Appendix 9
Hydrology and Water Quality Reports

SOUTH MILLIKEN DISTRIBUTION CENTER

Project No. PLN17-20013

INITIAL STUDY

Preliminary Drainage Report
of
South Milliken Distribution Center
City of Eastvale

Prepared for:
Newcastle Partners, Inc.
4740 Green River Road, Suite 118
Corona, CA 92880

Original: August 24, 2017
Revised: October 16, 2017

Prepared by:

Tory Walker, PE, CFM, LEED GA
R.C.E. 45005

TORY R. WALKER ENGINEERING
RELIABLE SOLUTIONS IN WATER RESOURCES
122 CIVIC CENTER DR, STE 206, VISTA, CA 92084 · 760-414-9212

TABLE OF CONTENTS

CHAPTER 1 - BACKGROUND

1.1 – Introduction

The purpose of this report is to summarize the hydrologic and hydraulic analyses of the proposed South Milliken Distribution Center (SMDC) project. This report is prepared in conjunction with precise grading plans for the SMDC project. The project site is located on the east side of South Milliken Avenue, north of Highway 60, in the City of Eastvale, CA. This study analyzes the following:

1. the on-site proposed storm drain system;
2. the on-site 100-year peak flow for sizing purposes and water surface check at basins;
3. the condition of the existing storm drain system south of the project site;
4. the on-site proposed bypass storm drain system

1.2 – Summary of Existing Conditions

The existing site is comprised of two parcels (APNs 156-030-001 and 156-030-002). The site is currently undeveloped with little to no vegetative cover. The total drainage area of the project site is approximately 15 acres with Hydrologic Soil Group Type A soils (according to NRCS Web Soil Survey).

The site generally discharges overland to the south and southwest where flows pond up and cascade into the existing City of Eastvale concrete channel along the site's southern boundary. The surface discharges into the channel at two points: (1) along the northwestern side of the channel terminus (just before the system transitions into the Caltrans triple box culvert undercrossing Freeway 60), and (2) along the southeastern elbow (where the channel changes bearing from south to northwest). Therefore, the offsite storm drain capacity was assessed.

1.2.1 Offsite Storm Drain

Despite its relatively short reach along the project's southern boundary, the existing offsite storm drain system varies significantly with regards to its age, size, and ownership. For the purposes of the SMDC drainage analysis, the offsite storm drain system will be defined as the portions of offsite storm drain either affecting or affected by SMDC. Based on our analysis, the offsite storm drain therefore ranges from the upstream end of the existing reinforced concrete open channel to its abrupt downstream transition into the Caltrans-owned 4-foot-wide by 2.2-foot-deep triple reinforced concrete box (RCB) culvert.

The concrete channel was built in the early 1990s (before the incorporation of the City of Eastvale) to hydraulically connect the Mira Loma Assembly Hall of Jehovah's Witnesses (eastern adjacent property) to the pre-existing Caltrans triple RCB culvert (undercrossing Freeway 60; likely constructed with Freeway 60). The original storm drain plans show that the total discharge at the upstream invert of the Caltrans culvert was 143.3 cfs at the time of construction: 72.1 cfs directly discharged from the Assembly Hall 48-inch diameter RCP plus an additional total 71.2 cfs cascaded into the open channel (over its length) from the adjacent tributary area (details per County of Riverside Drawing 901-PP, provided in Appendix 7).

Furthermore, the original storm drain plans show that culvert entrance loss due to the total discharge (143.3 cfs) resulted in 2.4 ponded feet within the downstream end of the channel. At that time, the resulting ponded water surface elevation was 806.1 feet, which would have produced some surface ponding along the downstream end of the existing concrete channel, southern portions of the existing SMDC project site, and some portions of the unimproved northern shoulder of the CA-60 NW off ramp. Using the original storm drain plan hydraulic data with FHWA HDS No. 5, Chart 9B (Headwater Depth for Inlet Control Rectangular Box Culverts, provided in Appendix 5), the headwater depth is 2.6 feet. Therefore, at the time of construction, the ponded depth shown on the storm drain plans (2.4 feet) was very likely determined using this chart (or similar). Based on this information, we can reasonably conclude that the Caltrans triple box culvert was not designed to openly convey flows from even its partially developed tributary; it is expected that ponding will continue unless the Caltrans culvert is upsized.

In 2003, the Eastvale Master Plan of Drainage (MPD) Line E-2, Stage 4 was built (RCFC&WCD Drawing No. 2-332, provided in Appendix 8), which begins at the downstream end of the undersized Caltrans triple box culvert. The design flow rate used at the MPD Line E-2 system headworks was 235 cfs, which accounted for the full build-out condition of the same 125-acre tributary drainage area. As the SMDC project is the final remaining developable parcel within the tributary drainage area, it is reasonable to conservatively assume that 235 cfs will be discharged into the triple box culvert upon its development. Using the same FWHA Chart 9B from above, the build-out condition peak flow (235 cfs) would increase the culvert headwater depth from 2.6 feet to 3.8 feet; this would increase the ponded water surface from 806.1 feet to 807.3 feet. When the build-out water surface elevation is superimposed over recent aerial topography, the resulting inundation would cover existing concrete channel, the project's proposed southwest infiltration basins, some portions of the adjacent on-site parking, and some portions of the unimproved northern shoulder of the CA-60 NW off ramp (see Appendix 6 for a visual representation of the ponded water depth).

Therefore, since: (1) the existing Caltrans triple box culvert has always been undersized, (2) the culvert headwater depth induced by the build-out peak flow rate would only marginally increase the historical ponding conditions due to the culvert's inlet control condition, and (3) projected inundation areas are limited, localized, and do not include the street right-of-way, nor other areas that compromise public health, safety, welfare, or private property, then any potential increase in 100-year peak flow due to SMDC is negligible.

1.2.2 Offsite Run-On

The northern adjacent property contributes run-on to SMDC from some combination of the following two sources: (1) the undeveloped 1.5 acres surrounding the existing Southern California Edison transmission tower, and (2) retention basin overflow—in circumstances when the basin capacity is exceeded. After inquiring with RCFC&WCD, the County of Riverside, and the City of Eastvale, basin details were rendered unobtainable. Therefore, we evaluated the available storm drain plans described in Section 1.2.1 to determine a conservative 100-year peak flow run-on estimate.

As discussed in Section 1.2.1, the build-out 100-year peak flow for the 125-acre tributary drainage area was determined to be 235 cfs per the Eastvale MPD. Using the build-out peak flow, we backed into a run-on estimate. The estimated peak flow was determined to be 45 cfs. The breakdown is provided in Table 1:

TABLE 1 – Peak Flow Run-On Estimate

Source(s)	**Acres**	**Impervious (%)**	**Q_{100} (cfs)**
SMDC[1]	15	83	43
Mira Loma Assembly Hall, E. Mission Boulevard, Cornerstone Drive, Corridor Drive & Warehouses[2]	50	90	125
I-15 South to CA-60 West Interchange[3]	15	25	22
Subtotal	**80**	**77**	**190**
J.W. Mitchell Building & SCE Easement	*45*	*90*	*45*
Total	***125***	***81***	***235***

[1] See Section 2.2 for peak flow determination.

[2] Aerial imagery and topographic review indicates all named sources discharge to offsite storm drain; peak flow estimated at 2.5 cfs per acre.

[3] Runoff intercepted by inlets along northern shoulder, discharges westerly along Caltrans right-of-way and into southeast channel elbow; peak flows estimated at 1.5 cfs per acre.

Further investigation was warranted to validate the 45 cfs estimate. Historical aerial imagery review shows that the retention basin was constructed during the development of the northern property. To assess the storage of the basin, we reviewed the offsite topographical information and determined that the retention basin can accommodate up to 7 acre-feet of storage. We estimated the incremental volume increase due to development of the northern property using the Riverside County Hydrology Manual's Short Cut Runoff Hydrograph. Refer to Appendix 9 for Short Cut Runoff Hydrograph data. The Short Cut Runoff Hydrograph results are summarized in Table 2:

TABLE 2 – Peak Flow Run-On Estimate

Storm	Pre-Developed Volume (ac-ft)	Post-Developed Volume (ac-ft)	Incremental Increase (ac-ft)
100-yr, 24-hour	9.90	13.51	3.61
100-yr, 6-hour	7.80	9.94	2.14
100-yr, 3-hour	5.60	6.69	1.09
100-yr, 1-hour	3.75	4.12	0.37

We found that the basin was sized to retain the incremental increase from the 100-year, 24-hour, 6-hour, 3-hour, and 1-hour storms. Therefore, since the site discharges to a retention basin adequately sized to store the incremental increase in runoff volume due to land development, it is reasonable to conclude that the site was designed to maintain the pre-developed peak flow. A reasonable conservative peak flow estimate for an undeveloped, mildly sloping site with favorable infiltration may be taken as 1 cfs per acre. Therefore, the peak flow run-on estimated at 45 cfs is warranted by multiple lines of evidence.

1.3 – Summary of Proposed Conditions

The proposed development project includes one large industrial building, parking, and landscaped areas. The project site will be divided into two major drainage areas. Each drainage area consists of rooftop, paved surfaces, and landscaped areas. Each drainage area presents the same general drainage characteristics: rooftop and downspouts, paved sheet flow, ribbon drains (sloped at roughly 1%), catch basins, and low impact development (LID) infiltration basins. The site drains to the LID basins via ribbon gutter and storm drain. The catch basins will intercept sheet and shallow ribbon gutter flow and tie into the private on-site storm drain system. The private storm drain system will discharge flows into low impact development (LID) infiltration basins. The basins each feature an overflow spillway with emergency positive overflow to convey peak flows in excess of the water quality design to the same discharge points as in the existing condition.

1.3.1 Offsite Run-On Bypass System

As discussed in Section 1.2.2, run-on from the northern property will be routed through an on-site bypass storm drain system. Run-on will enter into the bypass system through a headwall along the site’s northern boundary and into a 30-inch diameter pipe. At the downstream end, the system will be controlled by a “bubble up” structure. The bubble up structure will consist of a concrete box structure with a southerly facing, sharp-crested rectangular weir designed to discharge up to 45 cfs when sufficient elevation head is provided at the system headworks. To discharge low flows, the bubble up structure will be outfitted with a sump pump to discharge flows to the existing ground surface. In either case, flows will be discharged over the existing ground surface and spill over into the offsite concrete channel as they do in the existing condition. Energy dissipation (rip rap or similar) will be installed from the bubble up structure to the channel edge to mitigate potential increased flow velocity.

Based on a water surface pressure gradient (WSPG) analysis and culvert design with inlet control, we determined that a 30-inch diameter pipe will adequately convey the offsite the 100-year peak flow. Refer to Appendix 5 for further details.

CHAPTER 2 – HYDROLOGIC ANALYSIS

2.1 – Methodology

Methodology used for the computation of storm runoff is consistent with criteria set forth in the Riverside County Flood Control and Water Conservation District (RCFC&WCD) Hydrology Manual. Advanced Engineering Software (AES) was used for computing hydrologic calculations, which integrates the RCFC&WCD methodology and standards.

2.1.1 Design Storms

Two design storms were analyzed using the Rational Method from Section D of the RCFC&WCD Hydrology Manual. Those storms included:

- 10-year
- 100-year

2.1.2 Rational Method

The Rational Method, as described in the RCFC&WCD Hydrology Manual, was used to generate peak flows for this project. The Rational Method is an appropriate methodology because of the drainage area size. The Rational Method inputs include the land cover type, flow length, elevation, and drainage area.

2.2 – Proposed Condition Hydrology Approach and Results

2.2.1 Soil Type and Land Cover

The project site predominantly consists of Soil Type A. The land cover consists of rooftop, paved parking, and landscaping. Runoff coefficient C-values were assigned based on the combinations of land cover, paved, and building surfaces.

2.2.2 Peak Flow Determination

The Rational Method was used to analyze the 10-year and 100-year storm for the proposed condition. Post-developed peak flows were computed by AES Rational Method software for Riverside County and are presented in Table 3. The attenuation effects of each proposed on-lot water quality infiltration basin, which will attenuate the post-developed peak flows, were not considered; therefore, the peak flow rates are conservative. Supporting calculations are provided in Appendix 3.

TABLE 3 – Proposed Condition Peak Flows

Drainage Area	Drainage Area (ac)	Node ID	10-Year Peak Flow (cfs)	100-Year Peak Flow (cfs)
1	8.2	106	14.2	22.4
2	6.5	205	13.2	20.3

The peak flows in Table 3 were used to analyze the overflow riser capabilities in each basin (see Section 3.3 for further information).

CHAPTER 3 – HYDRAULIC ANALYSIS

3.1 – On-Site Storm Drain Hydraulic Analysis

For pipe hydraulic calculations, the 10-year storm peak flows are used, as the four sump inlets (6 inlets total) all have positive overflow for Q100. Pipes were assumed to be either PVC or HDPE (roughness coefficient *n* = 0.011). Advanced Engineering Software (AES) Hydrosoft Hydraulic Elements I (HELE I) software was used to calculate pipe normal depths. Our analysis demonstrates that the majority of pipes flow open-channel, with reaches 8 and 9 slightly under pressure. All pipe reaches/inlets have positive emergency 100-year overflow.

TABLE 4 – On-Site Storm Drain Summary

Reach	Diameter (in)	Q_{10} (cfs)	Slope (%)	Normal Depth (ft)
1	12	0.93	0.50	0.39
2 &3	15	5.0	0.50	0.95
4	15	6.0	0.60	1.04
5	8	1.0	2.0	0.33
6	15	7.6	1.56	0.85
7	18	7.6	0.5	1.08
8	12	1.0	10	0.29
9	18	5.9	0.25	1.17
10	15	6.1	1.12	0.81

3.2 – On-Site Storm Drain Inlet Analysis

Inlet capacities were checked at the seven project inlet locations using Hydraflow Express Extension for Autodesk AutoCAD Civil 3D software. The analysis provides the sizing information using either sump or flow-by analysis. Software output is provided in Appendix 3.

3.3 – LID Basin Overflow Characteristics

Each LID infiltration basin will feature controlled overflow with emergency positive overflow to convey peak flows in excess of the water quality design. Each controlled overflow location will convey flows to the same discharge points as in the existing condition.

Each controlled overflow location was analyzed to determine the conveyance capacity. The analysis assumed each overflow location functioned a broad-crested weir, where:

$$Q = CLH^{3/2}$$

At Node 106, the overflow length was taken as the 25.5 foot long segment along elevation 806 at the western corner of the western-most basin. At Node 205, the overflow length was taken as the 55 foot long "zero curb" along elevation 809 at the western edge of the western-most parking space, just north of the southern-most basin. The results are summarized in Table 5.

TABLE 5 – Basin Overflow Riser Summary

Node ID	100-Year Peak Flow (cfs)	Full Conveyance Flow Depth (ft)	Basin WS Elevation (ft)	Finished Floor Elevation (ft)
106	22.4	0.43	806.43	812.36
205	20.3	0.24	809.32	812.36

The overflow analysis demonstrates that each basin can completely convey the 100-year peak flow over the spillways without causing flooding to the adjacent structure finished floor elevation.

CHAPTER 4 – CONCLUSION

This study demonstrates that SDMC will:

1. Adequately convey peak flows through the on-site storm drain systems to the proposed basins;
2. Adequately convey the 100-year peak flow through the basin overflow spillways and into the offsite storm drain system;
3. Adequately isolate and bypass run-on through the project site and discharge it at its existing, historic point of discharge;
4. Adequately convey the 100-year peak flow into the offsite storm drain system without flooding onsite structures or exacerbating offsite ponding due to pre-existing drainage deficiencies.

REFERENCES

Riverside County Flood Control and Water Conservation District, *Hydrology Manual,* April 1978.

