.	0.00	0.00
39	19	130	2.488	1.817	65	31	0.445	Non-Liq.	0.00	0.00
40	19	130	2.553	1.851	65	30	0.448	Non-Liq.	0.00	0.00
41	45	130	2.618	1.884	98	62	0.451	Non-Liq.	0.00	0.00
42	45	130	2.683	1.918	98	62	0.455	Non-Liq.	0.00	0.00
43	45	130	2.748	1.952	98	61	0.457	Non-Liq.	0.00	0.00
44	45	130	2.813	1.986	98	61	0.460	Non-Liq.	0.00	0.00
45	45	130	2.878	2.020	98	60	0.463	Non-Liq.	0.00	0.00
46	24	130	2.943	2.053	69	35	0.466	Non-Liq.	0.00	0.00
47	24	130	3.008	2.087	69	35	0.468	Non-Liq.	0.00	0.00
48	24	130	3.073	2.121	69	35	0.471	Non-Liq.	0.00	0.00
49	66	130	3.138	2.155	112	82	0.473	Non-Liq.	0.00	0.00
50	66	130	3.203	2.189	112	81	0.476	Non-Liq.	0.00	0.00

TOTAL SETTLEMENT = 0.0 INCHES

GEOCON

Project : The Homestead
File No. : T2857-22-01
Boring : B-2 & B-5

TECHNICAL ENGINEERING AND DESIGN GUIDES AS ADAPTED FROM THE US ARMY CORPS OF ENGINEERS, NO. 9
EVALUATION OF EARTHQUAKE-INDUCED SETTLEMENTS IN DRY SANDY SOILS
MAXIMUM CONSIDERED EARTHQUAKE

MCE EARTHQUAKE INFORMATION:

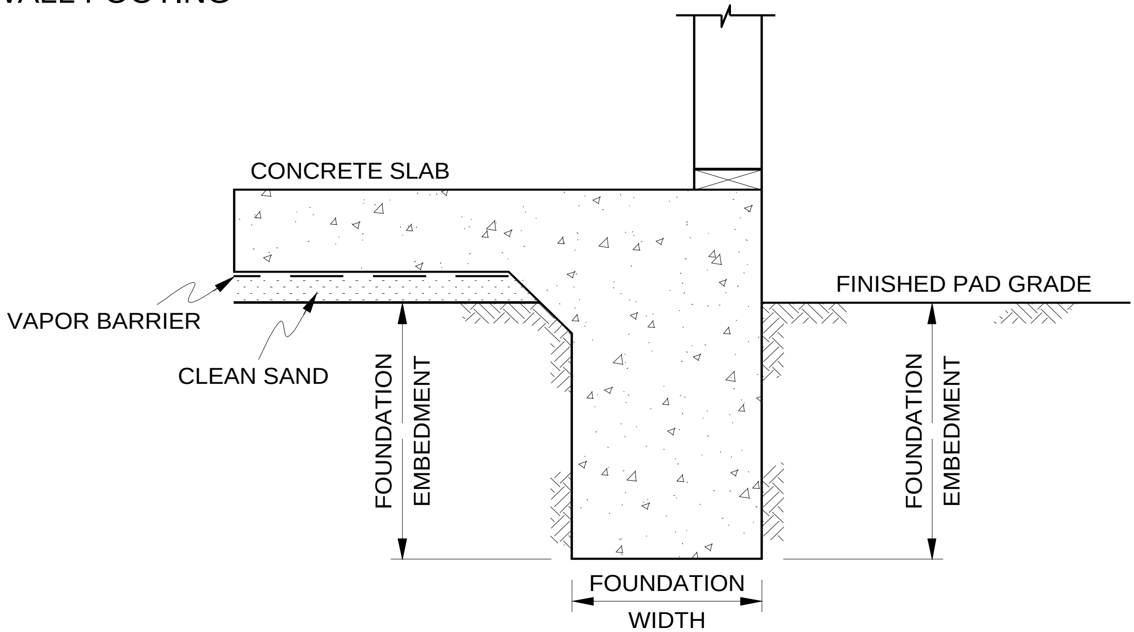
Earthquake Magnitude:	6.73
Peak Horiz. Acceleration (g):	0.500

Depth of Base of Strata (ft)	Thickness of Layer (ft)	Depth of Mid-point of Layer (ft)	Soil Unit Weight (pcf)	Overburden Pressure at Mid-point (tsf)	Mean Effective Pressure at Mid-point (tsf)	Average Cyclic Shear Stress [Tav]	Field SPT [N]	Correction Factor [Cer]	Relative Density [Dr] (%)	Correction Factor [Cn]	Corrected [N1]60	rd Factor	Maximum Shear Mod. [Gmax] (tsf)	[yeff]*[Geff] [Gmax]	yeff Shear Strain	[yeff]*100%	Volumetric Strain M7.5 [E15} (%)	Number of Strain Cycles [Nc]	Corrected Vol. Strains [Ec]	Estimated Settlement [S] (inches)
1.0	1.0	0.5	127.0	0.03	0.02	0.010	13	1.25	82.3	2.0	39.5	1.0	221.977	4.60E-05	6.00E-05	0.006	2.65E-03	8.8404	2.09E-03	0.001
2.0	1.0	1.5	127.0	0.10	0.06	0.031	13	1.25	82.3	2.0	39.5	1.0	384.476	7.82E-05	1.40E-04	0.014	6.19E-03	8.8404	4.88E-03	0.001
3.0	1.0	2.5	127.0	0.16	0.11	0.052	13	1.25	82.3	2.0	39.5	1.0	496.357	9.89E-05	1.60E-04	0.016	7.08E-03	8.8404	5.58E-03	0.001
4.0	1.0	3.5	127.0	0.22	0.15	0.072	13	1.25	82.3	2.0	39.5	1.0	587.297	1.15E-04	1.70E-04	0.017	7.52E-03	8.8404	5.93E-03	0.001
5.0	1.0	4.5	127.0	0.29	0.19	0.093	13	1.25	82.3	1.9	38.0	1.0	657.447	1.29E-04	1.70E-04	0.017	7.87E-03	8.8404	6.21E-03	0.001
6.0	1.0	5.5	127.0	0.35	0.23	0.113	24	1.25	106.2	1.7	59.5	1.0	844.230	1.21E-04	1.50E-04	0.015	4.05E-03	8.8404	3.19E-03	0.001
7.0	1.0	6.5	127.0	0.41	0.28	0.134	24	1.25	106.2	1.6	55.2	1.0	895.107	1.32E-04	1.50E-04	0.015	4.43E-03	8.8404	3.50E-03	0.001
8.0	1.0	7.5	127.0	0.48	0.32	0.154	18	1.25	85.8	1.5	41.5	1.0	874.055	1.53E-04	1.50E-04	0.015	6.25E-03	8.8404	4.93E-03	0.001
9.0	1.0	8.5	127.0	0.54	0.36	0.174	18	1.25	85.8	1.4	39.4	1.0	914.592	1.63E-04	1.50E-04	0.015	6.65E-03	8.8404	5.24E-03	0.001
10.0	1.0	9.5	127.0	0.60	0.40	0.194	18	1.25	85.8	1.3	37.6	1.0	952.341	1.72E-04	1.50E-04	0.015	7.02E-03	8.8404	5.54E-03	0.001
11.0	1.0	10.5	130.0	0.67	0.45	0.215	11	1.25	64.4	1.3	24.8	1.0	871.716	2.04E-04	4.50E-04	0.045	3.48E-02	8.8404	2.74E-02	0.007
12.0	1.0	11.5	130.0	0.73	0.49	0.235	11	1.25	64.4	1.2	24.0	0.9	903.146	2.12E-04	4.50E-04	0.045	3.62E-02	8.8404	2.85E-02	0.007
13.0	1.0	12.5	130.0	0.80	0.53	0.255	11	1.25	64.4	1.1	23.3	0.9	933.015	2.19E-04	3.70E-04	0.037	3.08E-02	8.8404	2.43E-02	0.006
14.0	1.0	13.5	130.0	0.86	0.58	0.275	11	1.25	64.4	1.1	22.7	0.9	961.523	2.26E-04	3.70E-04	0.037	3.19E-02	8.8404	2.51E-02	0.006
15.0	1.0	14.5	130.0	0.93	0.62	0.295	36	1.25	106.2	1.1	60.1	0.9	1380.551	1.67E-04	1.60E-04	0.016	4.27E-03	8.8404	3.37E-03	0.001
16.0	1.0	15.5	130.0	0.99	0.66	0.315	36	1.25	106.2	1.0	58.4	0.9	1413.961	1.71E-04	1.60E-04	0.016	4.43E-03	8.8404	3.49E-03	0.001
17.0	1.0	16.5	130.0	1.06	0.71	0.335	36	1.25	106.2	1.0	56.8	0.9	1446.036	1.75E-04	1.60E-04	0.016	4.58E-03	8.8404	3.61E-03	0.001
18.0	1.0	17.5	130.0	1.12	0.75	0.354	36	1.25	106.2	1.0	55.3	0.9	1476.909	1.79E-04	1.60E-04	0.016	4.72E-03	8.8404	3.72E-03	0.001
19.0	1.0	18.5	130.0	1.19	0.80	0.373	22	1.25	78.2	0.9	37.7	0.9	1336.683	2.06E-04	3.70E-04	0.037	1.73E-02	8.8404	1.36E-02	0.000
20.0	1.0	19.5	130.0	1.25	0.84	0.392	22	1.25	78.2	0.9	36.8	0.9	1362.533	2.09E-04	3.70E-04	0.037	1.78E-02	8.8404	1.40E-02	0.000
21.0	1.0	20.5	130.0	1.32	0.88	0.411	22	1.25	78.2	0.9	36.1	0.9	1387.578	2.13E-04	3.70E-04	0.037	1.82E-02	8.8404	1.44E-02	0.000
22.0	1.0	21.5	130.0	1.38	0.93	0.429	22	1.25	78.2	0.9	35.3	0.9	1411.882	2.16E-04	3.70E-04	0.037	1.87E-02	8.8404	1.47E-02	0.000
23.0	1.0	22.5	130.0	1.45	0.97	0.448	22	1.25	78.2	0.8	34.7	0.9	1435.501	2.18E-04	3.70E-04	0.037	1.91E-02	8.8404	1.51E-02	0.000
24.0	1.0	23.5	130.0	1.51	1.01	0.466	22	1.25	78.2	0.8	34.2	0.9	1460.577	2.21E-04	3.00E-04	0.030	1.58E-02	8.8404	1.24E-02	0.000
25.0	1.0	24.5	130.0	1.58	1.06	0.484	22	1.25	78.2	0.8	33.9	0.9	1487.038	2.22E-04	3.00E-04	0.030	1.59E-02	8.8404	1.26E-02	0.000
26.0	1.0	25.5	130.0	1.64	1.10	0.501	38	1.25	99.0	0.8	52.8	0.9	1759.034	1.93E-04	1.30E-04	0.013	4.06E-03	8.8404	3.20E-03	0.000
27.0	1.0	26.5	130.0	1.71	1.14	0.519	38	1.25	99.0	0.8	52.2	0.9	1787.323	1.94E-04	1.30E-04	0.013	4.11E-03	8.8404	3.24E-03	0.000
28.0	1.0	27.5	130.0	1.77	1.19	0.536	38	1.25	99.0	0.8	51.7	0.9	1814.883	1.95E-04	1.30E-04	0.013	4.16E-03	8.8404	3.28E-03	0.000
29.0	1.0	28.5	130.0	1.84	1.23	0.552	38	1.25	99.0	0.8	51.2	0.9	1841.758	1.96E-04	1.30E-04	0.013	4.21E-03	8.8404	3.32E-03	0.000
30.0	1.0	29.5	130.0	1.90	1.27	0.569	19	1.25	67.6	0.8	32.7	0.9	1613.605	2.28E-04	3.00E-04	0.030	1.66E-02	8.8404	1.31E-02	0.000
31.0	1.0	30.5	130.0	1.97	1.32	0.585	19	1.25	67.6	0.8	32.4	0.9	1636.716	2.29E-04	3.00E-04	0.030	1.68E-02	8.8404	1.32E-02	0.000
32.0	1.0	31.5	130.0	2.03	1.36	0.601	19	1.25	67.6	0.8	32.2	0.9	1659.344	2.30E-04	3.00E-04	0.030	1.69E-02	8.8404	1.34E-02	0.000
33.0	1.0	32.5	130.0	2.10	1.41	0.617	19	1.25	67.6	0.8	32.0	0.9	1681.513	2.31E-04	3.00E-04	0.030	1.71E-02	8.8404	1.35E-02	0.000
34.0	1.0	33.5	130.0	2.16	1.45	0.632	19	1.25	67.6	0.8	31.7	0.8	1703.246	2.32E-04	3.00E-04	0.030	1.72E-02	8.8404	1.36E-02	0.000
35.0	1.0	34.5	130.0	2.23	1.49	0.647	19	1.25	67.6	0.7	31.5	0.8	1724.565	2.32E-04	3.00E-04	0.030	1.74E-02	8.8404	1.37E-02	0.000
36.0	1.0	35.5	130.0	2.29	1.54	0.662	19	1.25	65.4	0.7	31.3	0.8	1745.489	2.32E-04	3.00E-04	0.030	1.75E-02	8.8404	1.38E-02	0.000
37.0	1.0	36.5	130.0	2.36	1.58	0.676	19	1.25	65.4	0.7	31.1	0.8	1766.038	2.33E-04	3.00E-04	0.030	1.77E-02	8.8404	1.39E-02	0.000
38.0	1.0	37.5	130.0	2.42	1.62	0.690	19	1.25	65.4	0.7	30.9	0.8	1786.227	2.33E-04	3.00E-04	0.030	1.78E-02	8.8404	1.41E-02	0.000
39.0	1.0	38.5	130.0	2.49	1.67	0.704	19	1.25	65.4	0.7	30.7	0.8	1806.072	2.33E-04	3.00E-04	0.030	1.80E-02	8.8404	1.42E-02	0.000
40.0	1.0	39.5	130.0	2.55	1.71	0.718	19	1.25	65.4	0.7	30.5	0.8	1825.589	2.34E-04	3.00E-04	0.030	1.81E-02	8.8404	1.43E-02	0.000
41.0	1.0	40.5	130.0	2.62	1.75	0.731	45	1.25	97.7	0.7	62.1	0.8	2344.243	1.84E-04	1.30E-04	0.013	3.34E-03	8.8404	2.63E-03	0.000
42.0	1.0	41.5	130.0	2.68	1.80	0.744	45	1.25	97.7	0.7	61.7	0.8	2367.501	1.84E-04	1.30E-04	0.013	3.37E-03	8.8404	2.65E-03	0.000
43.0	1.0	42.5	130.0	2.75	1.84	0.756	45	1.25	97.7	0.7	61.2	0.8	2390.383	1.84E-04	1.30E-04	0.013	3.39E-03	8.8404	2.68E-03	0.000
44.0	1.0	43.5	130.0	2.81	1.88	0.769	45	1.25	97.7	0.7	60.8	0.8	2412.906	1.84E-04	1.30E-04	0.013	3.42E-03	8.8404	2.70E-03	0.000
45.0	1.0	44.5	130.0	2.88	1.93	0.781	45	1.25	97.7	0.7	60.4	0.8	2435.082	1.84E-04	1.30E-04	0.013	3.45E-03	8.8404	2.72E-03	0.000
46.0	1.0	45.5	130.0	2.94	1.97	0.792	24	1.25	69.3	0.7	35.3	0.8	2058.095	2.19E-04	3.00E-04	0.030	1.52E-02	8.8404	1.20E-02	0.000
47.0	1.0	46.5	130.0	3.01	2.02	0.804	24	1.25	69.3	0.7	35.0	0.8	2076.549	2.19E-04	1.00E-02	1.000	5.10E-01	8.8404	4.02E-01	0.000
48.0	1.0	47.5	130.0	3.07	2.06	0.815	24	1.25	69.3	0.7	34.8	0.8	2094.746	2.19E-04	1.00E-02	1.000	5.14E-01	8.8404	4.05E-01	0.000
49.0	1.0	48.5	130.0	3.14	2.10	0.826	66	1.25	111.8	0.7	81.8	0.8	2813.887	1.64E-04	1.00E-02	1.000	1.84E-01	8.8404	1.45E-01	0.000
50.0	1.0	49.5	130.0	3.20	2.15	0.836	66	1.25	111.8	0.7	81.3	0.8	2836.589	1.64E-04	1.00E-02	1.000	1.86E-01	8.8404	1.46E-01	0.000