APPENDIX 1

Site Maps

- Hydrology Map
- Pipeflow Exhibit

DEVELOPED CONDITIONS HYDROLOGY MAP

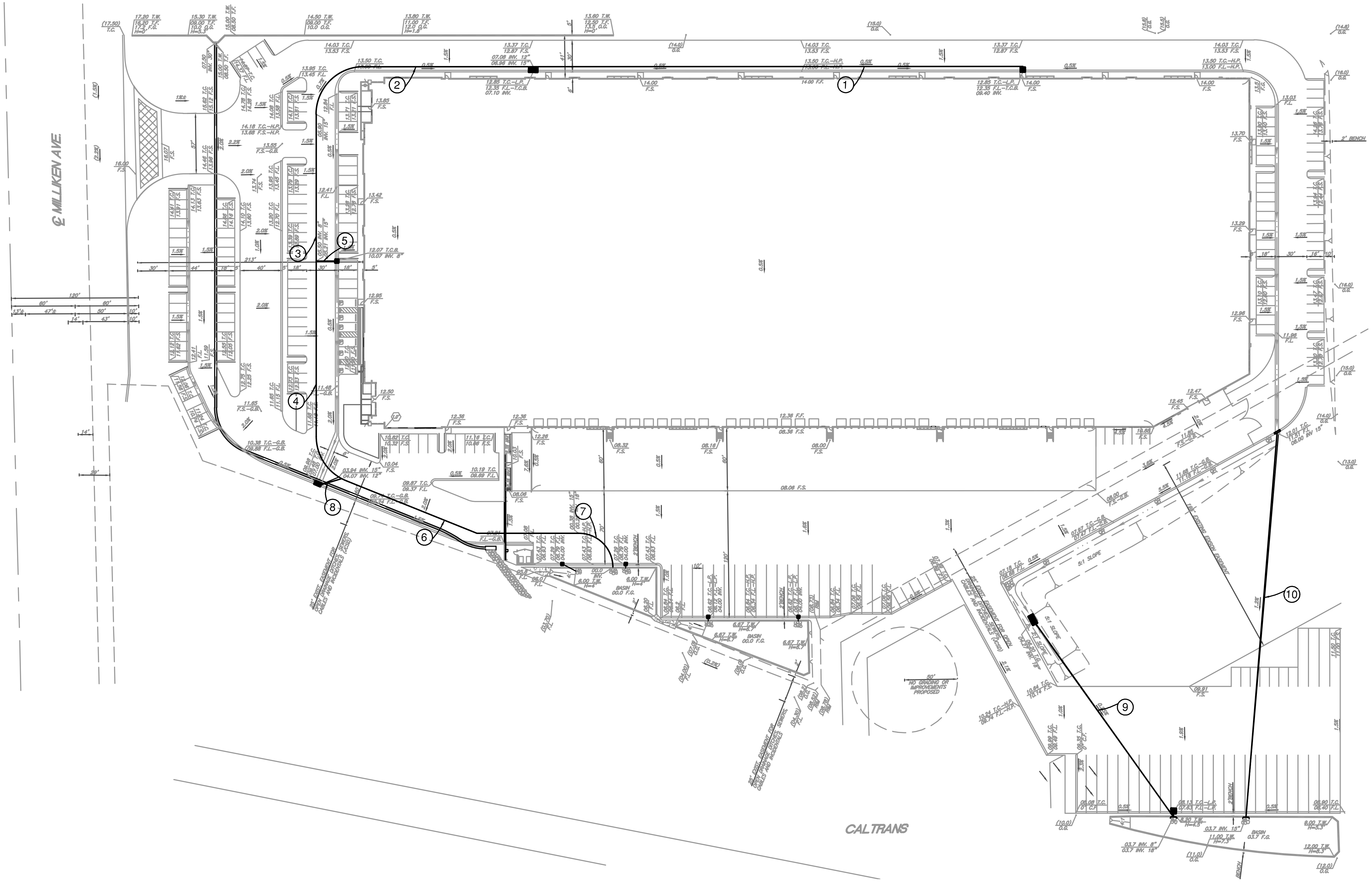
SOUTH MILLIKEN DISTRIBUTION CENTER

LEGEND

SUBAREA BASIN BOUNDARY	━━━━━━
EXISTING STORM DRAIN	=========
PROPOSED STORM DRAIN	══════
SPILLWAY	──────
DIRECTION OF FLOW	⟿ →
NODE	147.0
AREA (AC)	0.36

TORY R. WALKER ENGINEERING
RELIABLE SOLUTIONS IN WATER RESOURCES
122 CIVIC CENTER DR, STE 206, VISTA, CA 92084 · 760-414-9212

Date: August 23, 2017
Revised: October 16, 2017



PIPEFLOW EXHIBIT
SOUTH MILLIKEN
DISTRIBUTION CENTER

N

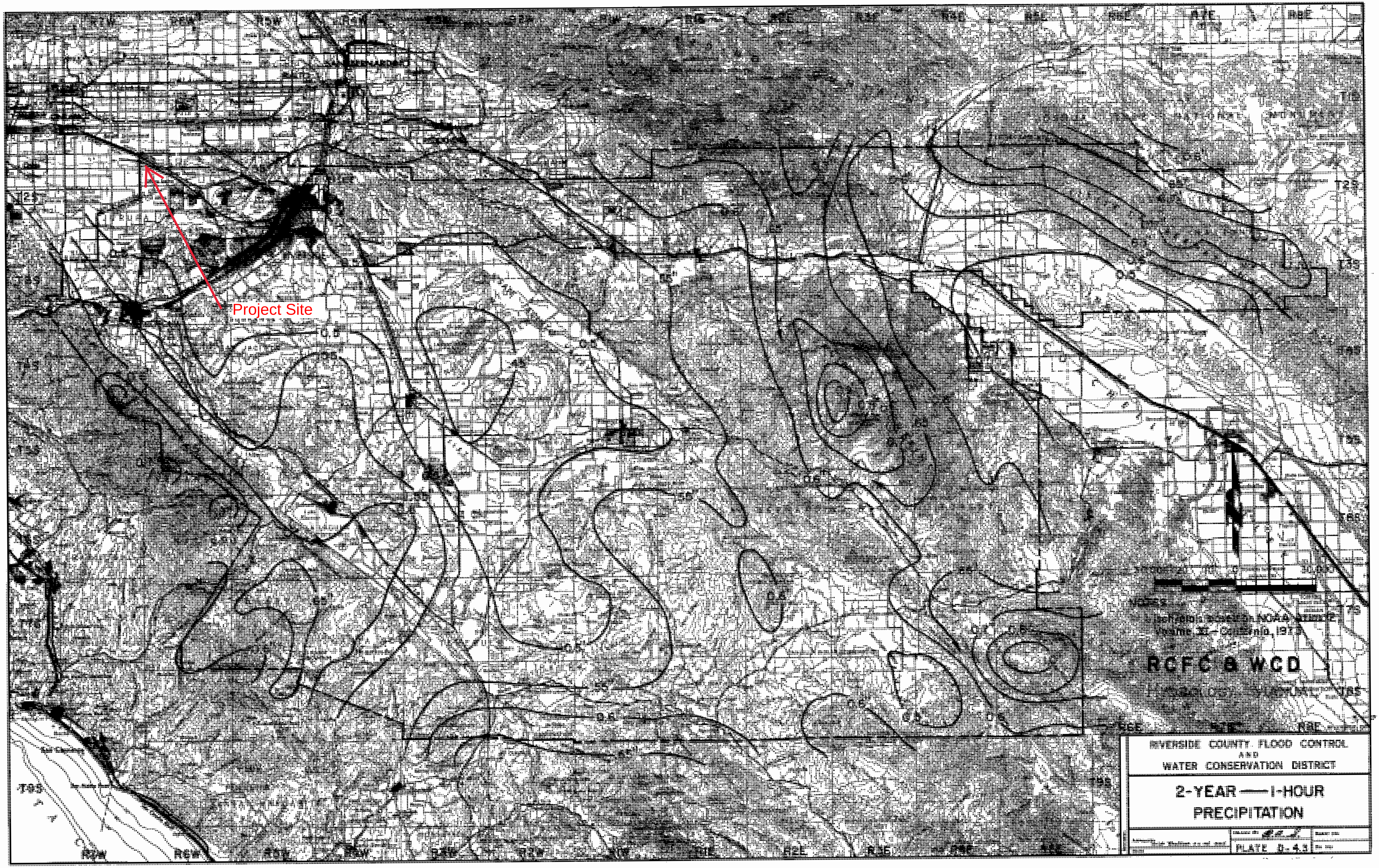
1"=50'

Date: October 16, 2017

TORY R. WALKER ENGINEERING
RELIABLE SOLUTIONS IN WATER RESOURCES
122 CIVIC CENTER DR, STE 206, VISTA, CA 92084 · 760-414-9212