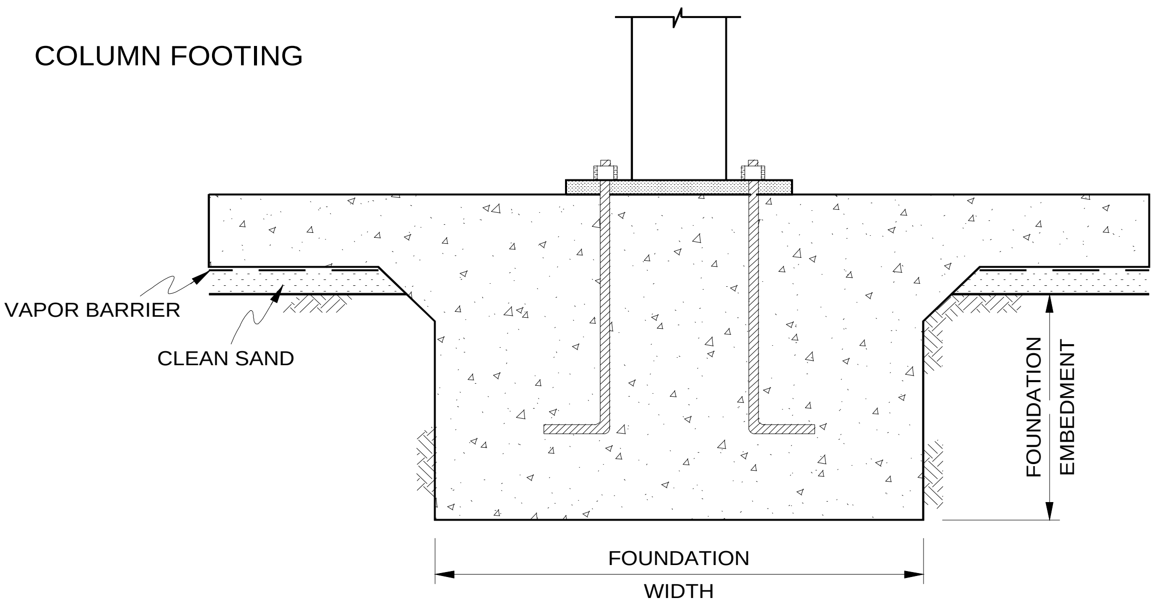
TOTAL SETTLEMENT = **0.04**

Figure 5

WALL FOOTING



COLUMN FOOTING



NOTE: SEE REPORT FOR FOUNDATION WIDTH AND DEPTH RECOMMENDATION

NO SCALE

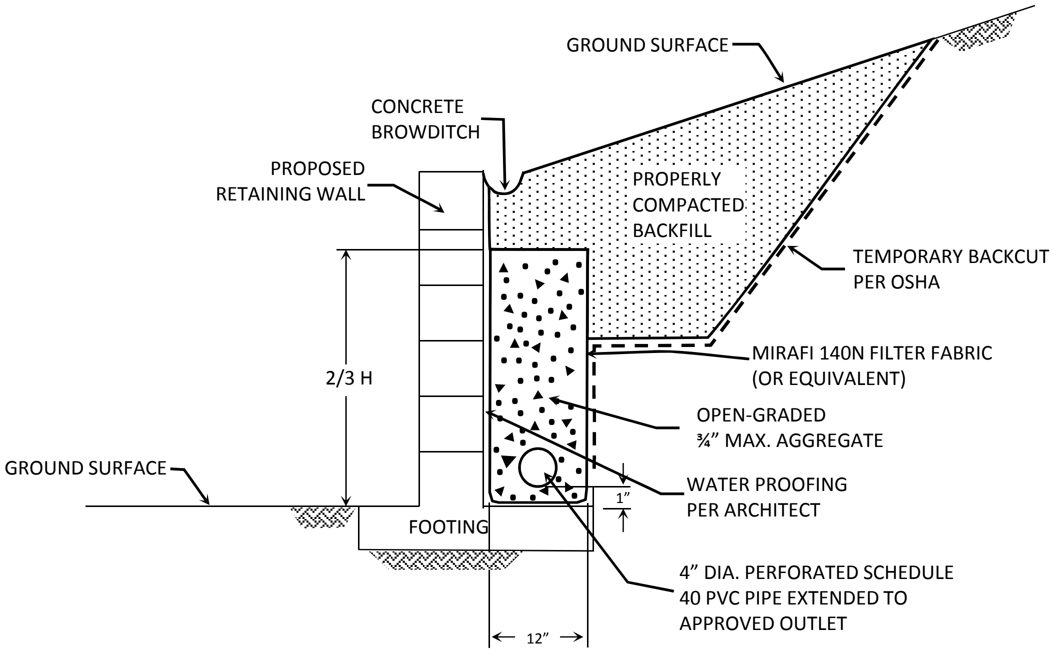
GEOCON WEST, INC.
GEOTECHNICAL ENVIRONMENTAL MATERIALS
41571 CORNING PLACE, SUITE 101, MURRIETA, CA 92562-7065
PHONE 951-304-2300 FAX 951-304-2392

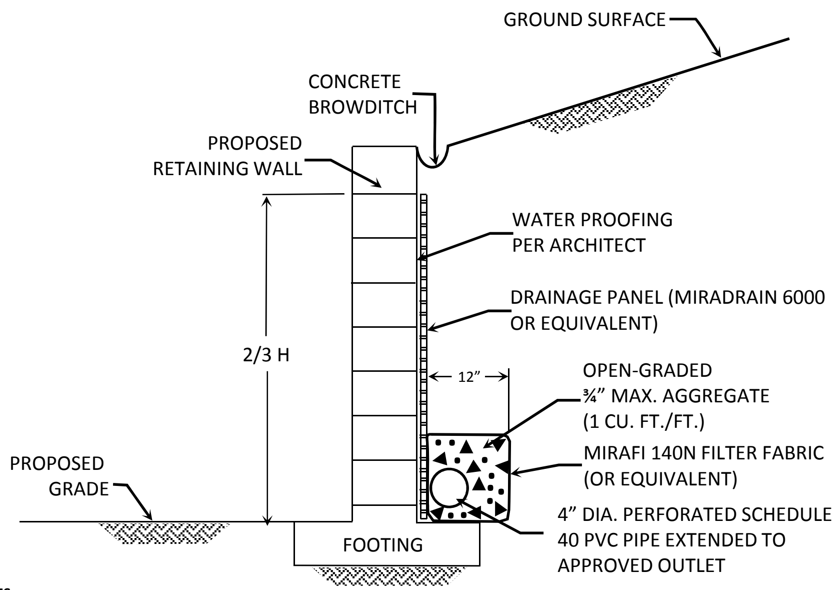
DF		

WALL / COLUMN FOOTING DETAIL

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL 2019	PROJECT NO. T2857-22-01	FIG. 6





NOTES:

DRAIN SHOULD BE UNFORMLY SLOPED TO GRAVITY OUTLET OR TO A SUMP WHERE WATER CAN BE REMOVED BY PUMPIMG

CONCRETE BROW DITCH RECOMMENDED FOR SLOPE HEIGHTS GREATER THAN 6 FEET

NO SCALE

TYPICAL RETAINING WALL DRAIN DETAIL

GEOCON WEST, INC.
GEOTECHNICAL ENVIRONMENTAL MATERIALS
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THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

DF			APRIL, 2019	PROJECT NO. T2857-22-01	FIG. 7

APPENDIX A

APPENDIX A

EXPLORATORY EXCAVATIONS

Geocon performed the field investigation on March 14 and 15, 2019. Our subsurface exploration consisted of drilling six small-diameter borings and four percolation tests at the site. The borings were drilled to depths of 30 to 51 feet below the existing ground surface and the percolation tests were advanced to depths of approximately 8 feet below the existing ground surface using a track-mounted, hollow stem auger drill rig. We collected bulk and relatively undisturbed samples from the borings by driving a 3-inch O. D., California Modified Sampler into the "undisturbed" soil mass with blows from a 140-pound hammer falling 30 inches or a slide hammer. The California Modified Sampler was equipped with 1-inch high by 2³/₈-inch inside diameter brass sampler rings to facilitate removal and testing. Standard Penetration Test samples were also collected by driving a 2-inch diameter sampler 18 inches into the soil to retrieve small bulk samples. Relatively undisturbed samples and bulk samples of disturbed soils were transported to our laboratory for testing.

The soil conditions encountered in the borings were visually examined, classified and logged in general accordance with the Unified Soil Classification System (USCS). Logs of the borings are presented on Figures A-1 through A-10. The logs depict the soil and geologic conditions encountered and the depth at which samples were obtained. The approximate locations of the excavations are indicated the *Geologic Map*, Figure 2.

Percolation testing was performed on March 28, 2018 in general accordance with *Riverside County Flood Control and Water Conservation District, LID BMP Manual, Appendix A.* The testing procedures were modified because of site constraints from the active dairy. The percolation tests were run in accordance with *Section 2.3., Shallow Percolation Test*. The percolation test data is presented on Figures A-11 through A-14.

PROJECT NO. T2857-22-01

BORING B-1

ELEV. (MSL.) 637 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0	B-1@0-5'	SM	**UNDOCUMENTED FILL (Afu)** Silty SAND, medium dense, moist, grayish brown; fine sand			
2	B-1@2.5'			38	106.7	19.2
4		SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, dense, moist, light olive brown; fine sand			
6	B-1@5'			92	107.6	10.1
8	B-1@7.5'			71	113.7	15.4
10	B-1@10'	ML	Sandy SILT, very stiff, moist, dark brown	42	106.8	20.3
12						
14		SM	Silty SAND, dense, damp, orangish brown; fine to medium sand			
16	B-1@15'			68	118.9	12.2
18						
20		CL	CLAY with sand, very stiff, moist, brown with orange and gray			
	B-1@20'			75	113.9	17.7
22						
24						
26	B-1@25'		-becomes fine to medium sand; iron oxide staining	61		
28						

Figure A-1,
Log of Boring B-1, Page 1 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... DISTURBED OR BAG SAMPLE
- ... STANDARD PENETRATION TEST
- ... CHUNK SAMPLE
- ... DRIVE SAMPLE (UNDISTURBED)
- ... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

BORING B-1

ELEV. (MSL.) 637 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B-1@30'			SM	Silty SAND, very dense, moist, orangish brown; fine to medium sand; trace gravel	91/10'	121.2	11.0
32								
34				SC	Clayey SAND, very dense, olive brown; fine sand			
36	B-1@35'					50/6'		
38								
40	B-1@40'					50/6'		

Total depth 41'
No Groundwater encountered
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-1,
Log of Boring B-1, Page 2 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
... SAMPLING UNSUCCESSFUL
... STANDARD PENETRATION TEST
... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE
... CHUNK SAMPLE
... WATER TABLE OR SEEPAGE

NOTE: THE LOG OF SUBSURFACE CONDITIONS SHOWN HEREON APPLIES ONLY AT THE SPECIFIC BORING OR TRENCH LOCATION AND AT THE DATE INDICATED. IT IS NOT WARRANTED TO BE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT OTHER LOCATIONS AND TIMES.

GEOCON

PROJECT NO. T2857-22-01

BORING B-2

ELEV. (MSL.) 642 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0		ML	**TOPSOIL** SILT with sand, soft, wet, dark brown with orange			
2.5	B-2@2.5'	SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, wet, olive brown; fine sand	20	111.1	14.5
5	B-2@5-7' B-2@5'	ML	Sandy SILT, stiff, wet, olive brown; fine to medium sand	36	103.8	22.0
7.5	B-2@7.5'			27		
10	B-2@10'	ML	SILT, stiff, wet, brown; trace fine sand	17	111.5	16.7
15	B-2@15'		-becomes very stiff	54	92.8	31.1
18		SM	Silty SAND, medium dense, moist, brown with gray and dark brown; micaceous			
20	B-2@20'			33	105.6	20.9
25	B-2@25'	SM	Silty SAND, dense, saturated, grayish brown; medium sand	38		
29		CL	Sandy CLAY, stiff, saturated, dark brown			

Figure A-2,
Log of Boring B-2, Page 1 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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GEOCON

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-2 ELEV. (MSL.) 642 DATE COMPLETED 03/14/2019 EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
					MATERIAL DESCRIPTION			
30	B-2@30'			CL	Sandy CLAY, stiff, saturated, dark brown	29		
32								
34								
	B-2@35'					19		
36				ML	Sandy SILT, very stiff, saturated, bluish gray; fine sand			
38								
40	B-2@40'			SM	Silty SAND, very dense, saturated, brown; fine to medium sand	50/4"		
					Total depth 40' 3" Seepage or perched water encountered at 24' 5" during drilling Penetration resisance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 03/14/19			

Figure A-2,
Log of Boring B-2, Page 2 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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GEOCON

BORING B-3

ELEV. (MSL.) 638 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			**TOPSOIL** Organic, loose, wet			
1	B-3@1-5'	SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, dense, moist, grayish brown	4		
2.5	B-3@2.5'			58	112.7	16.0
5	B-3@5'	CL-ML	Sandy silty CLAY, stiff, wet, grayish brown	12	101.5	23.7
7.5	B-3@7.5'			15	96.8	27.5
10	B-3@10'	SC	Clayey SAND, dense, wet, grayish brown	44	123.1	14.6
13		CL	CLAY with sand, stiff, moist, brown			
15	B-3@15'			25	101.4	24.7
20	B-3@20'			41	116.1	17.7
25	B-3@25'			46		

Figure A-3,
Log of Boring B-3, Page 1 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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BORING B-3

ELEV. (MSL.) 638 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B-3@30'		■			SM	Silty SAND, very dense, moist, brown	50/4"	113.7	14.6
							Total depth 30' 10" No Groundwater encountered Penetration resisance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 03/14/19			

Figure A-3,
Log of Boring B-3, Page 2 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ☐ ... SAMPLING UNSUCCESSFUL
- ☒ ... DISTURBED OR BAG SAMPLE
- ◧ ... STANDARD PENETRATION TEST
- ◩ ... CHUNK SAMPLE
- ■ ... DRIVE SAMPLE (UNDISTURBED)
- ▼ ... WATER TABLE OR SEEPAGE

PROJECT NO. T2857-22-01

BORING B-4

ELEV. (MSL.) 636 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**FILL (Disturbed soils)** Silty SAND, loose, moist, brown			
	B-4@1-5'			SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, moist, brown			
2	B-4@2.5'					28		
				ML	SILT with sand, stiff, moist, olive		94.5	23
4								
	B-4@5'					63	100.7	26.9
6				CL	CLAY, very stiff, moist, greenish brown			
8	B-4@7.5'				-becomes light brown	18	102.4	22.4
10	B-4@10'			SM	Silty SAND, medium dense, wet, brown with light brown	21		
12								
14								
	B-4@15'					20		
16								
18			▽					
				ML	SILT with sand, very stiff, saturated, brown			
20	B-4@20'					28	100.3	28.0
22								
24								
	B-4@25'			SC	Clayey SAND, medium dense, saturated, brown	20		
26								
28								

Figure A-4,
Log of Boring B-4, Page 1 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. T2857-22-01

DEPTH IN FEET	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING B-4 ELEV. (MSL.) 636 DATE COMPLETED 03/14/2019 EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
							MATERIAL DESCRIPTION			
30	B-4@30'					SC	-becomes very dense	50/6"	117.5	14.2
							Total depth 31' Seepage or perched water encountered at 18'3" during drilling Penetration resisance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 03/14/19			

Figure A-4,
Log of Boring B-4, Page 2 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	☐ ... SAMPLING UNSUCCESSFUL	◧ ... STANDARD PENETRATION TEST	■ ... DRIVE SAMPLE (UNDISTURBED)
	⊠ ... DISTURBED OR BAG SAMPLE	◪ ... CHUNK SAMPLE	▼ ... WATER TABLE OR SEEPAGE

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PROJECT NO. T2857-22-01

BORING B-5

ELEV. (MSL.) **643** DATE COMPLETED **03/14/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **C. Robinson**

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0			**TURF AND TOPSOIL** Loose, wet, dark brown			
	B-5@1-5'	SM	**UNDOCUMENTED FILL (afu)** Silty SAND, medium dense, moist, dark brown; fine sand			
2	B-5@2.5'			77		
		SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, dense, moist, dark brown; fine sand			
4						
	B-5@5'			20	100.2	9.0
6		ML	SILT with sand, very stiff, moist, olive brown			
8	B-5@7.5'		-becomes wet; trace roots	28		
10	B-5@10'	CL	CLAY, stiff, wet, olive brown	25	90.7	31.4
12						
14						
	B-5@15'		-becomes greenish brown	35	104.6	22.8
16						
18		CL	CLAY with sand,and gravel size cemented pieces, stiff, wet, light olive brown			
20	B-5@20'			13	90.5	34.6
22						
24		ML	Clayey SILT with sand, stiff, wet, dark brown; fine sand			
	B-5@25'			19		
26						
28						

Figure A-5,
Log of Boring B-5, Page 1 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. T2857-22-01

BORING B-5

ELEV. (MSL.) 643 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
30	B-5@30'	ML	-becomes fine to medium sand; very stiff	34		
33		SC	Clayey SAND, very dense, wet, olive brown; fine to medium sand			
35	B-5@35'			50/6"	121.4	14.0
39		ML	SILT with sand, hard, moist, olive brown; iron oxide staining; fine sand			
40	B-5@40'			67		
45	B-5@45'		-becomes very stiff	36	86.8	39.3
48		SM	Silty SAND, very dense, moist, olive brown; iron oxide staining			
50	B-5@50'			50/6"		

Total depth 51'
No Groundwater encountered
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-5,
Log of Boring B-5, Page 2 of 2

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS
- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. T2857-22-01

BORING B-6

ELEV. (MSL.) **645** DATE COMPLETED **03/14/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **C. Robinson**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				SM	**TOPSOIL** Silty SAND, loose, damp, light brown			
1	B-6@1-5'			SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, damp, light brown; fine sand			
2.5	B-6@2.5'					23	102.7	5.9
4					-becomes olive brown			
5	B-6@5'					22	106.9	13.3
7.5	B-6@7.5'					43		
8				ML	SILT with sand, very stiff, moist, olive brown; fine sand		95.1	27.6
10	B-6@10'					43		
13				SM	Silty SAND, medium dense, damp, olive brown; fine to medium sand			
15	B-6@15'					44	110.7	11.6
16				CL	Sandy CLAY, stiff, wet, light brown; fine to medium sand			
19				SM	Silty SAND, very dense, damp, olive brown; fine sand			
20	B-6@20'					50/5"		

Total depth 20' 5"
No Groundwater encountered
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-6,
Log of Boring B-6, Page 1 of 1

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS			
	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. T2857-22-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING P-1 ELEV. (MSL.) 637 DATE COMPLETED 03/14/2019 EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
	BULK / DR/SPT				MATERIAL DESCRIPTION			
0				ML	**UNDOCUMENTED FILL (afu)** SILT with sand, stiff, moist, medium brown; fine sand			
2								
4				SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, moist, light brown; fine sand			
6	P-1@6-8'							
8					Total depth 8' No Groundwater encountered Penetration resisance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 03/14/19			

Figure A-7,
Log of Boring P-1, Page 1 of 1

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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GEOCON

BORING P-2

ELEV. (MSL.) **637** DATE COMPLETED **03/14/2019**

EQUIPMENT **HOLLOW STEM AUGER** BY: **C. Robinson**

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0				ML	**UNDOCUMENTED FILL (afu)** SILT with sand, stiff, moist, medium brown; fine sand			
2								
4				SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, moist, light brown			
6	P-2@6-8'							
8					Total depth 8' No Groundwater encountered Penetration resisance for 140-lb hammer falling 30" by auto-hammer Backfilled with cuttings 03/14/19			

Figure A-8,
Log of Boring P-2, Page 1 of 1

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

- ... SAMPLING UNSUCCESSFUL
- ... STANDARD PENETRATION TEST
- ... DRIVE SAMPLE (UNDISTURBED)
- ... DISTURBED OR BAG SAMPLE
- ... CHUNK SAMPLE
- ... WATER TABLE OR SEEPAGE

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GEOCON

PROJECT NO. T2857-22-01

BORING P-3

ELEV. (MSL.) 645 DATE COMPLETED 03/14/2019

EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson

DEPTH IN FEET	SAMPLE NO.	BULK	DR/SPT	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	MATERIAL DESCRIPTION	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
0						SM	**UNDOCUMENTED FILL (afu)** Silty SAND, loose, damp, light brown			
						SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, damp, light brown			
2										
4										
6	P-3@6-8'	☒								
8										

Total depth 8' 2"
No Groundwater encountered
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-9,
Log of Boring P-3, Page 1 of 1

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS

... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

GEOCON

PROJECT NO. T2857-22-01

DEPTH IN FEET	SAMPLE NO.	LITHOLOGY	GROUNDWATER	SOIL CLASS (USCS)	BORING P-4 ELEV. (MSL.) 645 DATE COMPLETED 03/14/2019 EQUIPMENT HOLLOW STEM AUGER BY: C. Robinson	PENETRATION RESISTANCE (BLOWS/FT.)	DRY DENSITY (P.C.F.)	MOISTURE CONTENT (%)
	BULK / DR/SPT				MATERIAL DESCRIPTION			
0				SM	**UNDOCUMENTED FILL (afu)** Silty SAND, loose, damp, light brown			
2				SM	**YOUNG ALLUVIAL FAN DEPOSITS(Qyfa)** Silty SAND, medium dense, damp, light brown			
4								
6	P-4@6-8'							
8								

Total depth 8' 2"
No Groundwater encountered
Penetration resisance for 140-lb hammer falling 30" by auto-hammer
Backfilled with cuttings 03/14/19

Figure A-10,
Log of Boring P-4, Page 1 of 1

T2857-22-01 BORING LOGS.GPJ

SAMPLE SYMBOLS	... SAMPLING UNSUCCESSFUL	... STANDARD PENETRATION TEST	... DRIVE SAMPLE (UNDISTURBED)
	... DISTURBED OR BAG SAMPLE	... CHUNK SAMPLE	... WATER TABLE OR SEEPAGE

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GEOCON

PERCOLATION TEST REPORT

Project Name:	The Homestead	**Project No.:**	T2857-22-01
Test Hole No.:	P-1	**Date Excavated:**	3/14/2019
Length of Test Pipe:	96.0 inches	**Soil Classification:**	SM
Height of Pipe above Ground:	0.0 inches	**Presoak Date:**	3/14/2019
Depth of Test Hole:	96.0 inches	**Perc Test Date:**	3/28/2019
Check for Sandy Soil Criteria Tested by:	SP	**Percolation Tested by:**	CER

Water level measured from BOTTOM of hole

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	8:15 AM 8:40 AM	25	25	23.4	19.2	4.2	6.0
2	8:40 AM 9:05 AM	25	50	19.2	16.3	2.9	8.7

Soil Criteria: Normal

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:05 AM 9:35 AM	30	30	24.0	21.8	2.2	13.9
2	9:35 AM 10:05 AM	30	60	23.9	22.2	1.7	17.9
3	10:05 AM 10:35 AM	30	90	23.9	22.0	1.9	15.6
4	10:35 AM 11:05 AM	30	120	24.0	22.2	1.8	16.7
5	11:05 AM 11:35 AM	30	150	24.0	22.2	1.8	16.7
6	11:35 AM 12:05 PM	30	180	24.0	22.3	1.7	17.9
7	12:05 PM 12:35 PM	30	210	24.0	22.3	1.7	17.9

Infiltration Rate (in/hr):	0.27
Radius of test hole (in):	4
Average Head (in):	23.2

Figure A-11

PERCOLATION TEST REPORT

Project Name:	The Homestead	**Project No.:**	T2857-22-01
Test Hole No.:	P-2	**Date Excavated:**	3/14/2019
Length of Test Pipe:	96.0 inches	**Soil Classification:**	SM
Height of Pipe above Ground:	0.0 inches	**Presoak Date:**	3/14/2019
Depth of Test Hole:	96.0 inches	**Perc Test Date:**	3/28/2019
Check for Sandy Soil Criteria Tested by:	SP	**Percolation Tested by:**	CER

Water level measured from BOTTOM of hole

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	8:15 AM 8:40 AM	25	25	25.2	13.1	12.1	2.1
2	8:40 AM 9:05 AM	25	50	13.1	4.8	8.3	3.0

Soil Criteria: Normal

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	9:15 AM 9:45 AM	30	30	25.2	8.3	16.9	1.8
2	9:45 AM 10:15 AM	30	60	24.1	8.6	15.5	1.9
3	10:15 AM 10:35 AM	20	80	24.2	11.2	13.1	1.5
4	10:35 AM 10:45 AM	10	90	24.0	19.8	4.2	2.4
5	10:45 AM 10:55 AM	10	100	24.0	19.0	5.0	2.0
6	10:55 AM 11:05 AM	10	110	23.8	19.0	4.8	2.1
7	11:05 AM 11:15 AM	10	120	24.1	19.1	5.0	2.0
8	11:15 AM 11:25 AM	10	130	24.1	19.0	5.2	1.9
9	11:25 AM 11:35 AM	10	140	24.0	19.0	5.0	2.0

Infiltration Rate (in/hr):	2.58
Radius of test hole (in):	4
Average Head (in):	21.5

Figure A-12

PERCOLATION TEST REPORT							
Project Name:		The Homestead			**Project No.:**		T2857-22-01
Test Hole No.:		P-3			**Date Excavated:**		3/14/2019
Length of Test Pipe:			109.0	inches	**Soil Classification:**		SM
Height of Pipe above Ground:			12.0	inches	**Presoak Date:**		3/14/2019
Depth of Test Hole:			97.0	inches	**Perc Test Date:**		3/28/2019
Check for Sandy Soil Criteria Tested by:				SP	**Percolation Tested by:**		CER
Water level measured from BOTTOM of hole							

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	8:50 AM			35.9			
2		Not measured due to livestock in test area					
			Soil Criteria: Normal				

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	1:00 PM 1:10 PM	10	10	24.5	23.8	0.7	13.9
2	1:10 PM 1:20 PM	10	20	24.9	23.8	1.1	9.3
3	1:20 PM 1:30 PM	10	30	25.0	23.8	1.2	8.3
4	1:30 PM 1:40 PM	10	40	25.0	23.9	1.1	9.3
5	1:40 PM 1:50 PM	10	50	24.9	23.4	1.4	6.9
6	1:50 PM 2:00 PM	10	60	24.9	23.7	1.2	8.3
7	2:00 PM 2:10 PM	10	70	25.0	23.8	1.2	8.3
8	2:10 PM 2:20 PM	10	80	24.9	23.9	1.0	10.4
9	2:20 PM 2:30 PM	10	90	24.9	23.7	1.2	8.3
10	2:30 PM 2:40 PM	10	100	25.0	23.9	1.1	9.3
11	2:40 PM 2:50 PM	10	110	25.0	24.0	1.0	10.4
12	2:50 PM 3:00 PM	10	120	24.9	23.9	1.0	10.4

Infiltration Rate (in/hr):	0.44
Radius of test hole (in):	4
Average Head (in):	24.4

Figure A-13

PERCOLATION TEST REPORT

Project Name:	The Homestead	**Project No.:**	T2857-22-01
Test Hole No.:	P-4	**Date Excavated:**	3/14/2019
Length of Test Pipe:	96.0 inches	**Soil Classification:**	SM
Height of Pipe above Ground:	0.0 inches	**Presoak Date:**	3/14/2019
Depth of Test Hole:	96.0 inches	**Perc Test Date:**	3/28/2019
Check for Sandy Soil Criteria Tested by:	SP	**Percolation Tested by:**	CER

Water level measured from BOTTOM of hole

Sandy Soil Criteria Test

Trial No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	8:55 AM			22.8			
2		Not measured due to livestock in test area					
			Soil Criteria: Normal				

Percolation Test

Reading No.	Time	Time Interval (min)	Total Elapsed Time (min)	Initial Water Level (in)	Final Water Level (in)	Δ in Water Level (inches)	Percolation Rate (min/inch)
1	1:05 PM 1:15 PM	10	10	24.2	22.6	1.7	6.0
2	1:15 PM 1:25 PM	10	20	24.0	22.4	1.6	6.4
3	1:25 PM 1:35 PM	10	30	24.2	22.7	1.6	6.4
4	1:35 PM 1:45 PM	10	40	24.2	22.8	1.4	6.9
5	1:45 PM 1:55 PM	10	50	24.0	22.7	1.3	7.6
6	1:55 PM 2:05 PM	10	60	24.2	23.0	1.2	8.3
7	2:05 PM 2:15 PM	10	70	24.4	23.2	1.2	8.3
8	2:15 PM 2:25 PM	10	80	24.4	23.2	1.2	8.3
9	2:25 PM 2:35 PM	10	90	24.2	23.2	1.1	9.3
10	2:35 PM 2:45 PM	10	100	24.4	23.3	1.1	9.3
11	2:45 PM 2:55 PM	10	110	24.2	23.0	1.2	8.3
12	2:55 PM 3:05 PM	10	120	24.1	23.0	1.1	9.3

Infiltration Rate (in/hr):	0.51	
Radius of test hole (in):	4	**Figure A-14**
Average Head (in):	23.6	

APPENDIX B

APPENDIX B

LABORATORY TESTING

We performed laboratory tests in accordance with current, generally accepted test methods of ASTM International (ASTM) or other suggested procedures. We analyzed selected soil samples for in-situ density and moisture content, maximum dry density and optimum moisture content, expansion index, corrosivity, grain size distribution, R-Value, plasticity, organic content, consolidation characteristics, and direct shear strength. The results of the laboratory tests are presented on Figures B-1 through B-13. The in-place dry density and moisture content of the samples tested are presented on the boring logs in *Appendix A*.