APPENDIX 2

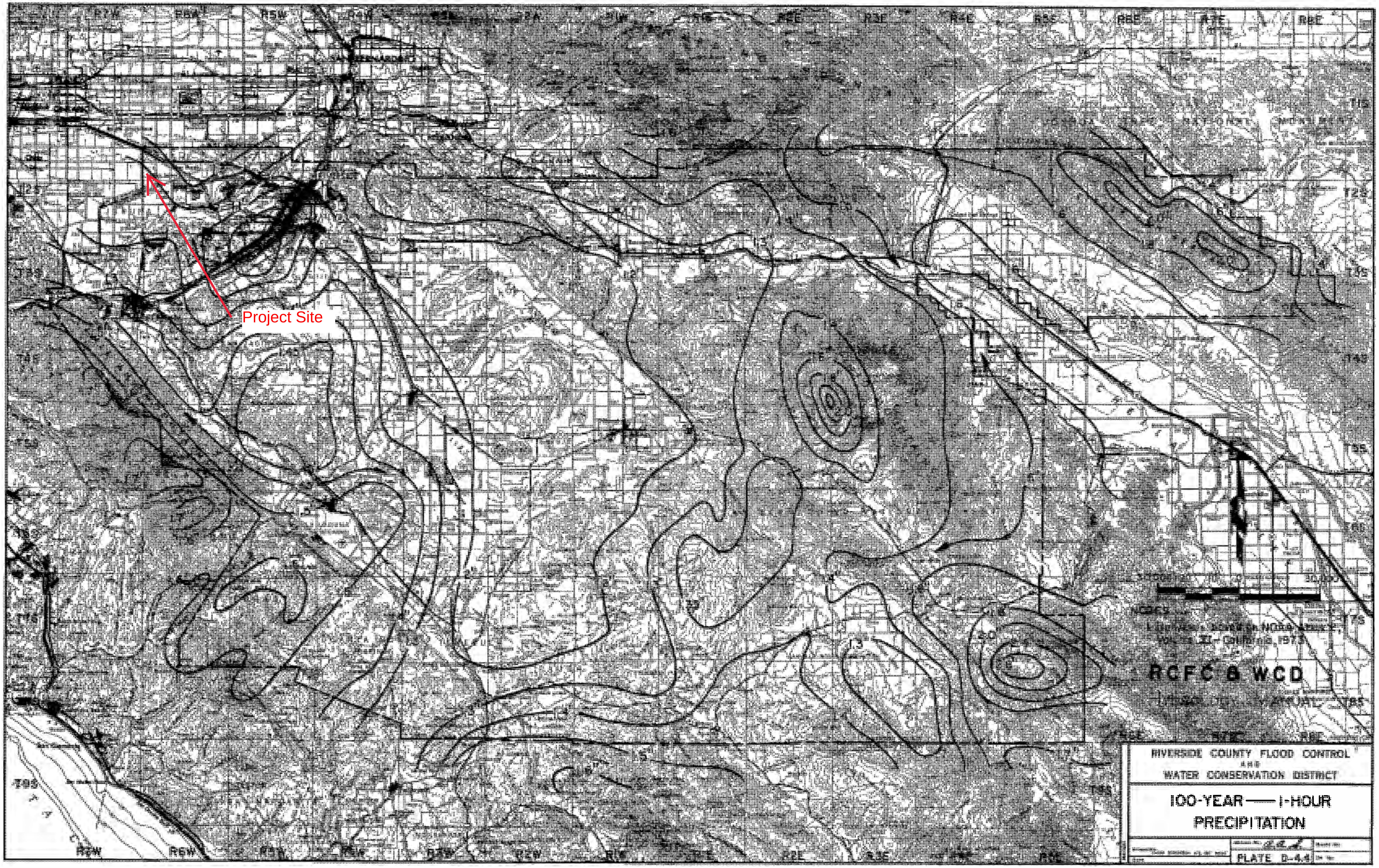
RCFC&WCD Hydrology Manual Charts

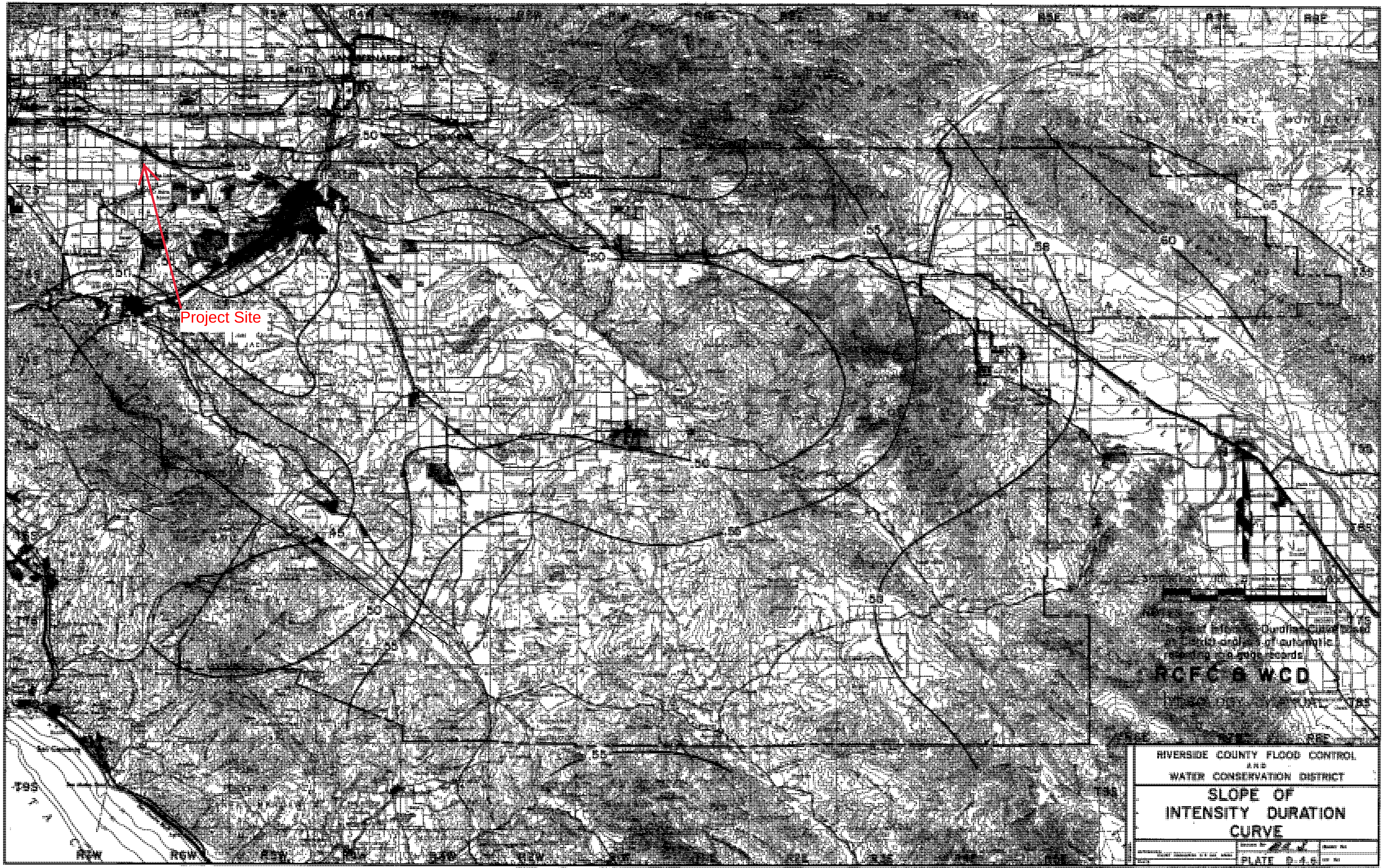


RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

2-YEAR —— 1-HOUR
PRECIPITATION

PLATE D-4.3

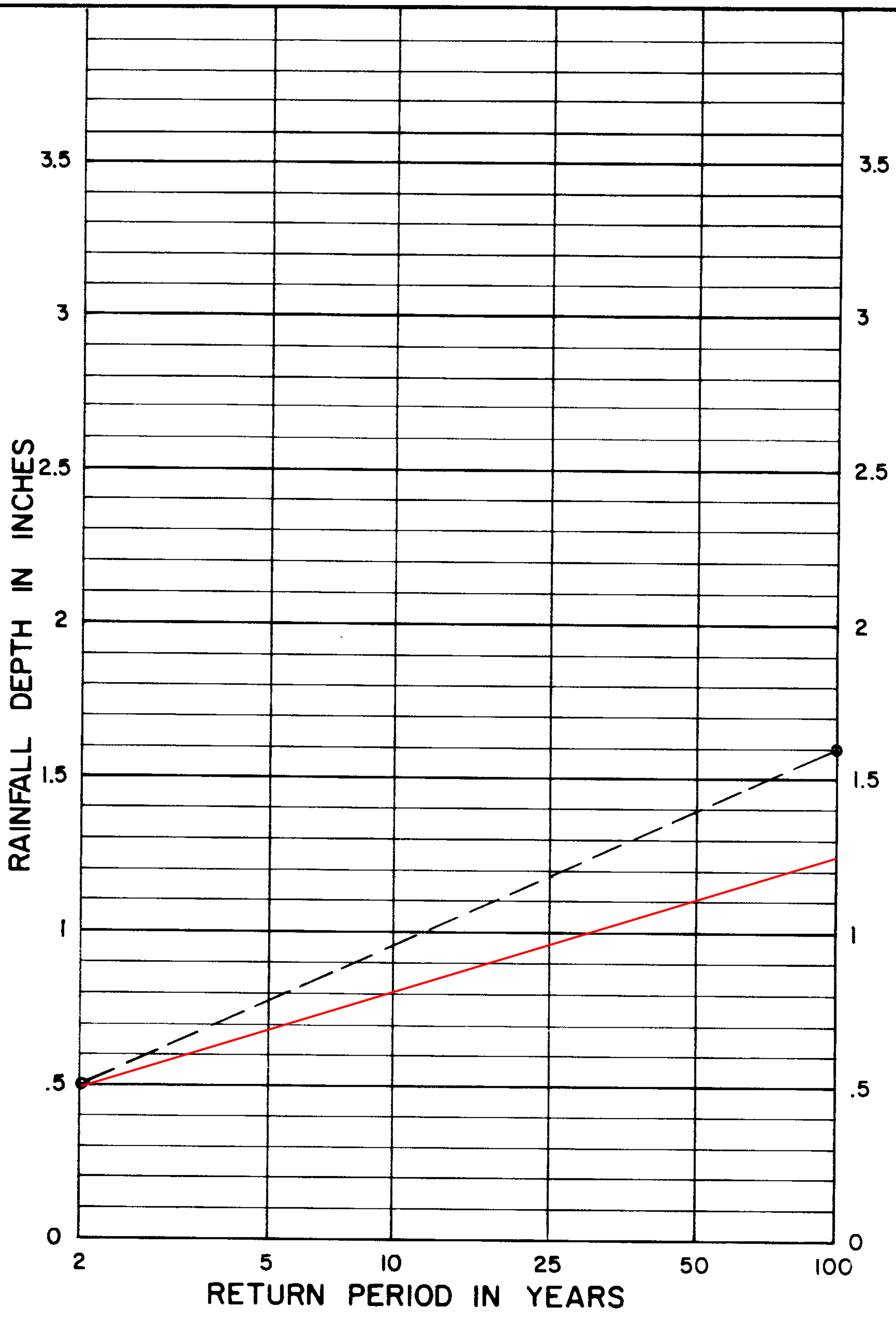
Project Site
RCFC & WCD
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT
100-YEAR —— 1-HOUR
PRECIPITATION
PLATE D-4.4
R7W
R6W
R5W
R4W
R3W
R1W
R1E
R2E
R3E
R4E
R5E
R6E
R7E
R8E
T1S
T2S
T3S
T4S
T5S
T6S
T7S
T8S
SAN BERNARDINO



RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

SLOPE OF
INTENSITY DURATION
CURVE

PLATE D-4.6



NOTE:

1. For intermediate return periods plot 2-year and 100-year one hour values from maps, then connect points and read value for desired return period. For example given 2-year one hour = .50" and 100-year one hour = 1.60", 25-year one hour = 1.18"

Reference: NOAA Atlas 2, Volume XI-California, 1973.

RCFC & WCD

HYDROLOGY MANUAL

RAINFALL DEPTH VERSUS RETURN PERIOD FOR PARTIAL DURATION SERIES

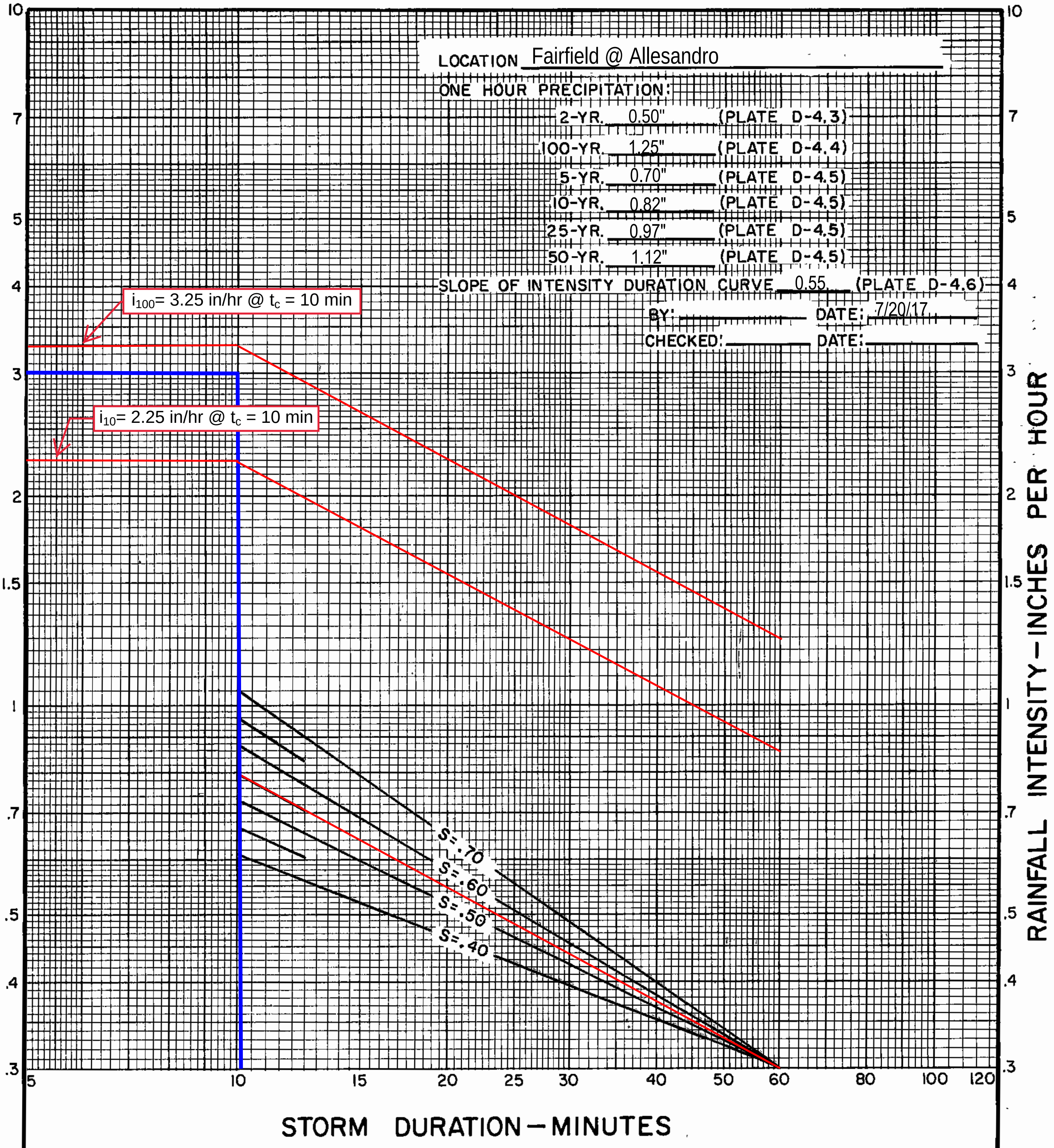
LOCATION Fairfield @ Allesandro

ONE HOUR PRECIPITATION:

2-YR. 0.50" (PLATE D-4.3)
100-YR. 1.25" (PLATE D-4.4)
5-YR. 0.70" (PLATE D-4.5)
10-YR. 0.82" (PLATE D-4.5)
25-YR. 0.97" (PLATE D-4.5)
50-YR. 1.12" (PLATE D-4.5)

SLOPE OF INTENSITY DURATION CURVE 0.55 (PLATE D-4.6)

BY: DATE: 7/20/17
CHECKED: DATE:



i_{100}= 3.25 in/hr @ t_c = 10 min

i_{10}= 2.25 in/hr @ t_c = 10 min

RCFC & WCD
Hydrology Manual

INTENSITY—DURATION CURVES CALCULATION SHEET

APPENDIX 3

Rational Method Hydrology Calculations

```
____________________________________________________________________________
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                    (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-2007 Advanced Engineering Software (aes)
                    (Rational Tabling Version 7.0D)
                 Release Date: 06/01/2007  License ID 1532

                         Analysis prepared by:

                       Tory R Walker Engineering



 ************************** DESCRIPTION OF STUDY **************************
 * EASTVALE - INDUSTRIAL PROJECT @ 3100 MILLIKEN                            *
 * RATIONAL METHOD  - 10-YEAR                                               *
 * SYSTEM 100 - WEST BASINS                                                 *
 **************************************************************************
  FILE NAME: EV1-10.DAT
  TIME/DATE OF STUDY: 14:03 07/20/2017
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.500
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.250
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   10.00   1-HOUR INTENSITY(INCH/HOUR) =   0.817
  SLOPE OF INTENSITY DURATION CURVE = 0.5500
  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   19.0     10.0    0.015/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

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

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     13.60
  DOWNSTREAM ELEVATION(FEET) =     13.00
  ELEVATION DIFFERENCE(FEET) =      0.60
  TC = 0.303*[(  120.00**3)/(     0.60)]**.2 =    5.936
```

```
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.915
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8000
  SUBAREA RUNOFF(CFS) =      0.26
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.26

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   13.00  DOWNSTREAM ELEVATION(FEET) =   12.40
  STREET LENGTH(FEET) =   140.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.030
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.030

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.030
  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) =       0.59
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.26
    HALFSTREET FLOOD WIDTH(FEET) =    4.85
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.29
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.33
  STREET FLOW TRAVEL TIME(MIN.) =   1.82   Tc(MIN.) =    7.75
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.517
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8300
  SUBAREA AREA(ACRES) =    0.32      SUBAREA RUNOFF(CFS) =    0.67
  TOTAL AREA(ACRES) =        0.4       PEAK FLOW RATE(CFS) =       0.93

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.29   HALFSTREET FLOOD WIDTH(FEET) =   6.05
  FLOW VELOCITY(FEET/SEC.) =  1.41   DEPTH*VELOCITY(FT*FT/SEC.) =   0.41
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     260.00 FEET.
****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     9.40  DOWNSTREAM(FEET) =     7.10
  FLOW LENGTH(FEET) =   460.00   MANNING'S N =  0.011
  ESTIMATED PIPE DIAMETER(INCH) INCREASED TO 12.000
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   4.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.29
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       0.93
  PIPE TRAVEL TIME(MIN.) =   2.33    Tc(MIN.) =   10.08
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.30 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.178
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .9500
  SUBAREA AREA(ACRES) =    1.60   SUBAREA RUNOFF(CFS) =    3.31
  TOTAL AREA(ACRES) =        2.0   TOTAL RUNOFF(CFS) =       4.24
  TC(MIN.) =   10.08

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   10.08
  RAINFALL INTENSITY(INCH/HR) =   2.18
  TOTAL STREAM AREA(ACRES) =     2.03
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      4.24

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.20 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) =    90.00
  UPSTREAM ELEVATION(FEET) =     13.90
  DOWNSTREAM ELEVATION(FEET) =     13.40
  ELEVATION DIFFERENCE(FEET) =      0.50
  TC = 0.303*[(   90.00**3)/(     0.50)]**.2 =    5.180
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.141
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8000
  SUBAREA RUNOFF(CFS) =      0.23
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.23

****************************************************************************
  FLOW PROCESS FROM NODE    103.20 TO NODE    103.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   13.40  DOWNSTREAM ELEVATION(FEET) =   12.40
  STREET LENGTH(FEET) =   200.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.030
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.030

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.030
  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) =       0.55
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.24
    HALFSTREET FLOOD WIDTH(FEET) =    4.46
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.37
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.33
```

```
  STREET FLOW TRAVEL TIME(MIN.) =   2.44   Tc(MIN.) =    7.62
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.540
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8000
  SUBAREA AREA(ACRES) =    0.32      SUBAREA RUNOFF(CFS) =    0.65
  TOTAL AREA(ACRES) =        0.4       PEAK FLOW RATE(CFS) =       0.88

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.28   HALFSTREET FLOOD WIDTH(FEET) =   5.65
  FLOW VELOCITY(FEET/SEC.) =  1.50   DEPTH*VELOCITY(FT*FT/SEC.) =   0.42
  LONGEST FLOWPATH FROM NODE    103.10 TO NODE    103.00 =     290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.20 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.62
  RAINFALL INTENSITY(INCH/HR) =   2.54
  TOTAL STREAM AREA(ACRES) =     0.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.88

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        4.24    10.08        2.178          2.03
      2        0.88     7.62        2.540          0.41

 *********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        4.08     7.62       2.540
      2        4.99    10.08       2.178

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       4.99   Tc(MIN.) =   10.08
  TOTAL AREA(ACRES) =        2.4
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     7.10  DOWNSTREAM(FEET) =     4.70
  FLOW LENGTH(FEET) =   420.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  11.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.18
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      4.99
```

```
  PIPE TRAVEL TIME(MIN.) =   1.35    Tc(MIN.) =   11.44
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    1140.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.10 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.032
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .7000
  SUBAREA AREA(ACRES) =    0.70   SUBAREA RUNOFF(CFS) =    1.00
  TOTAL AREA(ACRES) =        3.1   TOTAL RUNOFF(CFS) =       5.98
  TC(MIN.) =   11.44

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     4.70  DOWNSTREAM(FEET) =     3.40
  FLOW LENGTH(FEET) =   180.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  15.0 INCH PIPE IS  11.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.86
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       5.98
  PIPE TRAVEL TIME(MIN.) =   0.51    Tc(MIN.) =   11.95
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    1320.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.95
  RAINFALL INTENSITY(INCH/HR) =   1.98
  TOTAL STREAM AREA(ACRES) =     3.14
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.98

****************************************************************************
  FLOW PROCESS FROM NODE    105.10 TO NODE    105.00 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) =    85.00
  UPSTREAM ELEVATION(FEET) =     15.90
  DOWNSTREAM ELEVATION(FEET) =     14.60
  ELEVATION DIFFERENCE(FEET) =      1.30
  TC = 0.303*[(   85.00**3)/(     1.30)]**.2 =    4.135
  COMPUTED TIME OF CONCENTRATION INCREASED TO 5 MIN.
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.203
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8000
  SUBAREA RUNOFF(CFS) =      0.28
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.28

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