SUMMARY OF LABORATORY MAXIMUM DRY DENSITY AND OPTIMUM MOISTURE CONTENT TEST RESULTS ASTM D1557

Sample No.	Description	Maximum Dry Density (pcf)	Optimum Moisture Content (% of dry wt.)
B-1 @ 0-5’	Silty SAND (SM), grayish brown	120.0	12.5
B-5 @ 1-5’	Silty SAND (SM), dark brown	111.5	12.5

SUMMARY OF LABORATORY EXPANSION INDEX TEST RESULTS ASTM D4829

Sample No.	Moisture Content		After Test Dry Density (pcf)	Expansion Index
	Before Test (%)	After Test (%)		
B-1 @ 0-5’	11.8	19.1	103.2	0
B-2 @ 5-7’	10.0	18.4	108.0	1

SUMMARY OF CORROSIVITY TEST RESULTS

Sample No.	Chloride Content (ppm)	Sulfate Content (%)	pH	Resistivity (ohm-centimeter)
B-4 @ 1-5’	40	0.044	7.24	320
B-5 @ 1-5’	180	0.000	8.32	26,000

Chloride content determined by California Test 422.
Water-soluble sulfate determined by California Test 417.
Resistivity and pH determined by Caltrans Test 643.

SUMMARY OF LABORATORY R-VALUE TEST RESULTS ASTM D2844

Sample No.	R-Value
B-4 @ 1-5’	55
B-6 @ 1-5’	70

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LABORATORY TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

SUMMARY OF LABORATORY ORGANIC MATTER CONTENT TESTS
ASTM D2974 (Methods 'A' & 'C')

Sample No.	Organic Matter Content (%)
B-1 @ 2.5'	3.6
B-1 @ 7.5'	2.0
B-2 @ 2.5'	2.1
B-3 @ 2.5'	1.9
B-3 @ 10'	1.1
B-4 @ 2.5'	2.4
B-4 @ 5'	3.2
B-4 @ 20'	2.9
B-5 @ 2.5'	1.0
B-5 @ 7.5'	3.1
B-5 @ 10'	3.3
B-6 @ 2.5'	1.0
B-6 @ 5'	2.1

SUMMARY OF ONE-DIMENSIONAL CONSOLIDATION (COLLAPSE) TESTS
ASTM D2435

Sample No.	In-situ Dry Density (pcf)	Moisture Content Before Test (%)	Final Moisture Content (%)	Axial Load with Water Added (psf)	Percent Hydrocompression
B-2 @ 5'	103.8	22.0	20.6	2,000	0.02
B-2 @ 10'	111.5	16.7	15.2	2,000	0.03
B-3 @ 5'	101.5	23.7	22.7	2,000	0.02
B-3 @ 15'	101.4	24.7	22.9	4,000	0.10
B-5 @ 5'	100.2	9.0	20.5	2,000	0.30
B-5 @ 10'	90.7	31.4	30.8	2,000	0.01

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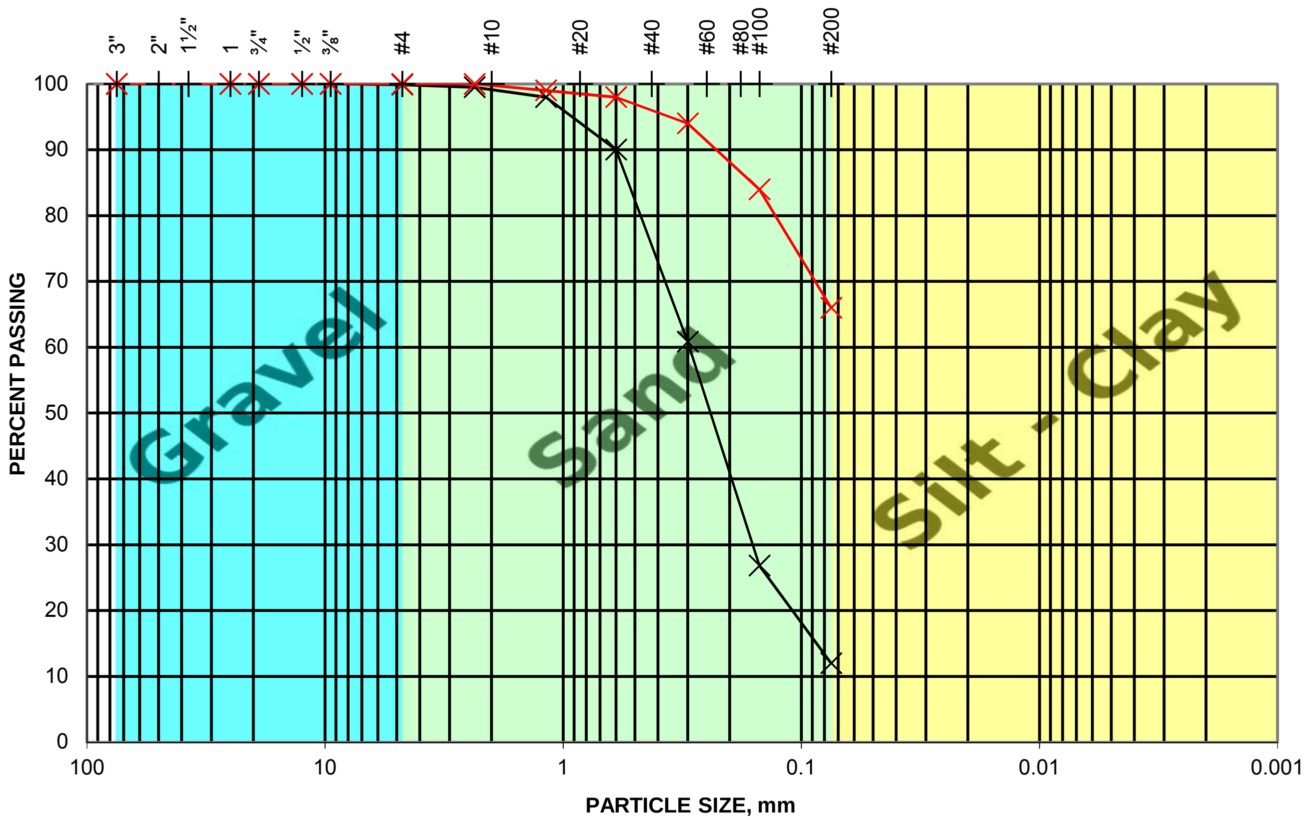
SUMMARY OF ATTERBERG LIMIT TEST RESULTS
ASTM D4318

Sample No.	Liquid Limit	Plastic Limit	Plasticity Index	USCS
B-2 @ 10’	**	**	0	ML
B-2 @ 35’	**	**	0	ML
B-3 @ 5’	23	19	4	CL-ML
B-4 @ 7.5’	26	17	9	CL
B-5 @ 10’	33	22	11	CL

** Non-plastic (NP): Material could not be rolled to 3 mm thread at any moisture content.



SAMPLE ID	SAMPLE DESCRIPTION
B-2 @ 25'	SM - Silty Sand
B-2 @ 35'	CL - Sandy Clay

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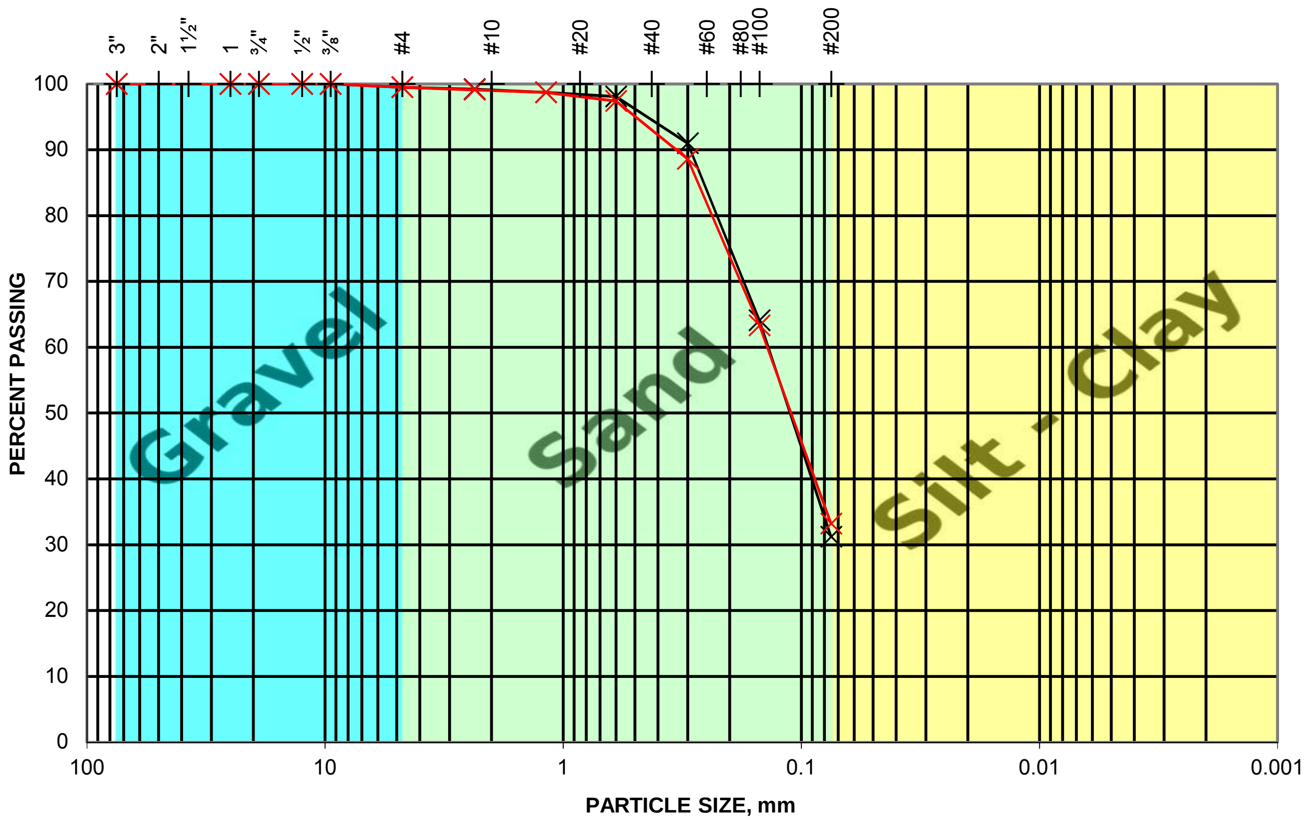
GRAIN SIZE DISTRIBUTION

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG B-4



SAMPLE ID	SAMPLE DESCRIPTION
P-1 @ 6-8'	SM - Silty Sand
P-3 @ 6-8'	SM - Silty Sand

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GRAIN SIZE DISTRIBUTION

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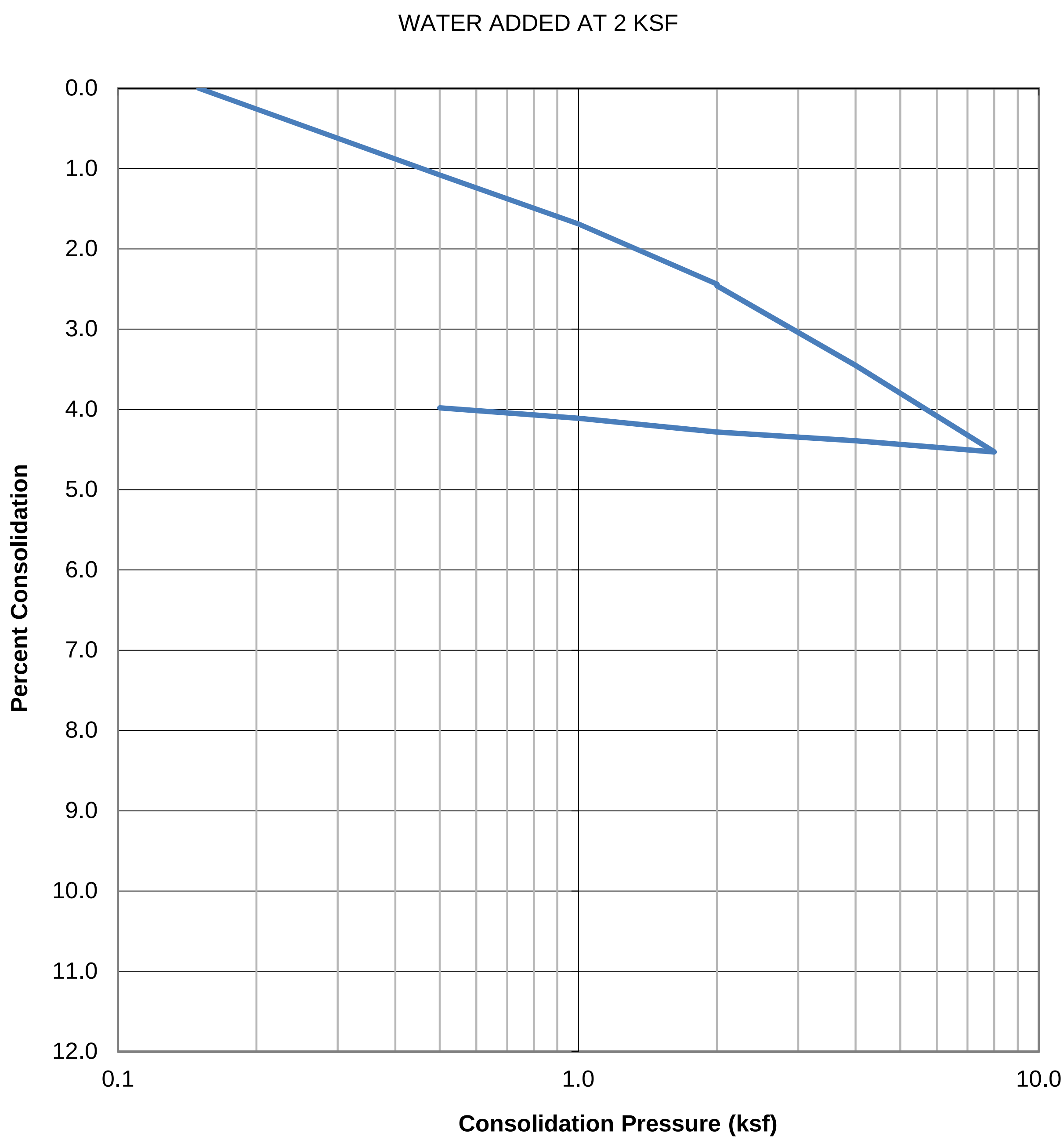

SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2@5'	ML	103.8	22.0	20.6

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CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
ANDARCHIBALD AVENUE
EASTVALE, CALIFORNIA

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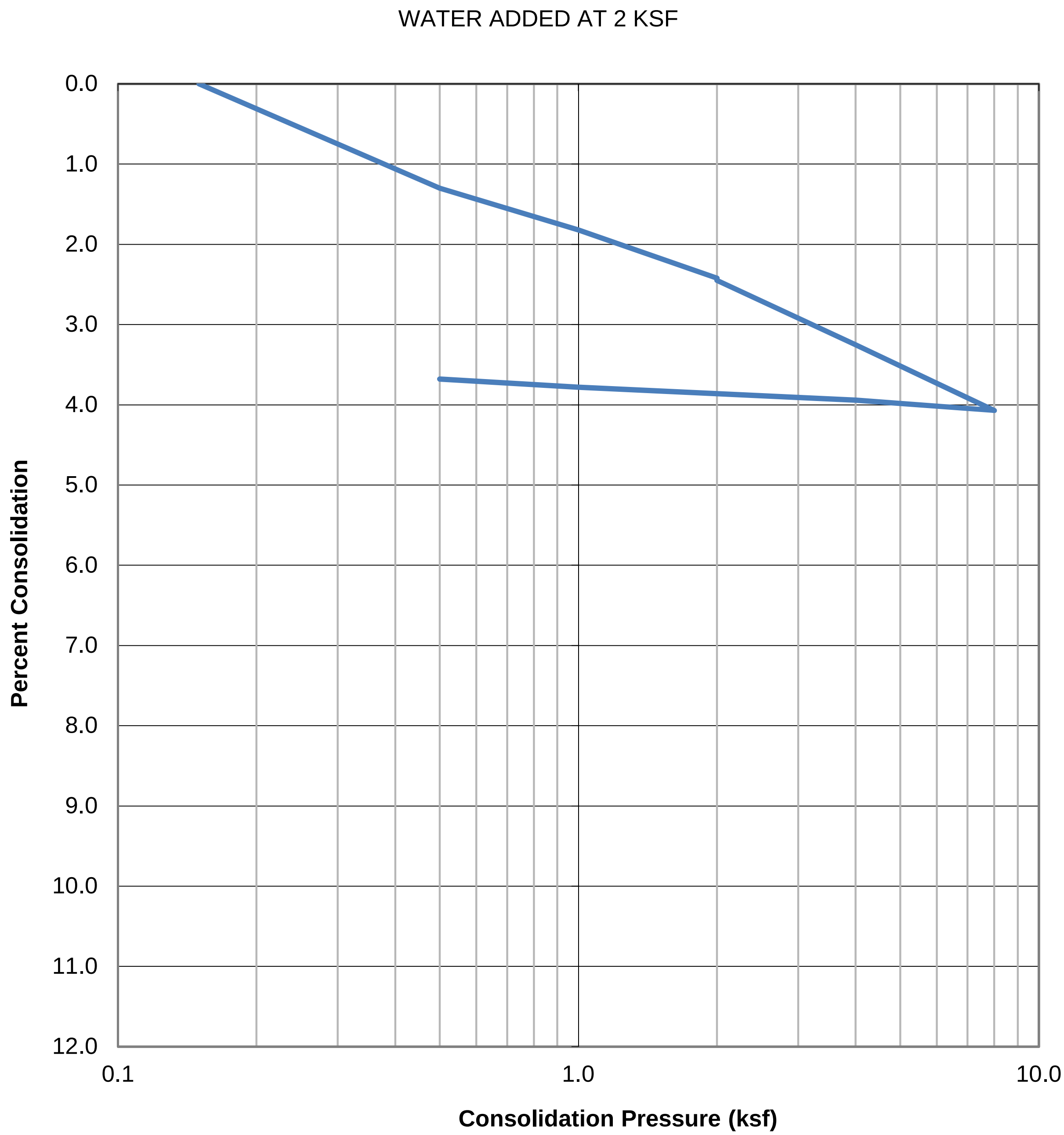

SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B2@10'	ML	111.5	16.7	15.2

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CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
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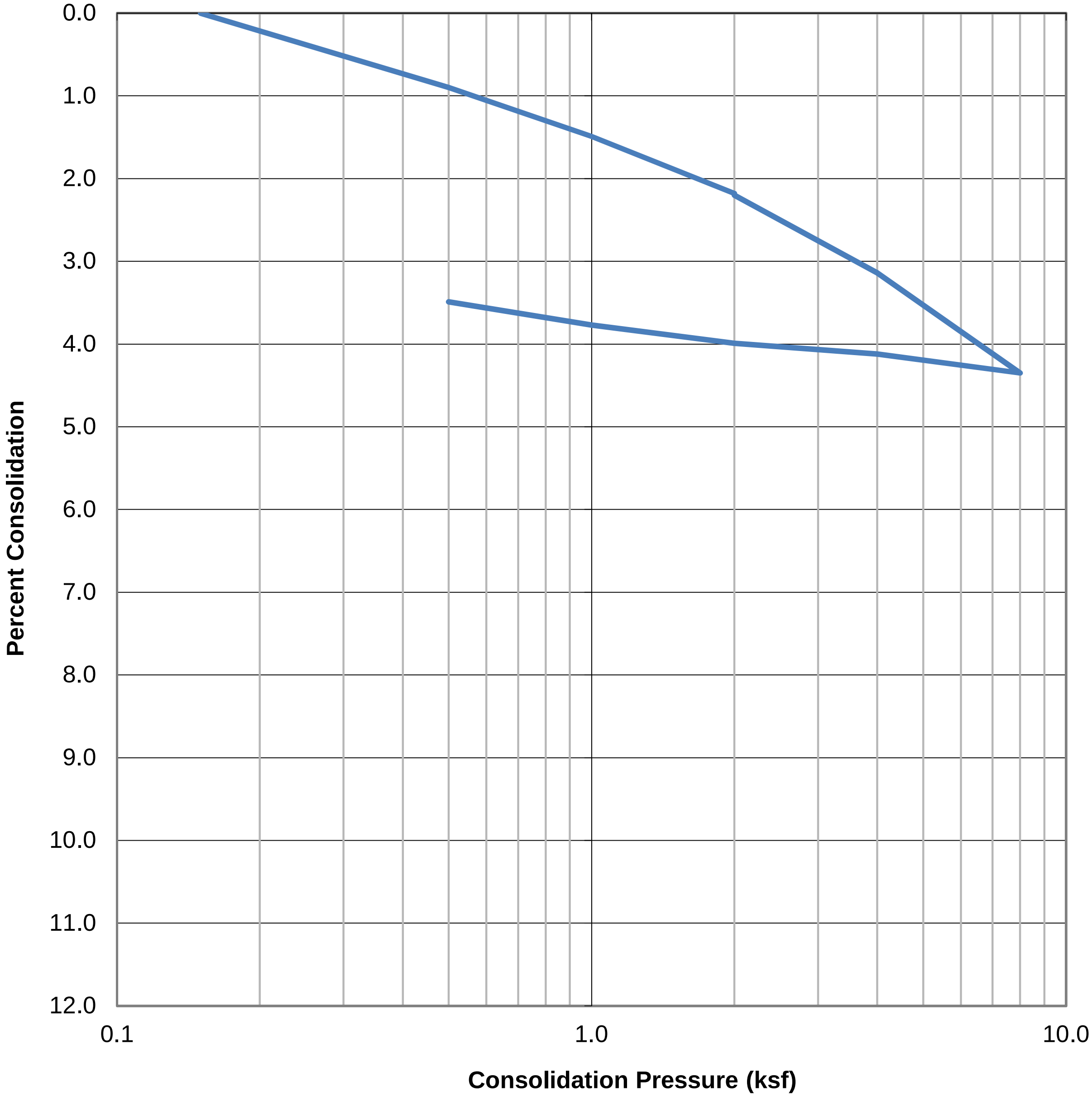
WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B3@5'	CL-ML	101.5	23.7	22.7

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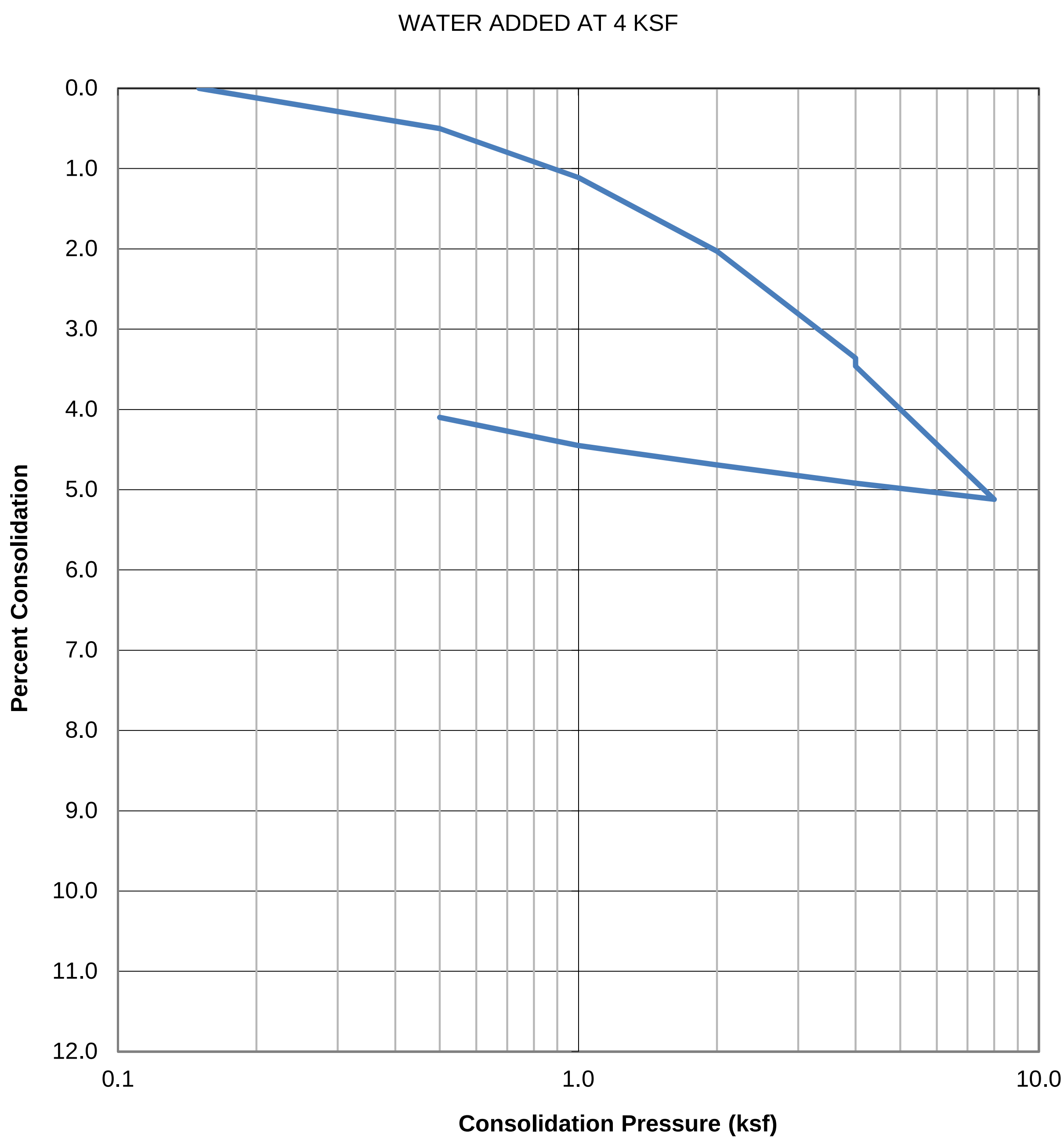
CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019	PROJECT NO. T2857-22-01	FIG B-8



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B3@15'	CL	101.4	24.7	22.9

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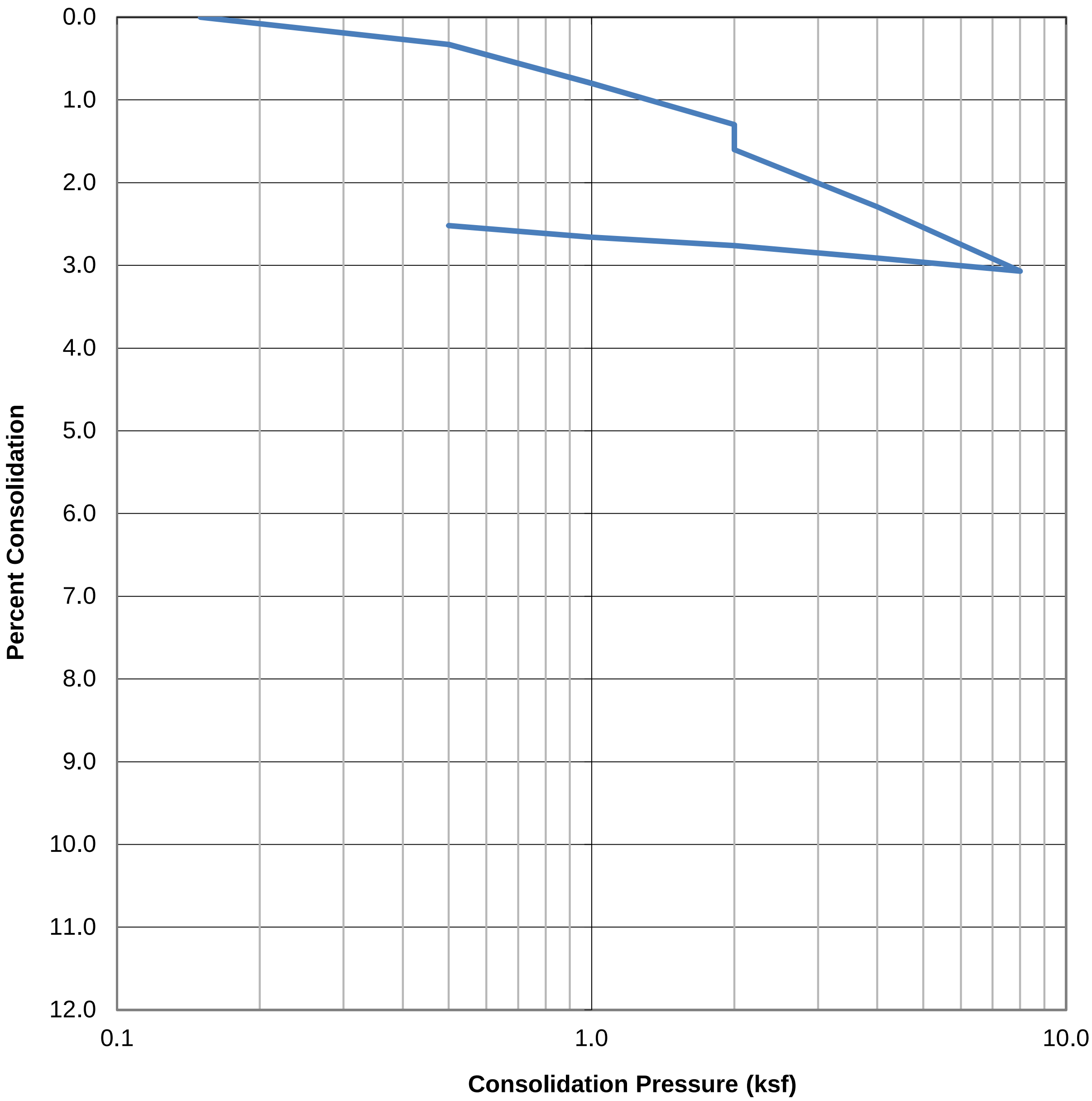
CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019	PROJECT NO. T2857-22-01	FIG B-9