```
  FLOW PROCESS FROM NODE    105.20 TO NODE    105.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     14.60
  DOWNSTREAM NODE ELEVATION(FEET) =      9.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   320.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.800
  PAVEMENT LIP(FEET) =  0.100   MANNING'S N = .0160
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01500
  MAXIMUM DEPTH(FEET) =   1.50
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.922
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .7500
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      1.36
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.86
  AVERAGE FLOW DEPTH(FEET) =   0.80   FLOOD WIDTH(FEET) =    3.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.91   Tc(MIN.) =    5.91
  SUBAREA AREA(ACRES) =    0.98       SUBAREA RUNOFF(CFS) =    2.15
  TOTAL AREA(ACRES) =        1.1         PEAK FLOW RATE(CFS) =       2.43

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL DEPTH
         IN A FLOWING-FULL GUTTER(NORMAL DEPTH = GUTTER HIKE)


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.80   FLOOD WIDTH(FEET) =    3.00
  FLOW VELOCITY(FEET/SEC.) =   5.86   DEPTH*VELOCITY(FT*FT/SEC) =   4.68
  LONGEST FLOWPATH FROM NODE    105.10 TO NODE    105.00 =     405.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.20 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.91
  RAINFALL INTENSITY(INCH/HR) =   2.92
  TOTAL STREAM AREA(ACRES) =     1.09
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      2.43

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.98    11.95        1.984          3.14
      2        2.43     5.91        2.922          1.09

 *********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        5.39     5.91       2.922
      2        7.63    11.95       1.984
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.63   Tc(MIN.) =   11.95
  TOTAL AREA(ACRES) =        4.2
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    1320.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     3.40  DOWNSTREAM(FEET) =     2.10
  FLOW LENGTH(FEET) =   260.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.3 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.47
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       7.63
  PIPE TRAVEL TIME(MIN.) =   0.79    Tc(MIN.) =   12.74
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    1580.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.10 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.915
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .9500
  SUBAREA AREA(ACRES) =    1.59   SUBAREA RUNOFF(CFS) =    2.89
  TOTAL AREA(ACRES) =        5.8   TOTAL RUNOFF(CFS) =      10.52
  TC(MIN.) =   12.74

****************************************************************************
  FLOW PROCESS FROM NODE    106.20 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.915
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8200
  SUBAREA AREA(ACRES) =    1.22   SUBAREA RUNOFF(CFS) =    1.92
  TOTAL AREA(ACRES) =        7.0   TOTAL RUNOFF(CFS) =      12.44
  TC(MIN.) =   12.74

****************************************************************************
  FLOW PROCESS FROM NODE    106.30 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  1.915
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8300
  SUBAREA AREA(ACRES) =    1.13   SUBAREA RUNOFF(CFS) =    1.80
  TOTAL AREA(ACRES) =        8.2   TOTAL RUNOFF(CFS) =      14.24
  TC(MIN.) =   12.74
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.2  TC(MIN.) =     12.74
  PEAK FLOW RATE(CFS)   =      14.24
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                      (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-2007 Advanced Engineering Software (aes)
                      (Rational Tabling Version 7.0D)
                   Release Date: 06/01/2007  License ID 1532

                           Analysis prepared by:

                         Tory R Walker Engineering



 ************************** DESCRIPTION OF STUDY **************************
 * EASTVALE - INDUSTRIAL PROJECT @ 3100 MILLIKEN                            *
 * RATIONAL METHOD  -  100-YEAR                                             *
 * SYSTEM 100 - WEST BASINS                                                 *
 **************************************************************************
  FILE NAME: EV1-100.DAT
  TIME/DATE OF STUDY: 13:51 07/20/2017
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.500
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.250
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.250
  SLOPE OF INTENSITY DURATION CURVE = 0.5500
  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   19.0     10.0    0.015/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150
  GLOBAL STREET FLOW-DEPTH CONSTRAINTS:
    1. Relative Flow-Depth =  0.00 FEET
       as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
    2. (Depth)*(Velocity) Constraint =  6.0 (FT*FT/S)
  *SIZE PIPE WITH A FLOW CAPACITY GREATER THAN
   OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

****************************************************************************
  FLOW PROCESS FROM NODE    100.00 TO NODE    101.00 IS CODE =  21
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  TC = K*[(LENGTH**3)/(ELEVATION CHANGE)]**.2
  INITIAL SUBAREA FLOW-LENGTH(FEET) =   120.00
  UPSTREAM ELEVATION(FEET) =     13.60
  DOWNSTREAM ELEVATION(FEET) =     13.00
  ELEVATION DIFFERENCE(FEET) =      0.60
  TC = 0.303*[(  120.00**3)/(     0.60)]**.2 =    5.936
```

```
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.462
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8000
  SUBAREA RUNOFF(CFS) =      0.39
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.39

****************************************************************************
  FLOW PROCESS FROM NODE    101.00 TO NODE    102.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   13.00  DOWNSTREAM ELEVATION(FEET) =   12.40
  STREET LENGTH(FEET) =   140.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.030
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.030

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.030
  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) =       0.91
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.29
    HALFSTREET FLOOD WIDTH(FEET) =    5.98
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.42
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.41
  STREET FLOW TRAVEL TIME(MIN.) =   1.65   Tc(MIN.) =    7.58
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.899
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8300
  SUBAREA AREA(ACRES) =    0.32      SUBAREA RUNOFF(CFS) =    1.04
  TOTAL AREA(ACRES) =        0.4        PEAK FLOW RATE(CFS) =       1.43

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.33   HALFSTREET FLOOD WIDTH(FEET) =   7.31
  FLOW VELOCITY(FEET/SEC.) =  1.57   DEPTH*VELOCITY(FT*FT/SEC.) =   0.52
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    102.00 =     260.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    102.00 TO NODE    103.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     9.40  DOWNSTREAM(FEET) =     7.10
  FLOW LENGTH(FEET) =   460.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  12.0 INCH PIPE IS   5.9 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   3.68
  ESTIMATED PIPE DIAMETER(INCH) =  12.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       1.43
  PIPE TRAVEL TIME(MIN.) =   2.08    Tc(MIN.) =    9.67
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.30 TO NODE    103.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
```

```
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.412
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .9500
  SUBAREA AREA(ACRES) =    1.60   SUBAREA RUNOFF(CFS) =    5.19
  TOTAL AREA(ACRES) =        2.0   TOTAL RUNOFF(CFS) =       6.61
  TC(MIN.) =    9.67

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.67
  RAINFALL INTENSITY(INCH/HR) =   3.41
  TOTAL STREAM AREA(ACRES) =     2.03
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      6.61

****************************************************************************
  FLOW PROCESS FROM NODE    103.10 TO NODE    103.20 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) =    90.00
  UPSTREAM ELEVATION(FEET) =     13.90
  DOWNSTREAM ELEVATION(FEET) =     13.40
  ELEVATION DIFFERENCE(FEET) =      0.50
  TC = 0.303*[(   90.00**3)/(     0.50)]**.2 =    5.180
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.808
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8000
  SUBAREA RUNOFF(CFS) =      0.35
  TOTAL AREA(ACRES) =      0.09   TOTAL RUNOFF(CFS) =      0.35

****************************************************************************
  FLOW PROCESS FROM NODE    103.20 TO NODE    103.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   13.40  DOWNSTREAM ELEVATION(FEET) =   12.40
  STREET LENGTH(FEET) =   200.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 30.00

  DISTANCE FROM CROWN TO CROSSFALL GRADEBREAK(FEET) =  20.00
  INSIDE STREET CROSSFALL(DECIMAL) =  0.030
  OUTSIDE STREET CROSSFALL(DECIMAL)  =  0.030

  SPECIFIED NUMBER OF HALFSTREETS CARRYING RUNOFF =  1
  STREET PARKWAY CROSSFALL(DECIMAL)  =  0.030
  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) =       0.85
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.28
    HALFSTREET FLOOD WIDTH(FEET) =    5.58
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    1.48
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    0.41
```

```
  STREET FLOW TRAVEL TIME(MIN.) =   2.24   Tc(MIN.) =    7.42
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.945
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8000
  SUBAREA AREA(ACRES) =    0.32      SUBAREA RUNOFF(CFS) =    1.01
  TOTAL AREA(ACRES) =        0.4        PEAK FLOW RATE(CFS) =      1.36

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.32   HALFSTREET FLOOD WIDTH(FEET) =   6.91
  FLOW VELOCITY(FEET/SEC.) =  1.65   DEPTH*VELOCITY(FT*FT/SEC.) =   0.52
  LONGEST FLOWPATH FROM NODE    103.10 TO NODE    103.00 =     290.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.20 TO NODE    103.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    7.42
  RAINFALL INTENSITY(INCH/HR) =   3.94
  TOTAL STREAM AREA(ACRES) =     0.41
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.36

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        6.61     9.67        3.412          2.03
      2        1.36     7.42        3.945          0.41

 *********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        6.44     7.42       3.945
      2        7.79     9.67       3.412

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       7.79   Tc(MIN.) =    9.67
  TOTAL AREA(ACRES) =        2.4
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    103.00 =     720.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    103.00 TO NODE    104.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     7.10  DOWNSTREAM(FEET) =     4.70
  FLOW LENGTH(FEET) =   420.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  12.8 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.81
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      7.79
```

```
  PIPE TRAVEL TIME(MIN.) =   1.20    Tc(MIN.) =   10.87
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    104.00 =    1140.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.10 TO NODE    104.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.199
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .7000
  SUBAREA AREA(ACRES) =    0.70   SUBAREA RUNOFF(CFS) =    1.57
  TOTAL AREA(ACRES) =        3.1   TOTAL RUNOFF(CFS) =       9.35
  TC(MIN.) =   10.87

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     4.70  DOWNSTREAM(FEET) =     3.40
  FLOW LENGTH(FEET) =   180.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  13.5 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.59
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.35
  PIPE TRAVEL TIME(MIN.) =   0.45    Tc(MIN.) =   11.32
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    1320.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    104.00 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =   11.32
  RAINFALL INTENSITY(INCH/HR) =   3.13
  TOTAL STREAM AREA(ACRES) =     3.14
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      9.35

****************************************************************************
  FLOW PROCESS FROM NODE    105.10 TO NODE    105.00 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) =    85.00
  UPSTREAM ELEVATION(FEET) =     15.90
  DOWNSTREAM ELEVATION(FEET) =     14.60
  ELEVATION DIFFERENCE(FEET) =      1.30
  TC = 0.303*[(   85.00**3)/(     1.30)]**.2 =    4.135
  COMPUTED TIME OF CONCENTRATION INCREASED TO 5 MIN.
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.903
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8000
  SUBAREA RUNOFF(CFS) =      0.43
  TOTAL AREA(ACRES) =      0.11   TOTAL RUNOFF(CFS) =      0.43

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

```
  FLOW PROCESS FROM NODE    105.20 TO NODE    105.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     14.60
  DOWNSTREAM NODE ELEVATION(FEET) =      9.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   320.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.800
  PAVEMENT LIP(FEET) =  0.100   MANNING'S N = .0160
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01500
  MAXIMUM DEPTH(FEET) =   1.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.472
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .7500
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      2.07
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   5.86
  AVERAGE FLOW DEPTH(FEET) =   0.80   FLOOD WIDTH(FEET) =    3.00
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   0.91   Tc(MIN.) =    5.91
  SUBAREA AREA(ACRES) =    0.98       SUBAREA RUNOFF(CFS) =    3.29
  TOTAL AREA(ACRES) =        1.1         PEAK FLOW RATE(CFS) =       3.72

         NOTE:TRAVEL TIME ESTIMATES BASED ON NORMAL DEPTH
         IN A FLOWING-FULL GUTTER(NORMAL DEPTH = GUTTER HIKE)


  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.80   FLOOD WIDTH(FEET) =    3.00
  FLOW VELOCITY(FEET/SEC.) =   5.86   DEPTH*VELOCITY(FT*FT/SEC) =   4.68
  LONGEST FLOWPATH FROM NODE    105.10 TO NODE    105.00 =     405.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.20 TO NODE    105.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    5.91
  RAINFALL INTENSITY(INCH/HR) =   4.47
  TOTAL STREAM AREA(ACRES) =     1.09
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      3.72

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        9.35    11.32        3.127          3.14
      2        3.72     5.91        4.472          1.09

 *********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
      1        8.60     5.91       4.472
      2       11.96    11.32       3.127
```

```
  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      11.96   Tc(MIN.) =   11.32
  TOTAL AREA(ACRES) =        4.2
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    105.00 =    1320.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    105.00 TO NODE    106.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     3.40  DOWNSTREAM(FEET) =     2.10
  FLOW LENGTH(FEET) =   260.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  16.0 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   6.09
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =      11.96
  PIPE TRAVEL TIME(MIN.) =   0.71    Tc(MIN.) =   12.04
  LONGEST FLOWPATH FROM NODE    100.00 TO NODE    106.00 =    1580.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    106.10 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.024
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .9500
  SUBAREA AREA(ACRES) =    1.59   SUBAREA RUNOFF(CFS) =    4.57
  TOTAL AREA(ACRES) =        5.8   TOTAL RUNOFF(CFS) =      16.52
  TC(MIN.) =   12.04

****************************************************************************
  FLOW PROCESS FROM NODE    106.20 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.024
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8200
  SUBAREA AREA(ACRES) =    1.22   SUBAREA RUNOFF(CFS) =    3.03
  TOTAL AREA(ACRES) =        7.0   TOTAL RUNOFF(CFS) =      19.55
  TC(MIN.) =   12.04

****************************************************************************
  FLOW PROCESS FROM NODE    106.30 TO NODE    106.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.024
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8300
  SUBAREA AREA(ACRES) =    1.13   SUBAREA RUNOFF(CFS) =    2.84
  TOTAL AREA(ACRES) =        8.2   TOTAL RUNOFF(CFS) =      22.39
  TC(MIN.) =   12.04
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        8.2  TC(MIN.) =     12.04
  PEAK FLOW RATE(CFS)   =      22.39
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                      (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-2007 Advanced Engineering Software (aes)
                      (Rational Tabling Version 7.0D)
                   Release Date: 06/01/2007  License ID 1532

                           Analysis prepared by:

                         Tory R Walker Engineering



 ************************** DESCRIPTION OF STUDY **************************
* EASTVALE - INDUSTRIAL PROJECT @ 3100 MILLIKEN                            *
* RATIONAL METHOD  - 10-YEAR                                               *
* SYSTEM  200  -  EAST BASIN                                               *
 **************************************************************************

  FILE NAME: EV2-10.DAT
  TIME/DATE OF STUDY: 16:26 08/16/2017
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =   10.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.500
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.250
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =   10.00   1-HOUR INTENSITY(INCH/HOUR) =   0.817
  SLOPE OF INTENSITY DURATION CURVE = 0.5500
  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   19.0     10.0    0.015/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

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

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 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) =   120.00
  UPSTREAM ELEVATION(FEET) =     13.30
  DOWNSTREAM ELEVATION(FEET) =     12.70
```

```
  ELEVATION DIFFERENCE(FEET) =      0.60
  TC = 0.303*[(  120.00**3)/(     0.60)]**.2 =    5.936
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.915
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .7700
  SUBAREA RUNOFF(CFS) =      0.45
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.45

****************************************************************************
  FLOW PROCESS FROM NODE    201.10 TO NODE    201.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.915
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .9800
  SUBAREA AREA(ACRES) =    1.61   SUBAREA RUNOFF(CFS) =    4.60
  TOTAL AREA(ACRES) =        1.8   TOTAL RUNOFF(CFS) =       5.05
  TC(MIN.) =    5.94

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     12.70
  DOWNSTREAM NODE ELEVATION(FEET) =     11.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   240.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.800
  PAVEMENT LIP(FEET) =  0.100   MANNING'S N = .0160
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01500
  MAXIMUM DEPTH(FEET) =   1.50
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.657
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      5.56
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.68
  AVERAGE FLOW DEPTH(FEET) =   0.90   FLOOD WIDTH(FEET) =    3.39
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.09   Tc(MIN.) =    7.02
  SUBAREA AREA(ACRES) =    0.45       SUBAREA RUNOFF(CFS) =    1.02
  TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =       6.06

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  0.93   FLOOD WIDTH(FEET) =    6.83
  FLOW VELOCITY(FEET/SEC.) =   3.70   DEPTH*VELOCITY(FT*FT/SEC) =   3.43
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     360.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    206.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     8.00  DOWNSTREAM(FEET) =     3.70
  FLOW LENGTH(FEET) =   365.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  15.0 INCH PIPE IS   9.7 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   7.22
  ESTIMATED PIPE DIAMETER(INCH) =  15.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.06
  PIPE TRAVEL TIME(MIN.) =   0.84    Tc(MIN.) =    7.86
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    206.00 =     725.00 FEET.

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

```
  FLOW PROCESS FROM NODE    206.00 TO NODE    205.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =      3.70  DOWNSTREAM(FEET) =      3.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   100.00   CHANNEL SLOPE =  0.0020
  CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.252
  *USER SPECIFIED(SUBAREA):
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .0350
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       6.06
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.02
  AVERAGE FLOW DEPTH(FEET) =   0.48   TRAVEL TIME(MIN.) =   1.63
  Tc(MIN.) =    9.49
  SUBAREA AREA(ACRES) =     0.01       SUBAREA RUNOFF(CFS) =    0.00
  TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =       6.07

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.48   FLOW VELOCITY(FEET/SEC.) =   1.02
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =     825.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    206.00 TO NODE    205.00 IS CODE =  10
----------------------------------------------------------------------------
  >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
  FLOW PROCESS FROM NODE    203.10 TO NODE    203.20 IS CODE =  22
----------------------------------------------------------------------------
  >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
         ASSUMED INITIAL SUBAREA UNIFORM
         DEVELOPMENT IS COMMERCIAL
  USER SPECIFIED Tc(MIN.) =    5.000
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.203
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .9500
  SUBAREA RUNOFF(CFS) =      4.50
  TOTAL AREA(ACRES) =      1.48   TOTAL RUNOFF(CFS) =      4.50

****************************************************************************
  FLOW PROCESS FROM NODE    203.20 TO NODE    203.00 IS CODE =  61
----------------------------------------------------------------------------
  >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
  UPSTREAM ELEVATION(FEET) =   10.90  DOWNSTREAM ELEVATION(FEET) =    6.90
  STREET LENGTH(FEET) =   210.00   CURB HEIGHT(INCHES) =  6.0
  STREET HALFWIDTH(FEET) = 40.00

  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 =  1
  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) =       5.18
```

```
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.36
    HALFSTREET FLOOD WIDTH(FEET) =   11.87
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.39
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.23
  STREET FLOW TRAVEL TIME(MIN.) =   1.03   Tc(MIN.) =    6.03
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.889
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .9000
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    1.35
  TOTAL AREA(ACRES) =        2.0        PEAK FLOW RATE(CFS) =       5.86

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.38   HALFSTREET FLOOD WIDTH(FEET) =  12.45
  FLOW VELOCITY(FEET/SEC.) =  3.51   DEPTH*VELOCITY(FT*FT/SEC.) =   1.32
  LONGEST FLOWPATH FROM NODE    203.10 TO NODE    203.00 =     450.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =      6.70  DOWNSTREAM(FEET) =      6.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =    45.00   CHANNEL SLOPE =  0.0089
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.804
  *USER SPECIFIED(SUBAREA):
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .0350
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       5.86
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.24
  AVERAGE FLOW DEPTH(FEET) =   0.48   TRAVEL TIME(MIN.) =   0.34
  Tc(MIN.) =    6.37
  SUBAREA AREA(ACRES) =     0.01       SUBAREA RUNOFF(CFS) =    0.00
  TOTAL AREA(ACRES) =        2.0         PEAK FLOW RATE(CFS) =       5.86

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.48   FLOW VELOCITY(FEET/SEC.) =   2.24
  LONGEST FLOWPATH FROM NODE    203.10 TO NODE    204.00 =     495.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.37
  RAINFALL INTENSITY(INCH/HR) =   2.80
  TOTAL STREAM AREA(ACRES) =     2.01
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      5.86

****************************************************************************
  FLOW PROCESS FROM NODE    204.10 TO NODE    204.20 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) =    85.00
  UPSTREAM ELEVATION(FEET) =    813.00
```

```
  DOWNSTREAM ELEVATION(FEET) =    811.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  TC = 0.533*[(   85.00**3)/(     2.00)]**.2 =    6.666
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.735
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .4420
  SOIL CLASSIFICATION IS "A"
  SUBAREA RUNOFF(CFS) =      0.15
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.15

****************************************************************************
  FLOW PROCESS FROM NODE    204.20 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    811.00  DOWNSTREAM(FEET) =    807.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   220.00   CHANNEL SLOPE =  0.0159
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.198
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .3932
  SOIL CLASSIFICATION IS "A"
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.35
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.13
  AVERAGE FLOW DEPTH(FEET) =   0.10   TRAVEL TIME(MIN.) =   3.25
  Tc(MIN.) =    9.91
  SUBAREA AREA(ACRES) =     0.46       SUBAREA RUNOFF(CFS) =    0.40
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       0.54

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.13   FLOW VELOCITY(FEET/SEC.) =   1.31
  LONGEST FLOWPATH FROM NODE    204.10 TO NODE    204.00 =     305.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.20 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.91
  RAINFALL INTENSITY(INCH/HR) =   2.20
  TOTAL STREAM AREA(ACRES) =     0.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      0.54

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        5.86     6.37        2.804          2.01
      2        0.54     9.91        2.198          0.58

 *********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1        6.21     6.37       2.804
     2        5.13     9.91       2.198

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       6.21   Tc(MIN.) =    6.37
  TOTAL AREA(ACRES) =        2.6
  LONGEST FLOWPATH FROM NODE    203.10 TO NODE    204.00 =     495.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     4.15  DOWNSTREAM(FEET) =     3.00
  FLOW LENGTH(FEET) =   230.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.4 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.28
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       6.21
  PIPE TRAVEL TIME(MIN.) =   0.73    Tc(MIN.) =    7.09
  LONGEST FLOWPATH FROM NODE    203.10 TO NODE    205.00 =     725.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.10 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
    10 YEAR RAINFALL INTENSITY(INCH/HOUR) =  2.643
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .5600
  SUBAREA AREA(ACRES) =    1.63   SUBAREA RUNOFF(CFS) =    2.41
  TOTAL AREA(ACRES) =        4.2   TOTAL RUNOFF(CFS) =       8.62
  TC(MIN.) =    7.09

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        8.62     7.09       2.643        4.22
  LONGEST FLOWPATH FROM NODE    203.10 TO NODE    205.00 =     725.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        6.07     9.49       2.252        2.27
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =     825.00 FEET.

 *********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
```

```
     1      13.15       7.09        2.643
     2      13.41       9.49        2.252

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      13.15   Tc(MIN.) =    7.09
  TOTAL AREA(ACRES) =        6.5
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.5  TC(MIN.) =      7.09
  PEAK FLOW RATE(CFS)   =      13.15
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

```
****************************************************************************
            RATIONAL METHOD HYDROLOGY COMPUTER PROGRAM BASED ON
        RIVERSIDE COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT
                      (RCFC&WCD)  1978 HYDROLOGY MANUAL
         (c) Copyright 1982-2007 Advanced Engineering Software (aes)
                      (Rational Tabling Version 7.0D)
                   Release Date: 06/01/2007  License ID 1532

                           Analysis prepared by:

                         Tory R Walker Engineering




 ************************** DESCRIPTION OF STUDY **************************
* EASTVALE - INDUSTRIAL PROJECT @ 3100 MILLIKEN                            *
* RATIONAL METHOD  -  100-YEAR                                             *
* SYSTEM  200  -  EAST BASIN                                               *
 **************************************************************************

  FILE NAME: EV2-100.DAT
  TIME/DATE OF STUDY: 16:50 08/16/2017
----------------------------------------------------------------------------
  USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:
----------------------------------------------------------------------------
  USER SPECIFIED STORM EVENT(YEAR) =  100.00
  SPECIFIED MINIMUM PIPE SIZE(INCH) =  12.00
  SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.95
  2-YEAR, 1-HOUR PRECIPITATION(INCH) =  0.500
  100-YEAR, 1-HOUR PRECIPITATION(INCH) =  1.250
  COMPUTED RAINFALL INTENSITY DATA:
  STORM EVENT =  100.00   1-HOUR INTENSITY(INCH/HOUR) =   1.250
  SLOPE OF INTENSITY DURATION CURVE = 0.5500
  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   19.0     10.0    0.015/0.020/0.020   0.50    1.50 0.0313 0.125 0.0150

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

****************************************************************************
  FLOW PROCESS FROM NODE    200.00 TO NODE    201.00 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) =   120.00
  UPSTREAM ELEVATION(FEET) =     13.30
  DOWNSTREAM ELEVATION(FEET) =     12.70
```

```
  ELEVATION DIFFERENCE(FEET) =      0.60
  TC = 0.303*[(  120.00**3)/(     0.60)]**.2 =    5.936
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.462
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .7700
  SUBAREA RUNOFF(CFS) =      0.69
  TOTAL AREA(ACRES) =      0.20   TOTAL RUNOFF(CFS) =      0.69

****************************************************************************
  FLOW PROCESS FROM NODE    201.10 TO NODE    201.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.462
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .9800
  SUBAREA AREA(ACRES) =    1.61   SUBAREA RUNOFF(CFS) =    7.04
  TOTAL AREA(ACRES) =        1.8   TOTAL RUNOFF(CFS) =       7.73
  TC(MIN.) =    5.94

****************************************************************************
  FLOW PROCESS FROM NODE    201.00 TO NODE    202.00 IS CODE =  91
----------------------------------------------------------------------------
  >>>>>COMPUTE "V" GUTTER FLOW TRAVEL TIME THRU SUBAREA<<<<<
============================================================================
  UPSTREAM NODE ELEVATION(FEET) =     12.70
  DOWNSTREAM NODE ELEVATION(FEET) =     11.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   240.00
  "V" GUTTER WIDTH(FEET) =   3.00   GUTTER HIKE(FEET) =  0.800
  PAVEMENT LIP(FEET) =  0.100   MANNING'S N = .0160
  PAVEMENT CROSSFALL(DECIMAL NOTATION) = 0.01500
  MAXIMUM DEPTH(FEET) =   1.50
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.014
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =      8.49
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   3.18
  AVERAGE FLOW DEPTH(FEET) =   1.01   FLOOD WIDTH(FEET) =   17.92
  "V" GUTTER FLOW TRAVEL TIME(MIN.) =   1.26   Tc(MIN.) =    7.19
  SUBAREA AREA(ACRES) =    0.45       SUBAREA RUNOFF(CFS) =    1.54
  TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =       9.26

  END OF SUBAREA "V" GUTTER HYDRAULICS:
  DEPTH(FEET) =  1.03   FLOOD WIDTH(FEET) =   20.27
  FLOW VELOCITY(FEET/SEC.) =   3.08   DEPTH*VELOCITY(FT*FT/SEC) =   3.17
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    202.00 =     360.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    202.00 TO NODE    206.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     8.00  DOWNSTREAM(FEET) =     3.70
  FLOW LENGTH(FEET) =   365.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  18.0 INCH PIPE IS  11.2 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   8.05
  ESTIMATED PIPE DIAMETER(INCH) =  18.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.26
  PIPE TRAVEL TIME(MIN.) =   0.76    Tc(MIN.) =    7.95
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    206.00 =     725.00 FEET.

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

```
 FLOW PROCESS FROM NODE    206.00 TO NODE    205.00 IS CODE =  51
----------------------------------------------------------------------------
 >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
 >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
 ELEVATION DATA: UPSTREAM(FEET) =      3.70  DOWNSTREAM(FEET) =      3.50
 CHANNEL LENGTH THRU SUBAREA(FEET) =   100.00   CHANNEL SLOPE =  0.0020
 CHANNEL BASE(FEET) =   10.00   "Z" FACTOR =   5.000
 MANNING'S FACTOR = 0.035   MAXIMUM DEPTH(FEET) =   3.00
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.471
 *USER SPECIFIED(SUBAREA):
 UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .0350
 TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       9.26
 TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.17
 AVERAGE FLOW DEPTH(FEET) =   0.61   TRAVEL TIME(MIN.) =   1.42
 Tc(MIN.) =    9.37
 SUBAREA AREA(ACRES) =     0.01       SUBAREA RUNOFF(CFS) =    0.00
 TOTAL AREA(ACRES) =        2.3         PEAK FLOW RATE(CFS) =       9.26

 END OF SUBAREA CHANNEL FLOW HYDRAULICS:
 DEPTH(FEET) =  0.61   FLOW VELOCITY(FEET/SEC.) =   1.17
 LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =     825.00 FEET.

****************************************************************************
 FLOW PROCESS FROM NODE    206.00 TO NODE    205.00 IS CODE =  10
----------------------------------------------------------------------------
 >>>>>MAIN-STREAM MEMORY COPIED ONTO MEMORY BANK # 1 <<<<<
============================================================================

****************************************************************************
 FLOW PROCESS FROM NODE    203.10 TO NODE    203.20 IS CODE =  22
----------------------------------------------------------------------------
 >>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
============================================================================
        ASSUMED INITIAL SUBAREA UNIFORM
        DEVELOPMENT IS COMMERCIAL
 USER SPECIFIED Tc(MIN.) =    5.000
  100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.903
 *USER SPECIFIED(SUBAREA):
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .9500
 SUBAREA RUNOFF(CFS) =      6.89
 TOTAL AREA(ACRES) =      1.48   TOTAL RUNOFF(CFS) =      6.89

****************************************************************************
 FLOW PROCESS FROM NODE    203.20 TO NODE    203.00 IS CODE =  61
----------------------------------------------------------------------------
 >>>>>COMPUTE STREET FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>>>>(STANDARD CURB SECTION USED)<<<<<
============================================================================
 UPSTREAM ELEVATION(FEET) =   10.90  DOWNSTREAM ELEVATION(FEET) =    6.90
 STREET LENGTH(FEET) =   210.00   CURB HEIGHT(INCHES) =  6.0
 STREET HALFWIDTH(FEET) = 40.00

 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 =  1
 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) =       7.94
```

```
    STREETFLOW MODEL RESULTS USING ESTIMATED FLOW:
    STREET FLOW DEPTH(FEET) =  0.41
    HALFSTREET FLOOD WIDTH(FEET) =   14.11
    AVERAGE FLOW VELOCITY(FEET/SEC.) =    3.76
    PRODUCT OF DEPTH&VELOCITY(FT*FT/SEC.) =    1.54
  STREET FLOW TRAVEL TIME(MIN.) =   0.93   Tc(MIN.) =    5.93
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.464
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .9000
  SUBAREA AREA(ACRES) =    0.52      SUBAREA RUNOFF(CFS) =    2.09
  TOTAL AREA(ACRES) =        2.0        PEAK FLOW RATE(CFS) =       8.98