WATER ADDED AT 2 KSF



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B5@5'	ML	100.2	9.0	20.5

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CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
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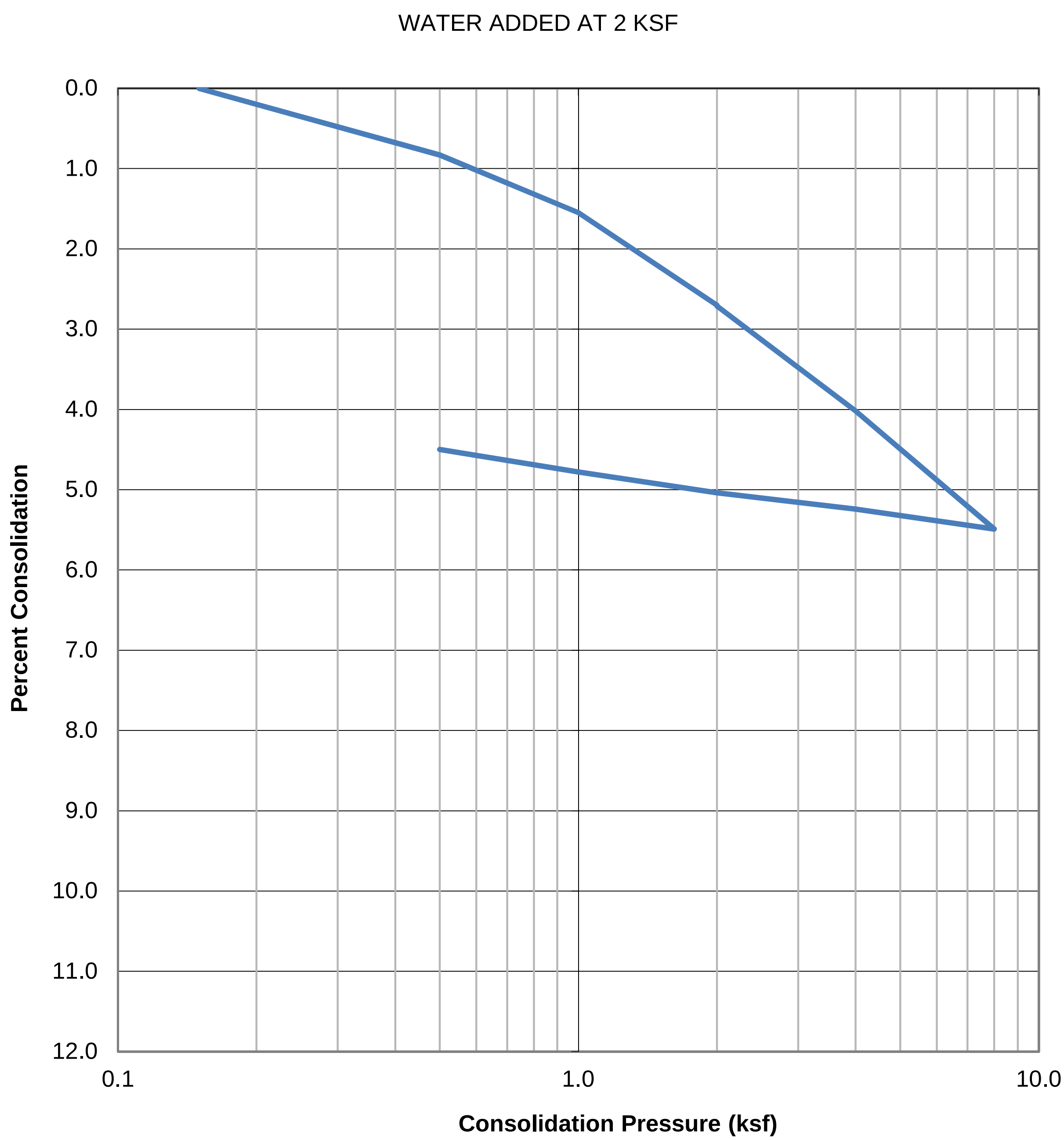
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG B-10



SAMPLE ID	SOIL TYPE	DRY DENSITY (PCF)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)
B5@10'	CL	90.7	31.4	30.8

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CONSOLIDATION TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
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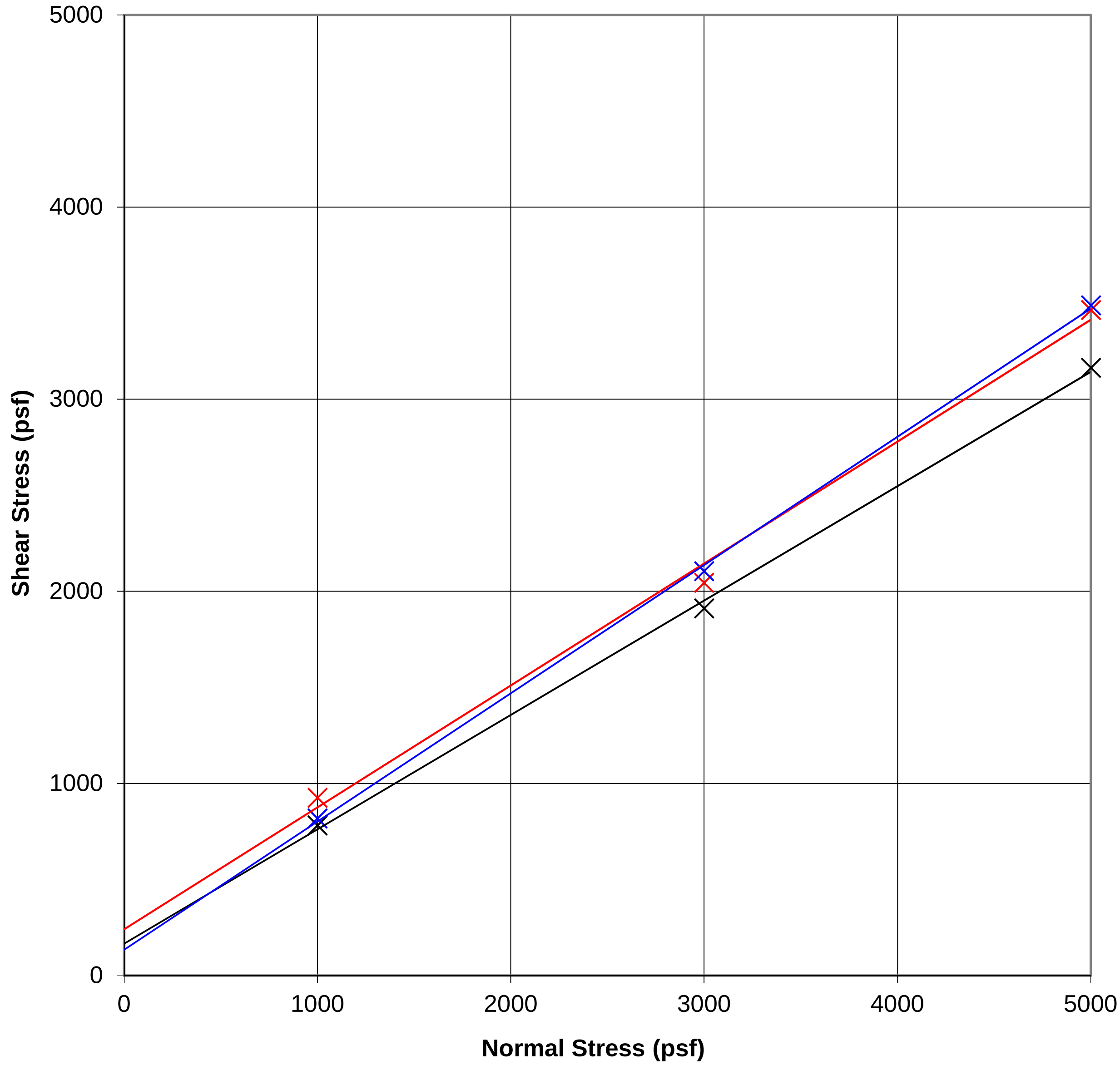
EASTVALE, CALIFORNIA

APRIL, 2019	PROJECT NO. T2857-22-01	FIG B-11



SAMPLE ID	SOIL TYPE	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	C (psf)	ϕ (deg)
*B-1@0-5	SM	120.0	12.5	3.3	170	31
B-1@7.5	SM	113.7	15.4	20.6	240	32
B-3@7.5	CL-ML	96.8	27.5	24.3	130	34

*Sample remolded to approximately 90% of the test maximum dry density at optimum moisture content.

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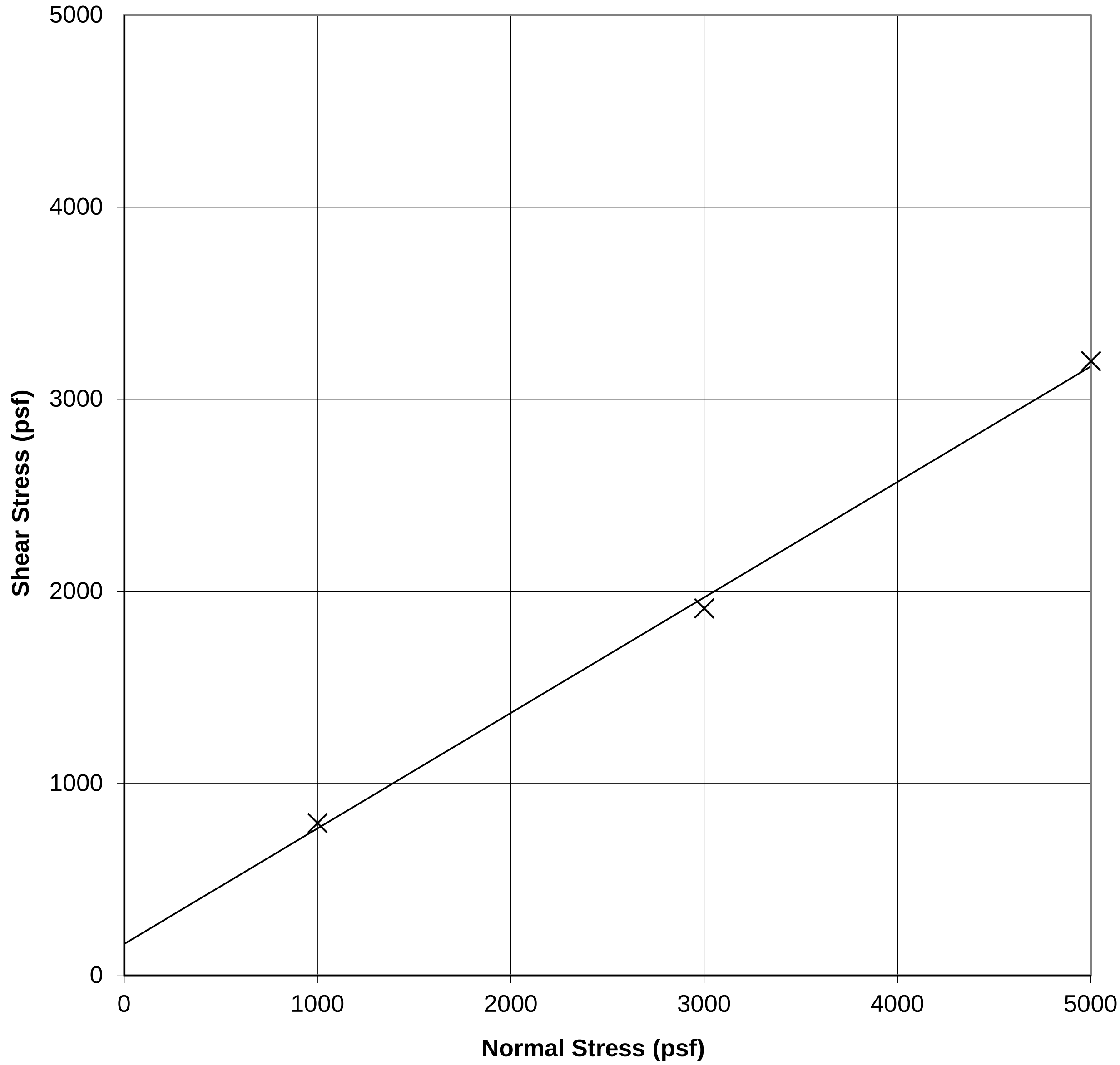
DIRECT SHEAR TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG B-12



SAMPLE ID	SOIL TYPE	INITIAL DRY DENSITY (pcf)	INITIAL MOISTURE (%)	FINAL MOISTURE (%)	C (psf)	ϕ (deg)
*B-5@1-5	SM	111.5	12.5	11.2	160	31

*Sample remolded to approximately 90% of the test maximum dry density at optimum moisture content.

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DIRECT SHEAR TEST RESULTS

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

APRIL, 2019 | PROJECT NO. T2857-22-01 | FIG B-13

APPENDIX C

APPENDIX C

RECOMMENDED GRADING SPECIFICATIONS

FOR

THE HOMESTEAD INDUSTRIAL BUSINESS PARK
WEST OF LIMONITE AVENUE
AND ARCHIBALD AVENUE
EASTVALE, CALIFORNIA

PROJECT NO. T2857-22-01

RECOMMENDED GRADING SPECIFICATIONS

1. GENERAL

1.1 These Recommended Grading Specifications shall be used in conjunction with the Geotechnical Report for the project prepared by Geocon. The recommendations contained in the text of the Geotechnical Report are a part of the earthwork and grading specifications and shall supersede the provisions contained hereinafter in the case of conflict.

1.2 Prior to the commencement of grading, a geotechnical consultant (Consultant) shall be employed for the purpose of observing earthwork procedures and testing the fills for substantial conformance with the recommendations of the Geotechnical Report and these specifications. The Consultant should provide adequate testing and observation services so that they may assess whether, in their opinion, the work was performed in substantial conformance with these specifications. It shall be the responsibility of the Contractor to assist the Consultant and keep them apprised of work schedules and changes so that personnel may be scheduled accordingly.

1.3 It shall be the sole responsibility of the Contractor to provide adequate equipment and methods to accomplish the work in accordance with applicable grading codes or agency ordinances, these specifications and the approved grading plans. If, in the opinion of the Consultant, unsatisfactory conditions such as questionable soil materials, poor moisture condition, inadequate compaction, and/or adverse weather result in a quality of work not in conformance with these specifications, the Consultant will be empowered to reject the work and recommend to the Owner that grading be stopped until the unacceptable conditions are corrected.

2. DEFINITIONS

2.1 **Owner** shall refer to the owner of the property or the entity on whose behalf the grading work is being performed and who has contracted with the Contractor to have grading performed.

2.2 **Contractor** shall refer to the Contractor performing the site grading work.

2.3 **Civil Engineer** or **Engineer of Work** shall refer to the California licensed Civil Engineer or consulting firm responsible for preparation of the grading plans, surveying and verifying as-graded topography.

2.4 **Consultant** shall refer to the soil engineering and engineering geology consulting firm retained to provide geotechnical services for the project.

2.5 **Soil Engineer** shall refer to a California licensed Civil Engineer retained by the Owner, who is experienced in the practice of geotechnical engineering. The Soil Engineer shall be responsible for having qualified representatives on-site to observe and test the Contractor's work for conformance with these specifications.

2.6 **Engineering Geologist** shall refer to a California licensed Engineering Geologist retained by the Owner to provide geologic observations and recommendations during the site grading.

2.7 **Geotechnical Report** shall refer to a soil report (including all addenda) which may include a geologic reconnaissance or geologic investigation that was prepared specifically for the development of the project for which these Recommended Grading Specifications are intended to apply.

3. MATERIALS

3.1 Materials for compacted fill shall consist of any soil excavated from the cut areas or imported to the site that, in the opinion of the Consultant, is suitable for use in construction of fills. In general, fill materials can be classified as *soil* fills, *soil-rock* fills or *rock* fills, as defined below.

3.1.1 **Soil fills** are defined as fills containing no rocks or hard lumps greater than 12 inches in maximum dimension and containing at least 40 percent by weight of material smaller than ¾ inch in size.

3.1.2 **Soil-rock fills** are defined as fills containing no rocks or hard lumps larger than 4 feet in maximum dimension and containing a sufficient matrix of soil fill to allow for proper compaction of soil fill around the rock fragments or hard lumps as specified in Paragraph 6.2. **Oversize rock** is defined as material greater than 12 inches.

3.1.3 **Rock fills** are defined as fills containing no rocks or hard lumps larger than 3 feet in maximum dimension and containing little or no fines. Fines are defined as material smaller than ¾ inch in maximum dimension. The quantity of fines shall be less than approximately 20 percent of the rock fill quantity.

3.2 Material of a perishable, spongy, or otherwise unsuitable nature as determined by the Consultant shall not be used in fills.

3.3 Materials used for fill, either imported or on-site, shall not contain hazardous materials as defined by the California Code of Regulations, Title 22, Division 4, Chapter 30, Articles 9 and 10; 40CFR; and any other applicable local, state or federal laws. The Consultant shall not be responsible for the identification or analysis of the potential presence of hazardous materials. However, if observations, odors or soil discoloration cause Consultant to suspect the presence of hazardous materials, the Consultant may request from the Owner the termination of grading operations within the affected area. Prior to resuming grading operations, the Owner shall provide a written report to the Consultant indicating that the suspected materials are not hazardous as defined by applicable laws and regulations.