  END OF SUBAREA STREET FLOW HYDRAULICS:
  DEPTH(FEET) = 0.42   HALFSTREET FLOOD WIDTH(FEET) =  14.83
  FLOW VELOCITY(FEET/SEC.) =  3.87   DEPTH*VELOCITY(FT*FT/SEC.) =   1.64
  LONGEST FLOWPATH FROM NODE    203.10 TO NODE    203.00 =     450.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =      6.70  DOWNSTREAM(FEET) =      6.30
  CHANNEL LENGTH THRU SUBAREA(FEET) =    45.00   CHANNEL SLOPE =  0.0089
  CHANNEL BASE(FEET) =    3.00   "Z" FACTOR =   5.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   3.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.345
  *USER SPECIFIED(SUBAREA):
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .0350
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       8.98
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   2.51
  AVERAGE FLOW DEPTH(FEET) =   0.60   TRAVEL TIME(MIN.) =   0.30
  Tc(MIN.) =    6.23
  SUBAREA AREA(ACRES) =     0.01       SUBAREA RUNOFF(CFS) =    0.00
  TOTAL AREA(ACRES) =        2.0         PEAK FLOW RATE(CFS) =       8.98

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.60   FLOW VELOCITY(FEET/SEC.) =   2.51
  LONGEST FLOWPATH FROM NODE    203.10 TO NODE    204.00 =     495.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    203.00 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  1 ARE:
  TIME OF CONCENTRATION(MIN.) =    6.23
  RAINFALL INTENSITY(INCH/HR) =   4.34
  TOTAL STREAM AREA(ACRES) =     2.01
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      8.98

****************************************************************************
  FLOW PROCESS FROM NODE    204.10 TO NODE    204.20 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) =    85.00
  UPSTREAM ELEVATION(FEET) =    813.00
```

```
  DOWNSTREAM ELEVATION(FEET) =    811.00
  ELEVATION DIFFERENCE(FEET) =      2.00
  TC = 0.533*[(   85.00**3)/(     2.00)]**.2 =    6.666
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.186
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .5367
  SOIL CLASSIFICATION IS "A"
  SUBAREA RUNOFF(CFS) =      0.27
  TOTAL AREA(ACRES) =      0.12   TOTAL RUNOFF(CFS) =      0.27

****************************************************************************
  FLOW PROCESS FROM NODE    204.20 TO NODE    204.00 IS CODE =  51
----------------------------------------------------------------------------
  >>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<
  >>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =    811.00  DOWNSTREAM(FEET) =    807.50
  CHANNEL LENGTH THRU SUBAREA(FEET) =   220.00   CHANNEL SLOPE =  0.0159
  CHANNEL BASE(FEET) =    2.00   "Z" FACTOR =  10.000
  MANNING'S FACTOR = 0.030   MAXIMUM DEPTH(FEET) =   2.00
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  3.479
  UNDEVELOPED WATERSHED RUNOFF COEFFICIENT = .4961
  SOIL CLASSIFICATION IS "A"
  TRAVEL TIME COMPUTED USING ESTIMATED FLOW(CFS) =       0.67
  TRAVEL TIME THRU SUBAREA BASED ON VELOCITY(FEET/SEC.) =   1.38
  AVERAGE FLOW DEPTH(FEET) =   0.14   TRAVEL TIME(MIN.) =   2.66
  Tc(MIN.) =    9.33
  SUBAREA AREA(ACRES) =     0.46       SUBAREA RUNOFF(CFS) =    0.79
  TOTAL AREA(ACRES) =        0.6         PEAK FLOW RATE(CFS) =       1.06

  END OF SUBAREA CHANNEL FLOW HYDRAULICS:
  DEPTH(FEET) =  0.18   FLOW VELOCITY(FEET/SEC.) =   1.55
  LONGEST FLOWPATH FROM NODE    204.10 TO NODE    204.00 =     305.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.20 TO NODE    204.00 IS CODE =   1
----------------------------------------------------------------------------
  >>>>>DESIGNATE INDEPENDENT STREAM FOR CONFLUENCE<<<<<
  >>>>>AND COMPUTE VARIOUS CONFLUENCED STREAM VALUES<<<<<
============================================================================
  TOTAL NUMBER OF STREAMS =  2
  CONFLUENCE VALUES USED FOR INDEPENDENT STREAM  2 ARE:
  TIME OF CONCENTRATION(MIN.) =    9.33
  RAINFALL INTENSITY(INCH/HR) =   3.48
  TOTAL STREAM AREA(ACRES) =     0.58
  PEAK FLOW RATE(CFS) AT CONFLUENCE =      1.06

  ** CONFLUENCE DATA **
  STREAM     RUNOFF       Tc      INTENSITY      AREA
  NUMBER      (CFS)     (MIN.)   (INCH/HOUR)    (ACRE)
      1        8.98     6.23        4.345          2.01
      2        1.06     9.33        3.479          0.58

 *********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

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

  ** PEAK FLOW RATE TABLE **
  STREAM     RUNOFF      Tc      INTENSITY
```

```
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)
     1         9.69     6.23       4.345
     2         8.26     9.33       3.479

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =       9.69   Tc(MIN.) =    6.23
  TOTAL AREA(ACRES) =        2.6
  LONGEST FLOWPATH FROM NODE    203.10 TO NODE    204.00 =     495.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    204.00 TO NODE    205.00 IS CODE =  31
----------------------------------------------------------------------------
  >>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
  >>>>>USING COMPUTER-ESTIMATED PIPESIZE (NON-PRESSURE FLOW)<<<<<
============================================================================
  ELEVATION DATA: UPSTREAM(FEET) =     4.15  DOWNSTREAM(FEET) =     3.00
  FLOW LENGTH(FEET) =   230.00   MANNING'S N =  0.011
  DEPTH OF FLOW IN  21.0 INCH PIPE IS  13.6 INCHES
  PIPE-FLOW VELOCITY(FEET/SEC.) =   5.89
  ESTIMATED PIPE DIAMETER(INCH) =  21.00    NUMBER OF PIPES =   1
  PIPE-FLOW(CFS) =       9.69
  PIPE TRAVEL TIME(MIN.) =   0.65    Tc(MIN.) =    6.88
  LONGEST FLOWPATH FROM NODE    203.10 TO NODE    205.00 =     725.00 FEET.

****************************************************************************
  FLOW PROCESS FROM NODE    205.10 TO NODE    205.00 IS CODE =  81
----------------------------------------------------------------------------
  >>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<
============================================================================
   100 YEAR RAINFALL INTENSITY(INCH/HOUR) =  4.114
  *USER SPECIFIED(SUBAREA):
  COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .5600
  SUBAREA AREA(ACRES) =    1.63   SUBAREA RUNOFF(CFS) =    3.76
  TOTAL AREA(ACRES) =        4.2   TOTAL RUNOFF(CFS) =      13.45
  TC(MIN.) =    6.88

****************************************************************************
  FLOW PROCESS FROM NODE    205.00 TO NODE    205.00 IS CODE =  11
----------------------------------------------------------------------------
  >>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<
============================================================================

  ** MAIN STREAM CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1        13.45     6.88       4.114        4.22
  LONGEST FLOWPATH FROM NODE    203.10 TO NODE    205.00 =     725.00 FEET.

  ** MEMORY BANK #  1 CONFLUENCE DATA **
  STREAM     RUNOFF      Tc      INTENSITY     AREA
  NUMBER      (CFS)    (MIN.)   (INCH/HOUR)   (ACRE)
     1         9.26     9.37       3.471        2.27
  LONGEST FLOWPATH FROM NODE    200.00 TO NODE    205.00 =     825.00 FEET.

 ********************************WARNING**********************************
  IN THIS COMPUTER PROGRAM, THE CONFLUENCE VALUE USED IS BASED
  ON THE RCFC&WCD FORMULA OF PLATE D-1 AS DEFAULT VALUE. THIS FORMULA
  WILL NOT NECESSARILY RESULT IN THE MAXIMUM VALUE OF PEAK FLOW.
 **************************************************************************

  ** PEAK FLOW RATE TABLE **
  STREAM    RUNOFF       Tc      INTENSITY
  NUMBER     (CFS)     (MIN.)   (INCH/HOUR)
```

```
     1      20.25       6.88        4.114
     2      20.61       9.37        3.471

  COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:
  PEAK FLOW RATE(CFS) =      20.25   Tc(MIN.) =    6.88
  TOTAL AREA(ACRES) =        6.5
============================================================================
  END OF STUDY SUMMARY:
  TOTAL AREA(ACRES)     =        6.5  TC(MIN.) =      6.88
  PEAK FLOW RATE(CFS)   =      20.25
============================================================================
============================================================================
  END OF RATIONAL METHOD ANALYSIS
```

APPENDIX 4

Hydraulics (Pipe, Inlet)

Channel Report

Reach 1 - 12-inch pipe

Circular

Diameter (ft) = 1.00

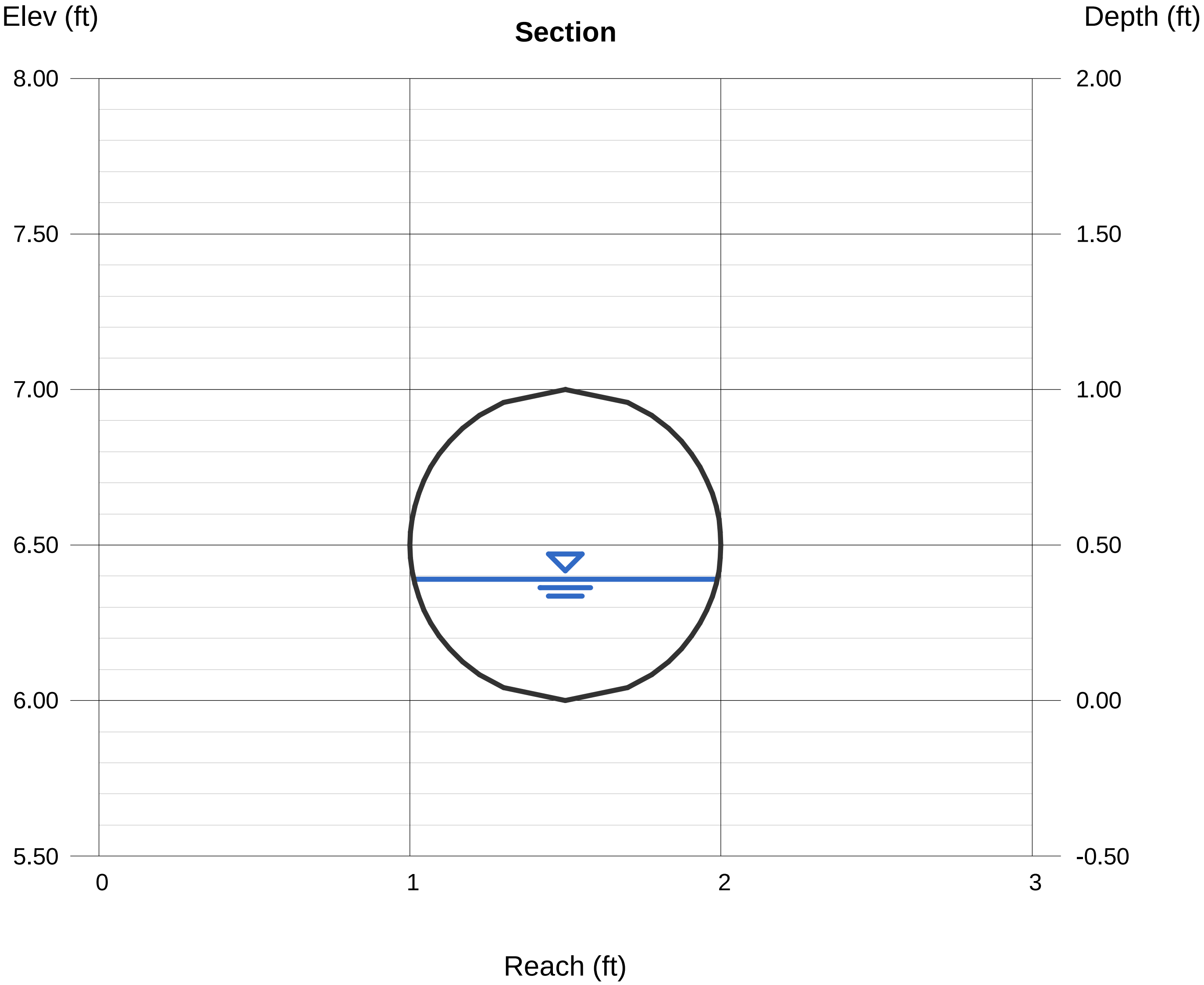
Invert Elev (ft) = 6.00
Slope (%) = 0.50
N-Value = 0.011

Calculations

Compute by: Known Q
Known Q (cfs) = 0.93

Highlighted

Depth (ft) = 0.39
Q (cfs) = 0.930
Area (sqft) = 0.28
Velocity (ft/s) = 3.27
Wetted Perim (ft) = 1.35
Crit Depth, Yc (ft) = 0.41
Top Width (ft) = 0.98
EGL (ft) = 0.56



Channel Report

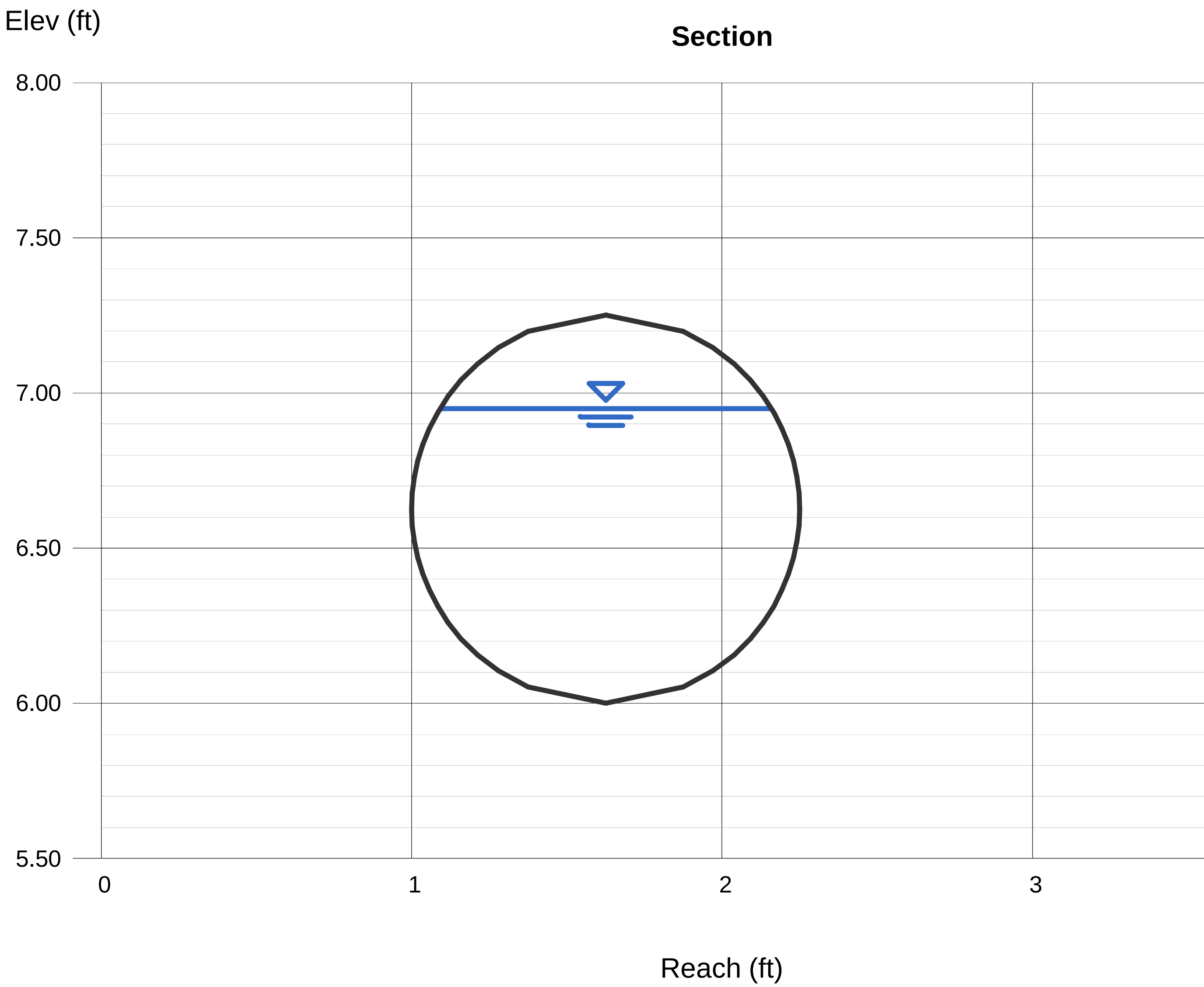
Reaches 2 and 3 - 15-inch pipe

Circular
Diameter (ft) = 1.25

Invert Elev (ft) = 6.00
Slope (%) = 0.50
N-Value = 0.011

Calculations
Compute by: Known Q
Known Q (cfs) = 4.99

Highlighted
Depth (ft) = 0.95
Q (cfs) = 4.990
Area (sqft) = 1.00
Velocity (ft/s) = 4.98
Wetted Perim (ft) = 2.65
Crit Depth, Yc (ft) = 0.91
Top Width (ft) = 1.07
EGL (ft) = 1.34



Channel Report

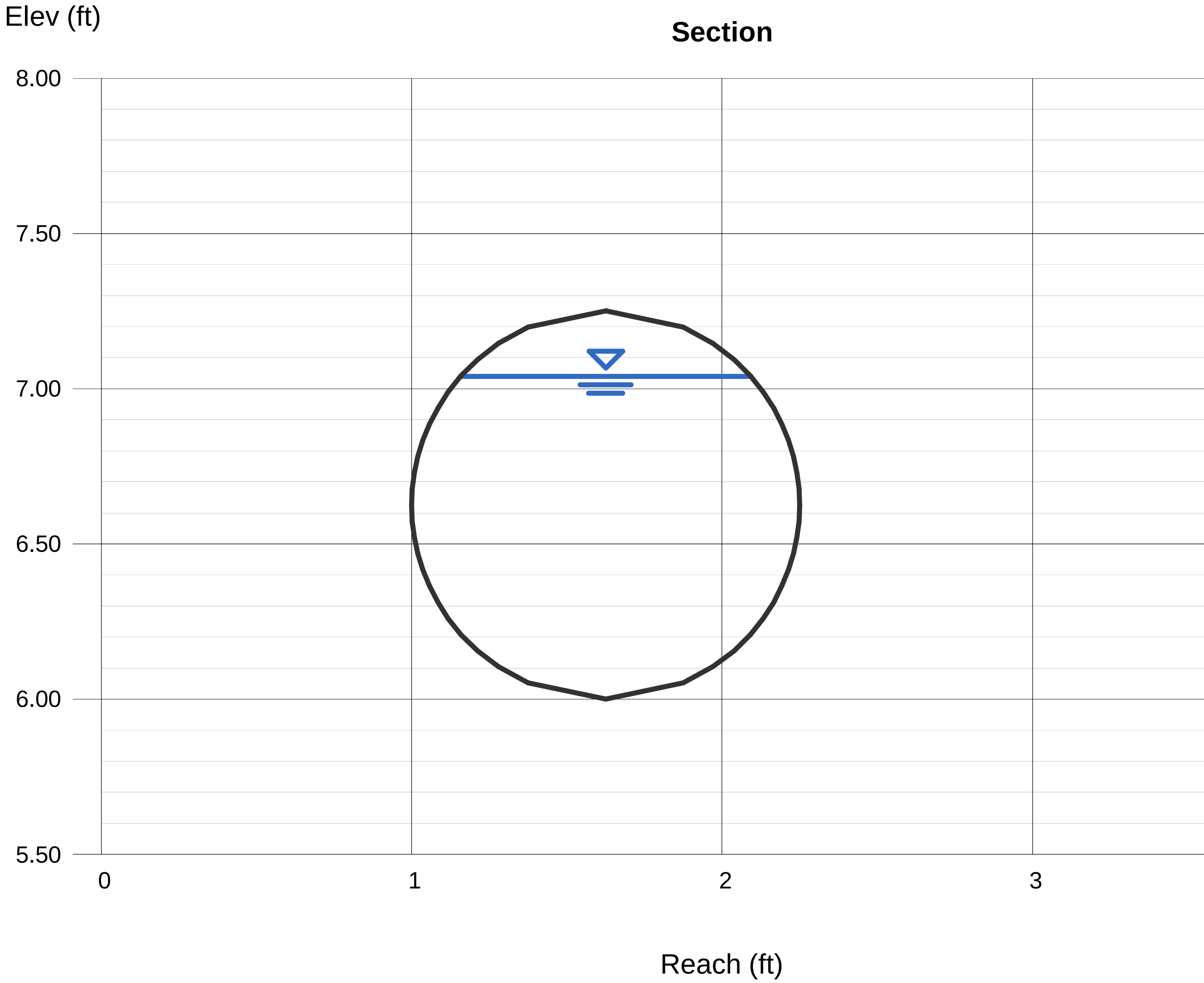
Reach 4 - 15-inch pipe

Circular
Diameter (ft) = 1.25

Invert Elev (ft) = 6.00
Slope (%) = 0.60
N-Value = 0.011

Calculations
Compute by: Known Q
Known Q (cfs) = 5.98

Highlighted
Depth (ft) = 1.04
Q (cfs) = 5.980
Area (sqft) = 1.09
Velocity (ft/s) = 5.47
Wetted Perim (ft) = 2.88
Crit Depth, Yc (ft) = 0.99
Top Width (ft) = 0.93
EGL (ft) = 1.51



Channel Report

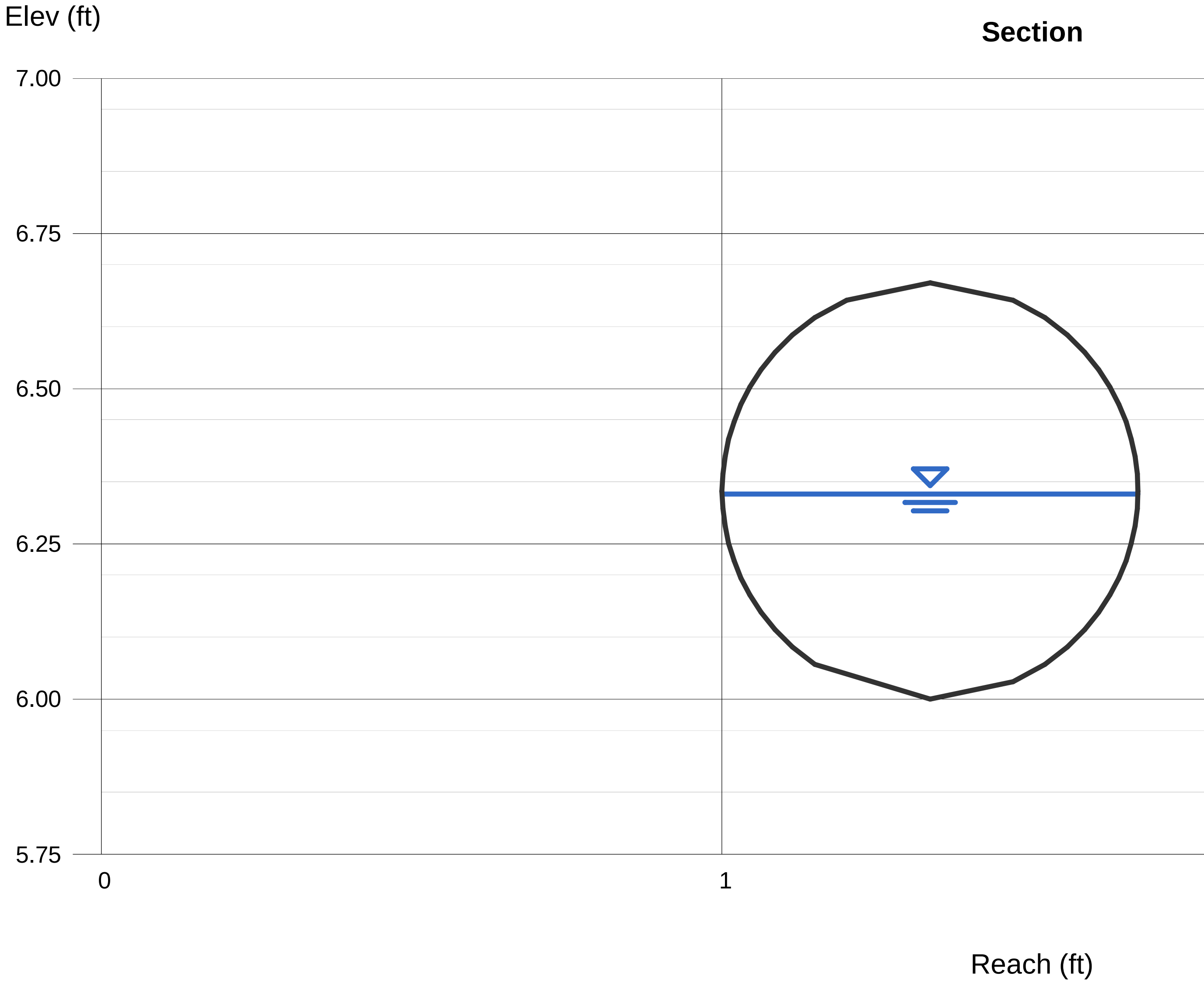
Reach 5 - 8-inch pipe

Circular
Diameter (ft) = 0.67

Invert Elev (ft) = 6.00
Slope (%) = 2.00
N-Value = 0.011

Calculations
Compute by: Known Q
Known Q (cfs) = 1.00

Highlighted
Depth (ft) = 0.33
Q (cfs) = 1.000
Area (sqft) = 0.17
Velocity (ft/s) = 5.75
Wetted Perim (ft) = 1.05
Crit Depth, Yc (ft) = 0.48
Top Width (ft) = 0.67
EGL (ft) = 0.84



Channel Report

Reach 6 - 15-inch pipe

Circular

Diameter (ft) = 1.25