3.4 The outer 15 feet of *soil-rock* fill slopes, measured horizontally, should be composed of properly compacted *soil* fill materials approved by the Consultant. *Rock* fill may extend to the slope face, provided that the slope is not steeper than 2:1 (horizontal:vertical) and a soil layer no thicker than 12 inches is track-walked onto the face for landscaping purposes. This procedure may be utilized provided it is acceptable to the governing agency, Owner and Consultant.

3.5 Samples of soil materials to be used for fill should be tested in the laboratory by the Consultant to determine the maximum density, optimum moisture content, and, where appropriate, shear strength, expansion, and gradation characteristics of the soil.

3.6 During grading, soil or groundwater conditions other than those identified in the Geotechnical Report may be encountered by the Contractor. The Consultant shall be notified immediately to evaluate the significance of the unanticipated condition

4. CLEARING AND PREPARING AREAS TO BE FILLED

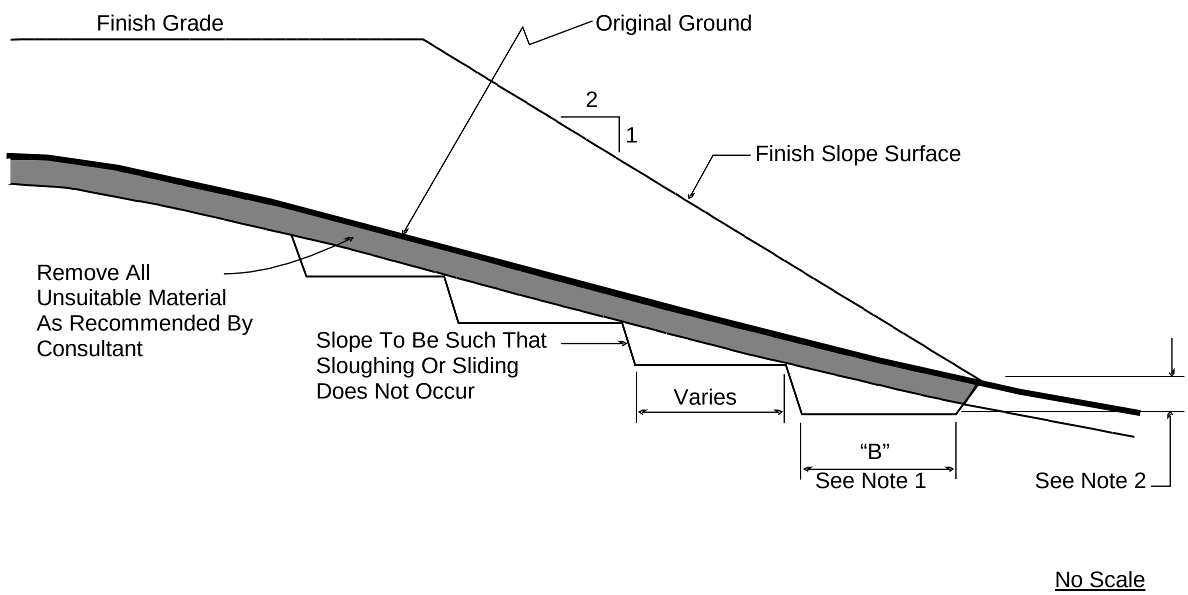
4.1 Areas to be excavated and filled shall be cleared and grubbed. Clearing shall consist of complete removal above the ground surface of trees, stumps, brush, vegetation, man-made structures, and similar debris. Grubbing shall consist of removal of stumps, roots, buried logs and other unsuitable material and shall be performed in areas to be graded. Roots and other projections exceeding 1½ inches in diameter shall be removed to a depth of 3 feet below the surface of the ground. Borrow areas shall be grubbed to the extent necessary to provide suitable fill materials.

4.2 Asphalt pavement material removed during clearing operations should be properly disposed at an approved off-site facility or in an acceptable area of the project evaluated by Geocon and the property owner. Concrete fragments that are free of reinforcing steel may be placed in fills, provided they are placed in accordance with Section 6.2 or 6.3 of this document.

4.3 After clearing and grubbing of organic matter and other unsuitable material, loose or porous soils shall be removed to the depth recommended in the Geotechnical Report. The depth of removal and compaction should be observed and approved by a representative of the Consultant. The exposed surface shall then be plowed or scarified to a minimum depth of 6 inches and until the surface is free from uneven features that would tend to prevent uniform compaction by the equipment to be used.

4.4 Where the slope ratio of the original ground is steeper than 5:1 (horizontal:vertical), or where recommended by the Consultant, the original ground should be benched in accordance with the following illustration.

TYPICAL BENCHING DETAIL



DETAIL NOTES:

(1) Key width "B" should be a minimum of 10 feet, or sufficiently wide to permit complete coverage with the compaction equipment used. The base of the key should be graded horizontal, or inclined slightly into the natural slope.

(2) The outside of the key should be below the topsoil or unsuitable surficial material and at least 2 feet into dense formational material. Where hard rock is exposed in the bottom of the key, the depth and configuration of the key may be modified as approved by the Consultant.

4.5 After areas to receive fill have been cleared and scarified, the surface should be moisture conditioned to achieve the proper moisture content, and compacted as recommended in Section 6 of these specifications.

5. COMPACTION EQUIPMENT

5.1 Compaction of *soil* or *soil-rock* fill shall be accomplished by sheepsfoot or segmented-steel wheeled rollers, vibratory rollers, multiple-wheel pneumatic-tired rollers, or other types of acceptable compaction equipment. Equipment shall be of such a design that it will be capable of compacting the *soil* or *soil-rock* fill to the specified relative compaction at the specified moisture content.

5.2 Compaction of *rock* fills shall be performed in accordance with Section 6.3.

6. PLACING, SPREADING AND COMPACTION OF FILL MATERIAL

6.1 *Soil* fill, as defined in Paragraph 3.1.1, shall be placed by the Contractor in accordance with the following recommendations:

6.1.1 *Soil* fill shall be placed by the Contractor in layers that, when compacted, should generally not exceed 8 inches. Each layer shall be spread evenly and shall be thoroughly mixed during spreading to obtain uniformity of material and moisture in each layer. The entire fill shall be constructed as a unit in nearly level lifts. Rock materials greater than 12 inches in maximum dimension shall be placed in accordance with Section 6.2 or 6.3 of these specifications.

6.1.2 In general, the *soil* fill shall be compacted at a moisture content at or above the optimum moisture content as determined by ASTM D 1557.

6.1.3 When the moisture content of *soil* fill is below that specified by the Consultant, water shall be added by the Contractor until the moisture content is in the range specified.

6.1.4 When the moisture content of the *soil* fill is above the range specified by the Consultant or too wet to achieve proper compaction, the *soil* fill shall be aerated by the Contractor by blading/mixing, or other satisfactory methods until the moisture content is within the range specified.

6.1.5 After each layer has been placed, mixed, and spread evenly, it shall be thoroughly compacted by the Contractor to a relative compaction of at least 90 percent. Relative compaction is defined as the ratio (expressed in percent) of the in-place dry density of the compacted fill to the maximum laboratory dry density as determined in accordance with ASTM D 1557. Compaction shall be continuous over the entire area, and compaction equipment shall make sufficient passes so that the specified minimum relative compaction has been achieved throughout the entire fill.

6.1.6 Where practical, soils having an Expansion Index greater than 50 should be placed at least 3 feet below finish pad grade and should be compacted at a moisture content generally 2 to 4 percent greater than the optimum moisture content for the material.

6.1.7 Properly compacted *soil* fill shall extend to the design surface of fill slopes. To achieve proper compaction, it is recommended that fill slopes be over-built by at least 3 feet and then cut to the design grade. This procedure is considered preferable to track-walking of slopes, as described in the following paragraph.

6.1.8 As an alternative to over-building of slopes, slope faces may be back-rolled with a heavy-duty loaded sheepsfoot or vibratory roller at maximum 4-foot fill height intervals. Upon completion, slopes should then be track-walked with a D-8 dozer or similar equipment, such that a dozer track covers all slope surfaces at least twice.

6.2 *Soil-rock* fill, as defined in Paragraph 3.1.2, shall be placed by the Contractor in accordance with the following recommendations:

6.2.1 Rocks larger than 12 inches but less than 4 feet in maximum dimension may be incorporated into the compacted *soil* fill, but shall be limited to the area measured 15 feet minimum horizontally from the slope face and 5 feet below finish grade or 3 feet below the deepest utility, whichever is deeper.

6.2.2 Rocks or rock fragments up to 4 feet in maximum dimension may either be individually placed or placed in windrows. Under certain conditions, rocks or rock fragments up to 10 feet in maximum dimension may be placed using similar methods. The acceptability of placing rock materials greater than 4 feet in maximum dimension shall be evaluated during grading as specific cases arise and shall be approved by the Consultant prior to placement.

6.2.3 For individual placement, sufficient space shall be provided between rocks to allow for passage of compaction equipment.

6.2.4 For windrow placement, the rocks should be placed in trenches excavated in properly compacted *soil* fill. Trenches should be approximately 5 feet wide and 4 feet deep in maximum dimension. The voids around and beneath rocks should be filled with approved granular soil having a Sand Equivalent of 30 or greater and should be compacted by flooding. Windrows may also be placed utilizing an "open-face" method in lieu of the trench procedure, however, this method should first be approved by the Consultant.

6.2.5 Windrows should generally be parallel to each other and may be placed either parallel to or perpendicular to the face of the slope depending on the site geometry. The minimum horizontal spacing for windrows shall be 12 feet center-to-center with a 5-foot stagger or offset from lower courses to next overlying course. The minimum vertical spacing between windrow courses shall be 2 feet from the top of a lower windrow to the bottom of the next higher windrow.

6.2.6 Rock placement, fill placement and flooding of approved granular soil in the windrows should be continuously observed by the Consultant.

6.3 *Rock* fills, as defined in Section 3.1.3, shall be placed by the Contractor in accordance with the following recommendations:

6.3.1 The base of the *rock* fill shall be placed on a sloping surface (minimum slope of 2 percent). The surface shall slope toward suitable subdrainage outlet facilities. The *rock* fills shall be provided with subdrains during construction so that a hydrostatic pressure buildup does not develop. The subdrains shall be permanently connected to controlled drainage facilities to control post-construction infiltration of water.

6.3.2 *Rock* fills shall be placed in lifts not exceeding 3 feet. Placement shall be by rock trucks traversing previously placed lifts and dumping at the edge of the currently placed lift. Spreading of the *rock* fill shall be by dozer to facilitate *seating* of the rock. The *rock* fill shall be watered heavily during placement. Watering shall consist of water trucks traversing in front of the current rock lift face and spraying water continuously during rock placement. Compaction equipment with compactive energy comparable to or greater than that of a 20-ton steel vibratory roller or other compaction equipment providing suitable energy to achieve the required compaction or deflection as recommended in Paragraph 6.3.3 shall be utilized. The number of passes to be made should be determined as described in Paragraph 6.3.3. Once a *rock* fill lift has been covered with *soil* fill, no additional *rock* fill lifts will be permitted over the *soil* fill.

6.3.3 Plate bearing tests, in accordance with ASTM D 1196, may be performed in both the compacted *soil* fill and in the *rock* fill to aid in determining the required minimum number of passes of the compaction equipment. If performed, a minimum of three plate bearing tests should be performed in the properly compacted *soil* fill (minimum relative compaction of 90 percent). Plate bearing tests shall then be performed on areas of *rock* fill having two passes, four passes and six passes of the compaction equipment, respectively. The number of passes required for the *rock* fill shall be determined by comparing the results of the plate bearing tests for the *soil* fill and the *rock* fill and by evaluating the deflection variation with number of passes. The required number of passes of the compaction equipment will be performed as necessary until the plate bearing deflections are equal to or less than that determined for the properly compacted *soil* fill. In no case will the required number of passes be less than two.

6.3.4 A representative of the Consultant should be present during *rock* fill operations to observe that the minimum number of “passes” have been obtained, that water is being properly applied and that specified procedures are being followed. The actual number of plate bearing tests will be determined by the Consultant during grading.

6.3.5 Test pits shall be excavated by the Contractor so that the Consultant can state that, in their opinion, sufficient water is present and that voids between large rocks are properly filled with smaller rock material. In-place density testing will not be required in the *rock* fills.

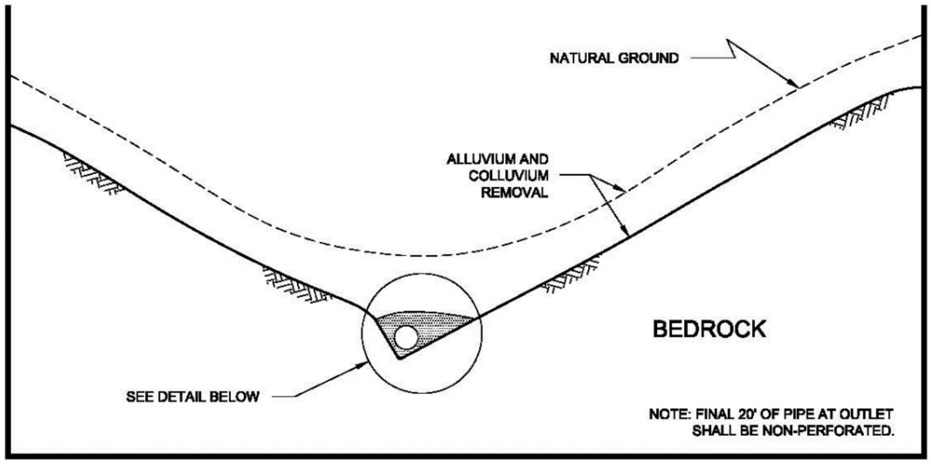
6.3.6 To reduce the potential for “piping” of fines into the *rock* fill from overlying *soil* fill material, a 2-foot layer of graded filter material shall be placed above the uppermost lift of *rock* fill. The need to place graded filter material below the *rock* should be determined by the Consultant prior to commencing grading. The gradation of the graded filter material will be determined at the time the *rock* fill is being excavated. Materials typical of the *rock* fill should be submitted to the Consultant in a timely manner, to allow design of the graded filter prior to the commencement of *rock* fill placement.

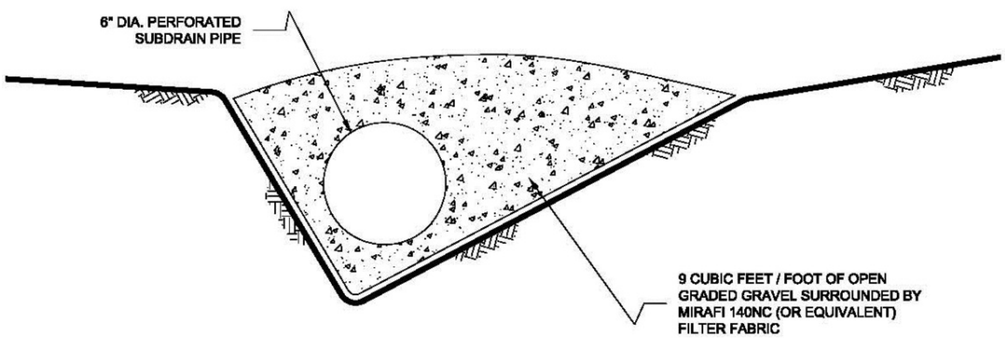
6.3.7 *Rock* fill placement should be continuously observed during placement by the Consultant.

7. SUBDRAINS

7.1 The geologic units on the site may have permeability characteristics and/or fracture systems that could be susceptible under certain conditions to seepage. The use of canyon subdrains may be necessary to mitigate the potential for adverse impacts associated with seepage conditions. Canyon subdrains with lengths in excess of 500 feet or extensions of existing offsite subdrains should use 8-inch-diameter pipes. Canyon subdrains less than 500 feet in length should use 6-inch-diameter pipes.

TYPICAL CANYON DRAIN DETAIL





NOTES:

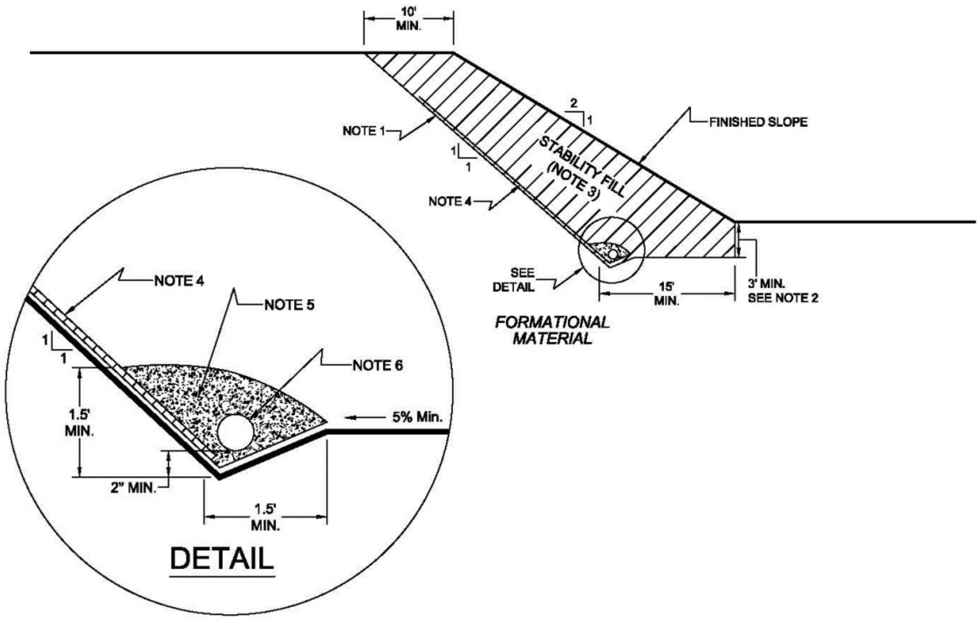
1......6-INCH DIAMETER, SCHEDULE 80 PVC PERFORATED PIPE FOR FILLS IN EXCESS OF 100-FEET IN DEPTH OR A PIPE LENGTH OF LONGER THAN 500 FEET.

2......6-INCH DIAMETER, SCHEDULE 40 PVC PERFORATED PIPE FOR FILLS LESS THAN 100-FEET IN DEPTH OR A PIPE LENGTH SHORTER THAN 500 FEET.

NO SCALE

7.2 Slope drains within stability fill keyways should use 4-inch-diameter (or larger) pipes.

TYPICAL STABILITY FILL DETAIL



NOTES:

1.....EXCAVATE BACKCUT AT 1:1 INCLINATION (UNLESS OTHERWISE NOTED).

2.....BASE OF STABILITY FILL TO BE 3 FEET INTO FORMATIONAL MATERIAL, SLOPING A MINIMUM 5% INTO SLOPE.

3.....STABILITY FILL TO BE COMPOSED OF PROPERLY COMPACTED GRANULAR SOIL.

4.....CHIMNEY DRAINS TO BE APPROVED PREFABRICATED CHIMNEY DRAIN PANELS (MIRADRAIN G200N OR EQUIVALENT) SPACED APPROXIMATELY 20 FEET CENTER TO CENTER AND 4 FEET WIDE. CLOSER SPACING MAY BE REQUIRED IF SEEPAGE IS ENCOUNTERED.

5.....FILTER MATERIAL TO BE 3/4-INCH, OPEN-GRADED CRUSHED ROCK ENCLOSED IN APPROVED FILTER FABRIC (MIRAFI 140NC).

6.....COLLECTOR PIPE TO BE 4-INCH MINIMUM DIAMETER, PERFORATED, THICK-WALLED PVC SCHEDULE 40 OR EQUIVALENT, AND SLOPED TO DRAIN AT 1 PERCENT MINIMUM TO APPROVED OUTLET.

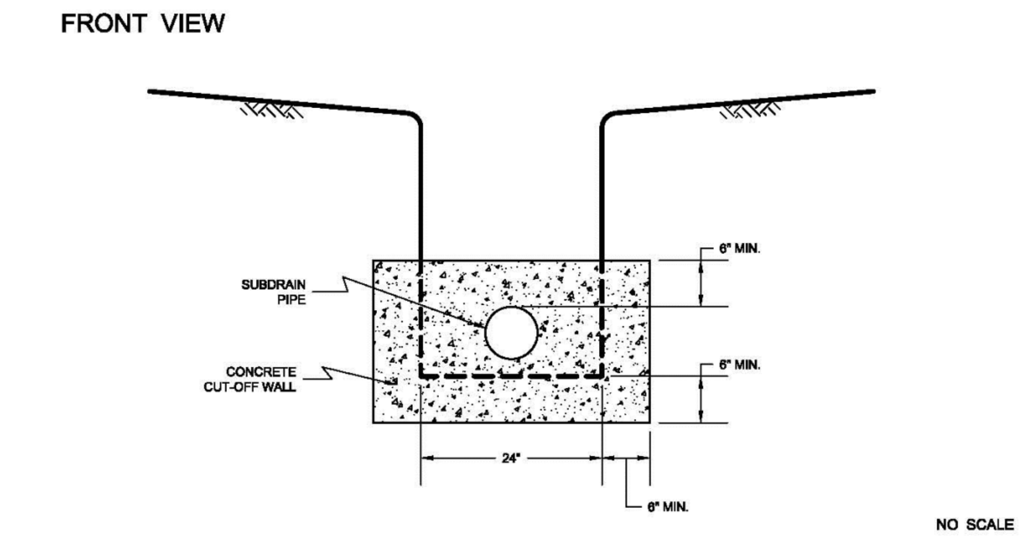
NO SCALE

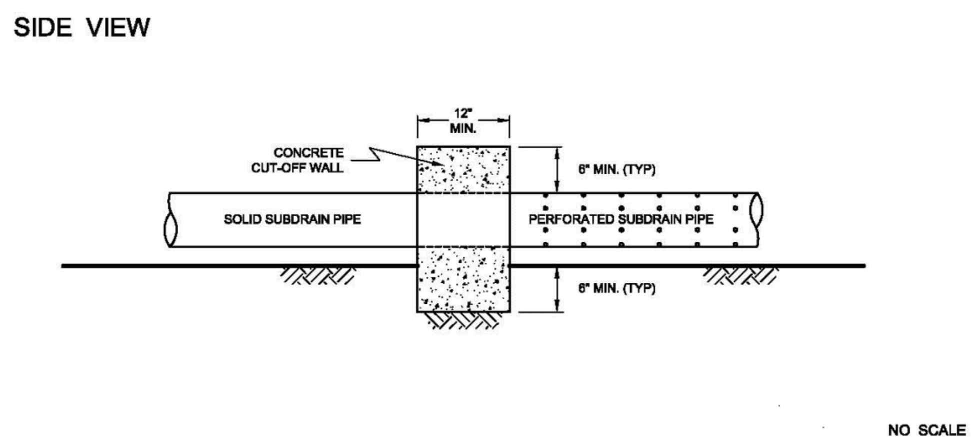
7.3 The actual subdrain locations will be evaluated in the field during the remedial grading operations. Additional drains may be necessary depending on the conditions observed and the requirements of the local regulatory agencies. Appropriate subdrain outlets should be evaluated prior to finalizing 40-scale grading plans.

7.4 *Rock* fill or *soil-rock* fill areas may require subdrains along their down-slope perimeters to mitigate the potential for buildup of water from construction or landscape irrigation. The subdrains should be at least 6-inch-diameter pipes encapsulated in gravel and filter fabric. *Rock* fill drains should be constructed using the same requirements as canyon subdrains.

7.5 Prior to outletting, the final 20-foot segment of a subdrain that will not be extended during future development should consist of non-perforated drainpipe. At the non-perforated/ perforated interface, a seepage cutoff wall should be constructed on the downslope side of the pipe.

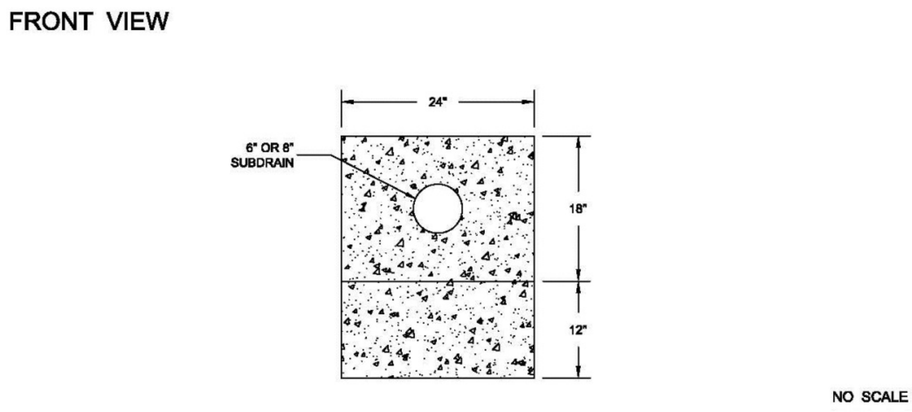
TYPICAL CUT OFF WALL DETAIL

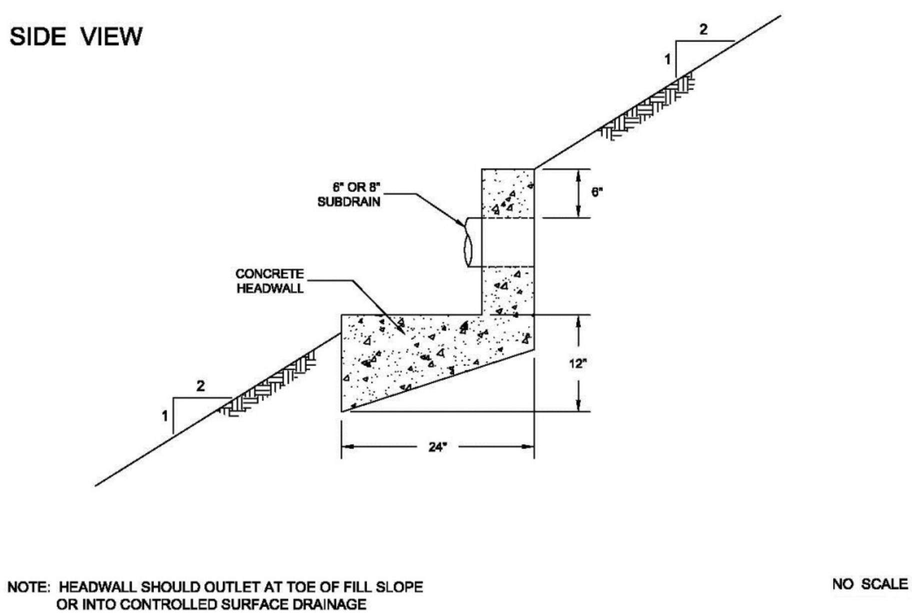




7.6 Subdrains that discharge into a natural drainage course or open space area should be provided with a permanent headwall structure.

TYPICAL HEADWALL DETAIL





7.7 The final grading plans should show the location of the proposed subdrains. After completion of remedial excavations and subdrain installation, the project civil engineer should survey the drain locations and prepare an "as-built" map showing the drain locations. The final outlet and connection locations should be determined during grading operations. Subdrains that will be extended on adjacent projects after grading can be placed on formational material and a vertical riser should be placed at the end of the subdrain. The grading contractor should consider videoing the subdrains shortly after burial to check proper installation and functionality. The contractor is responsible for the performance of the drains.

8. OBSERVATION AND TESTING

8.1 The Consultant shall be the Owner's representative to observe and perform tests during clearing, grubbing, filling, and compaction operations. In general, no more than 2 feet in vertical elevation of *soil* or *soil-rock* fill should be placed without at least one field density test being performed within that interval. In addition, a minimum of one field density test should be performed for every 2,000 cubic yards of *soil* or *soil-rock* fill placed and compacted.

8.2 The Consultant should perform a sufficient distribution of field density tests of the compacted *soil* or *soil-rock* fill to provide a basis for expressing an opinion whether the fill material is compacted as specified. Density tests shall be performed in the compacted materials below any disturbed surface. When these tests indicate that the density of any layer of fill or portion thereof is below that specified, the particular layer or areas represented by the test shall be reworked until the specified density has been achieved.

8.3 During placement of *rock* fill, the Consultant should observe that the minimum number of passes have been obtained per the criteria discussed in Section 6.3.3. The Consultant should request the excavation of observation pits and may perform plate bearing tests on the placed *rock* fills. The observation pits will be excavated to provide a basis for expressing an opinion as to whether the *rock* fill is properly seated and sufficient moisture has been applied to the material. When observations indicate that a layer of *rock* fill or any portion thereof is below that specified, the affected layer or area shall be reworked until the *rock* fill has been adequately seated and sufficient moisture applied.

8.4 A settlement monitoring program designed by the Consultant may be conducted in areas of *rock* fill placement. The specific design of the monitoring program shall be as recommended in the Conclusions and Recommendations section of the project Geotechnical Report or in the final report of testing and observation services performed during grading.

8.5 We should observe the placement of subdrains, to check that the drainage devices have been placed and constructed in substantial conformance with project specifications.

8.6 Testing procedures shall conform to the following Standards as appropriate:

8.6.1 Soil and Soil-Rock Fills:

8.6.1.1 Field Density Test, ASTM D 1556, *Density of Soil In-Place By the Sand-Cone Method.*

8.6.1.2 Field Density Test, Nuclear Method, ASTM D 6938, *Density of Soil and Soil-Aggregate In-Place by Nuclear Methods (Shallow Depth).*

8.6.1.3 Laboratory Compaction Test, ASTM D 1557, *Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-Pound Hammer and 18-Inch Drop*.

8.6.1.4. Expansion Index Test, ASTM D 4829, *Expansion Index Test*.

9. PROTECTION OF WORK

9.1 During construction, the Contractor shall properly grade all excavated surfaces to provide positive drainage and prevent ponding of water. Drainage of surface water shall be controlled to avoid damage to adjoining properties or to finished work on the site. The Contractor shall take remedial measures to prevent erosion of freshly graded areas until such time as permanent drainage and erosion control features have been installed. Areas subjected to erosion or sedimentation shall be properly prepared in accordance with the Specifications prior to placing additional fill or structures.

9.2 After completion of grading as observed and tested by the Consultant, no further excavation or filling shall be conducted except in conjunction with the services of the Consultant.

10. CERTIFICATIONS AND FINAL REPORTS

10.1 Upon completion of the work, Contractor shall furnish Owner a certification by the Civil Engineer stating that the lots and/or building pads are graded to within 0.1 foot vertically of elevations shown on the grading plan and that all tops and toes of slopes are within 0.5 foot horizontally of the positions shown on the grading plans. After installation of a section of subdrain, the project Civil Engineer should survey its location and prepare an *as-built* plan of the subdrain location. The project Civil Engineer should verify the proper outlet for the subdrains and the Contractor should ensure that the drain system is free of obstructions.

10.2 The Owner is responsible for furnishing a final as-graded soil and geologic report satisfactory to the appropriate governing or accepting agencies. The as-graded report should be prepared and signed by a California licensed Civil Engineer experienced in geotechnical engineering and by a California Certified Engineering Geologist, indicating that the geotechnical aspects of the grading were performed in substantial conformance with the Specifications or approved changes to the Specifications.