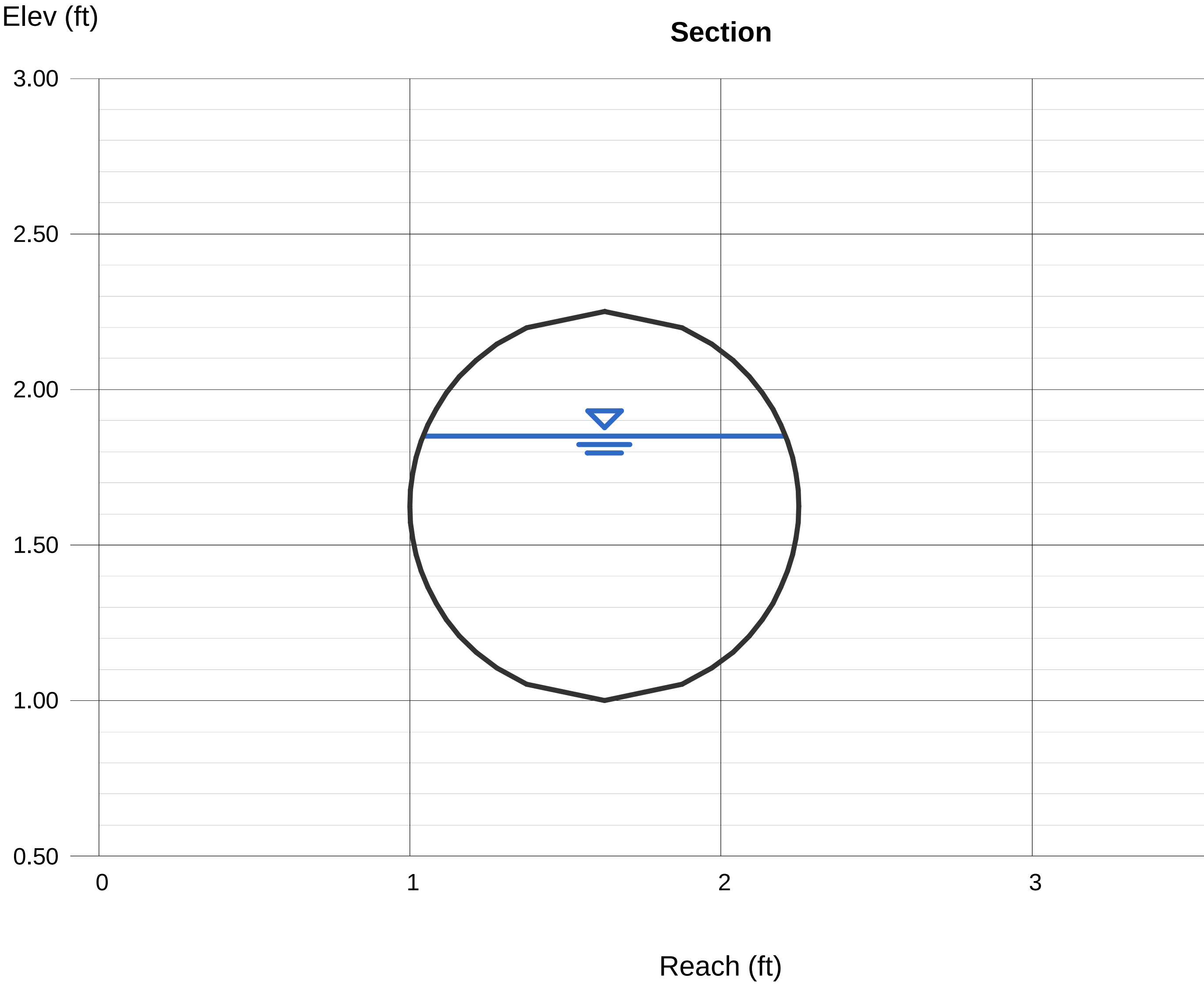
Invert Elev (ft) = 1.00
Slope (%) = 1.56
N-Value = 0.011

Calculations

Compute by: Known Q
Known Q (cfs) = 7.63

Highlighted

Depth (ft) = 0.85
Q (cfs) = 7.630
Area (sqft) = 0.89
Velocity (ft/s) = 8.58
Wetted Perim (ft) = 2.42
Crit Depth, Yc (ft) = 1.10
Top Width (ft) = 1.17
EGL (ft) = 1.99



Channel Report

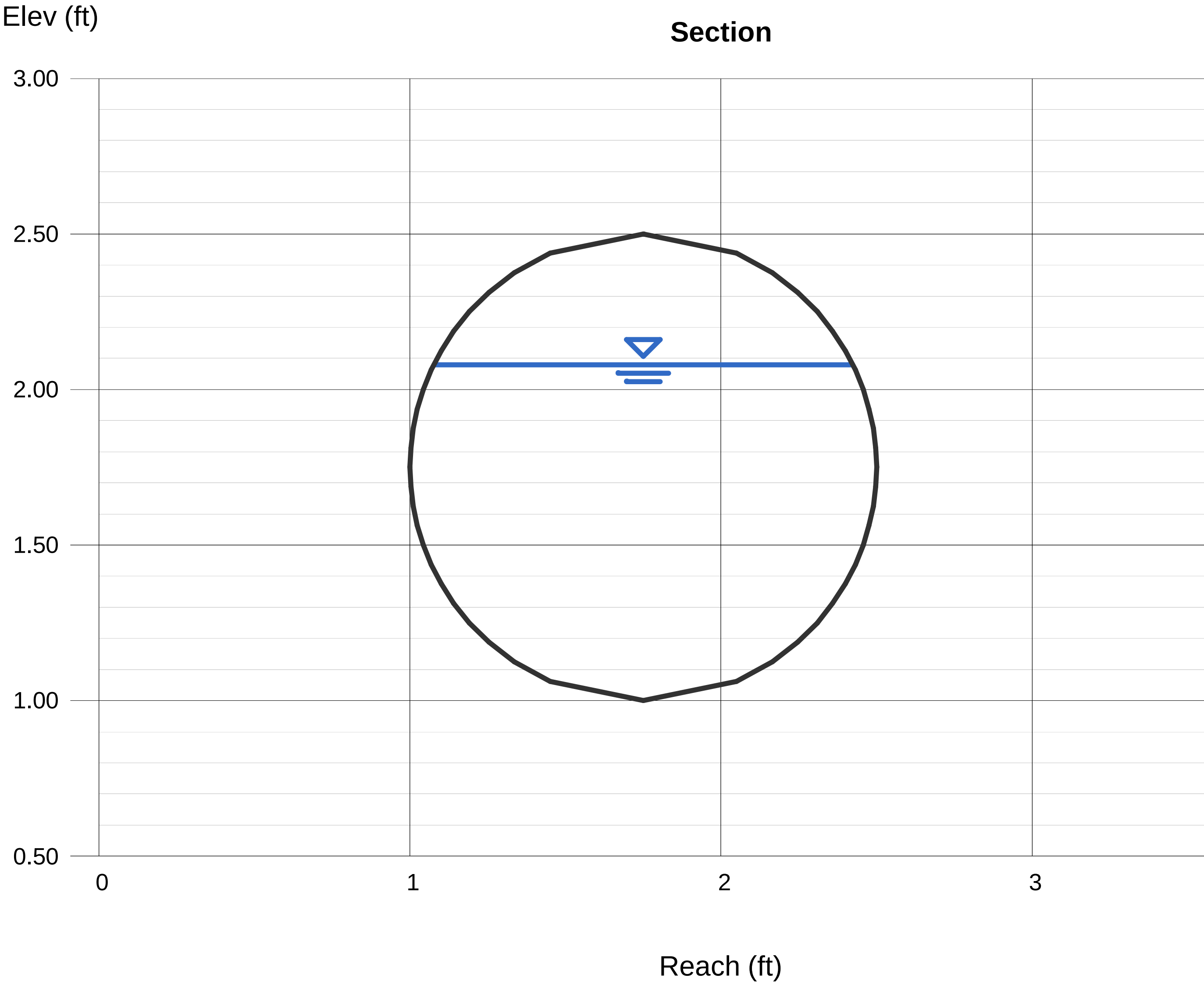
Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc.

Wednesday, Aug 23 2017

Reach 7 - 18-inch pipe

Circular	
Diameter (ft)	= 1.50
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.011
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 7.63

Highlighted	
Depth (ft)	= 1.08
Q (cfs)	= 7.630
Area (sqft)	= 1.37
Velocity (ft/s)	= 5.59
Wetted Perim (ft)	= 3.04
Crit Depth, Yc (ft)	= 1.07
Top Width (ft)	= 1.34
EGL (ft)	= 1.57



Channel Report

Reach 8 - 12-inch pipe

Circular

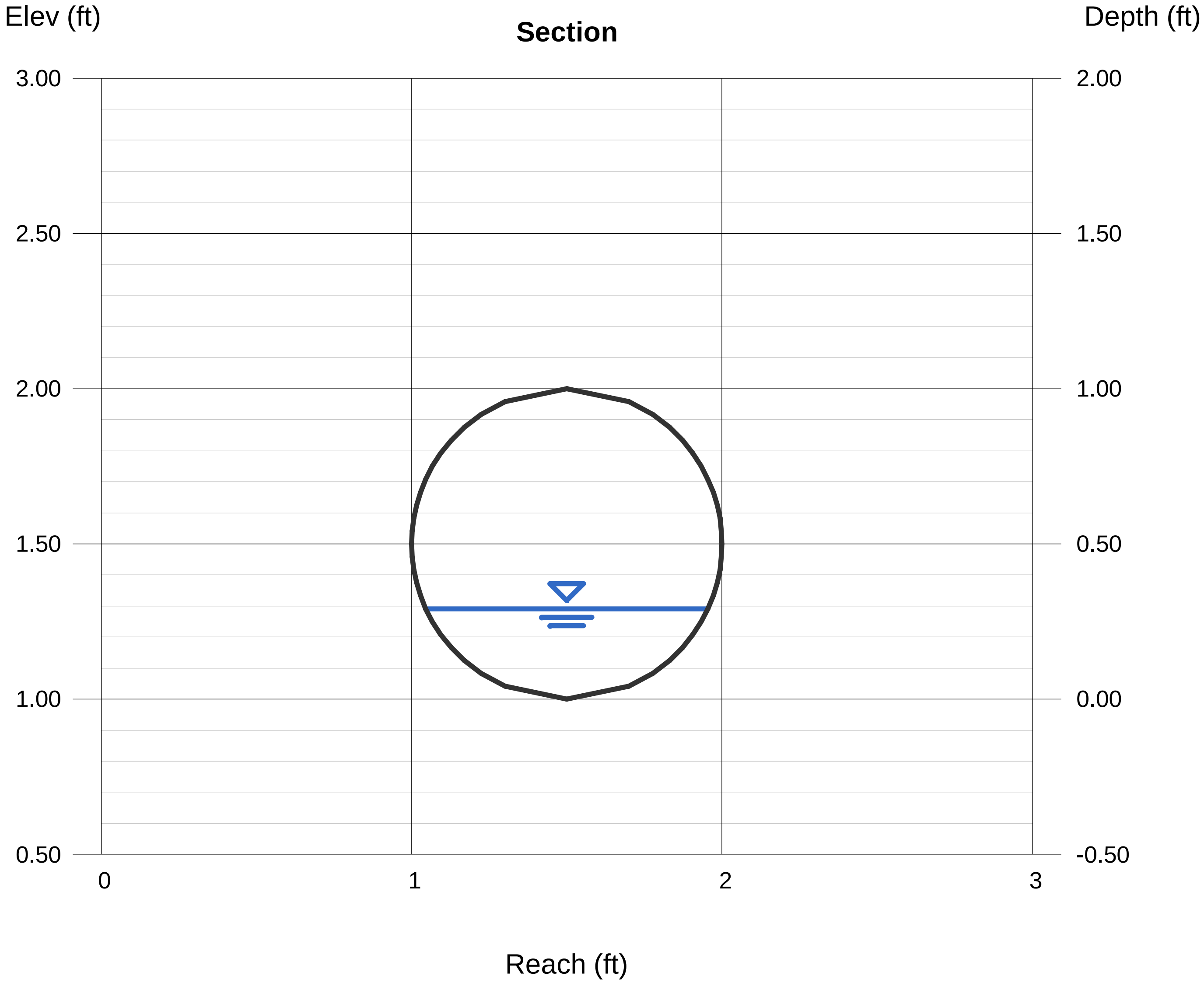
Diameter (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 10.00
N-Value	= 0.011

Calculations

Compute by:	Known Q
Known Q (cfs)	= 2.43

Highlighted

Depth (ft)	= 0.29
Q (cfs)	= 2.430
Area (sqft)	= 0.19
Velocity (ft/s)	= 12.78
Wetted Perim (ft)	= 1.14
Crit Depth, Yc (ft)	= 0.67
Top Width (ft)	= 0.91
EGL (ft)	= 2.83



Channel Report

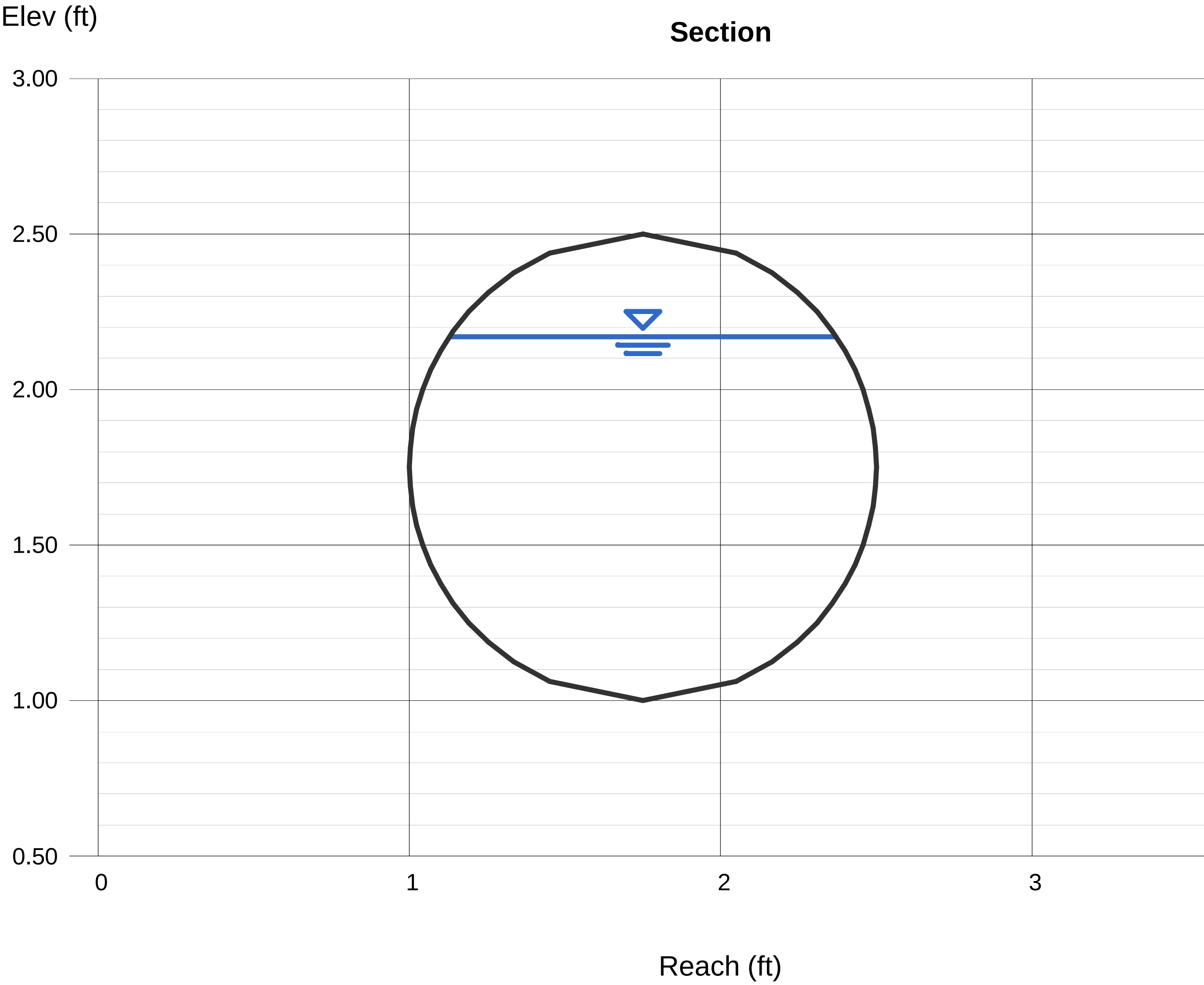
Reach 9 - 18-inch pipe

Circular
Diameter (ft) = 1.50

Invert Elev (ft) = 1.00
Slope (%) = 0.25
N-Value = 0.011

Calculations
Compute by: Known Q
Known Q (cfs) = 5.90

Highlighted
Depth (ft) = 1.17
Q (cfs) = 5.900
Area (sqft) = 1.48
Velocity (ft/s) = 3.98
Wetted Perim (ft) = 3.26
Crit Depth, Yc (ft) = 0.94
Top Width (ft) = 1.24
EGL (ft) = 1.42

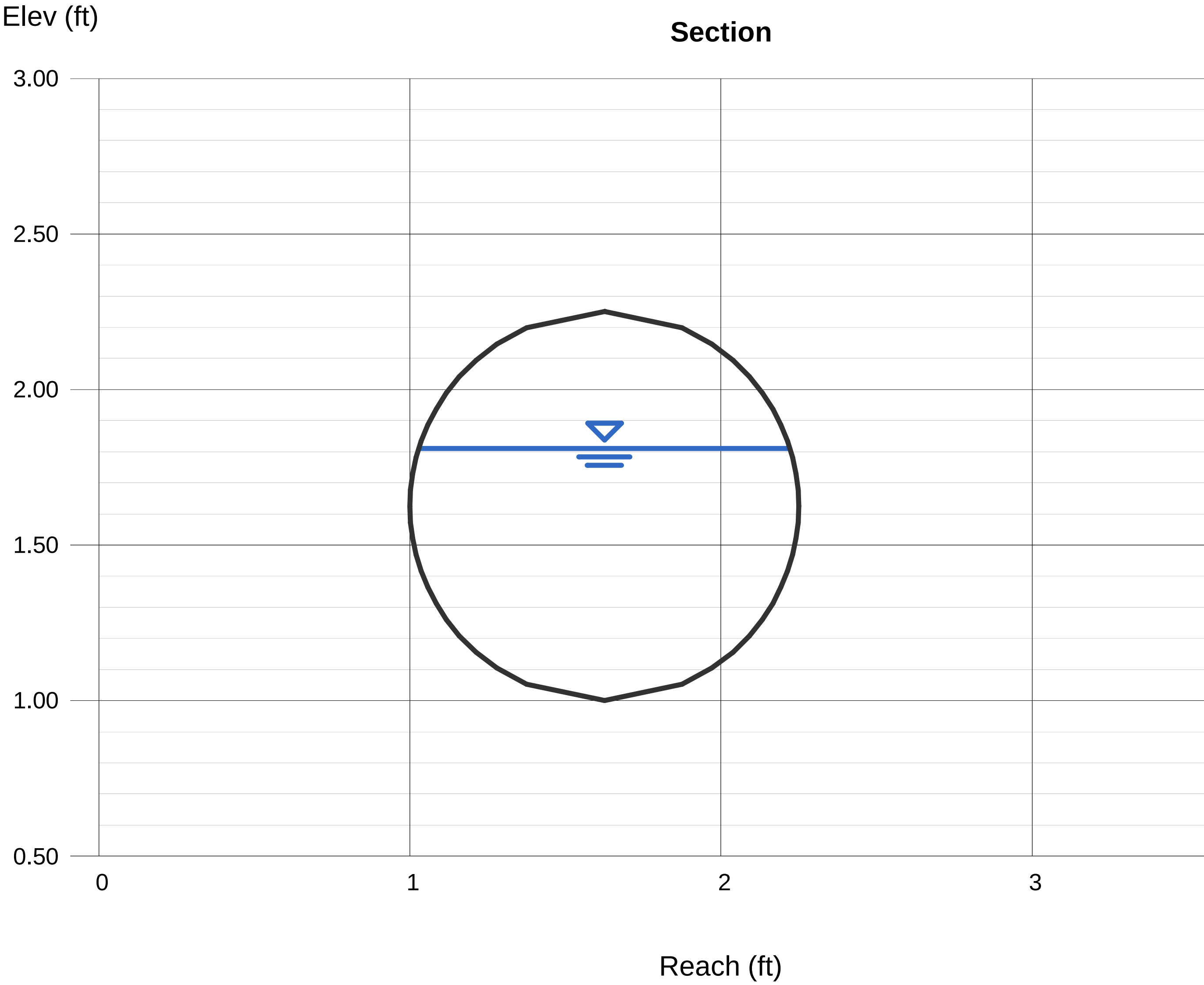


Channel Report

Reach 10 - 15-inch pipe

Circular	
Diameter (ft)	= 1.25
Invert Elev (ft)	= 1.00
Slope (%)	= 1.12
N-Value	= 0.011
Calculations	
Compute by:	Known Q
Known Q (cfs)	= 6.10

Highlighted	
Depth (ft)	= 0.81
Q (cfs)	= 6.100
Area (sqft)	= 0.84
Velocity (ft/s)	= 7.23
Wetted Perim (ft)	= 2.34
Crit Depth, Yc (ft)	= 1.00
Top Width (ft)	= 1.19
EGL (ft)	= 1.62



Inlet Report

Node 102 - Q10=0.93 cfs single 24-inch grate w 50% clog factor

Drop Grate Inlet

Location = Sag
Curb Length (ft) = -0-
Throat Height (in) = -0-
Grate Area (sqft) = 1.00
Grate Width (ft) = 1.00
Grate Length (ft) = 1.00

Gutter

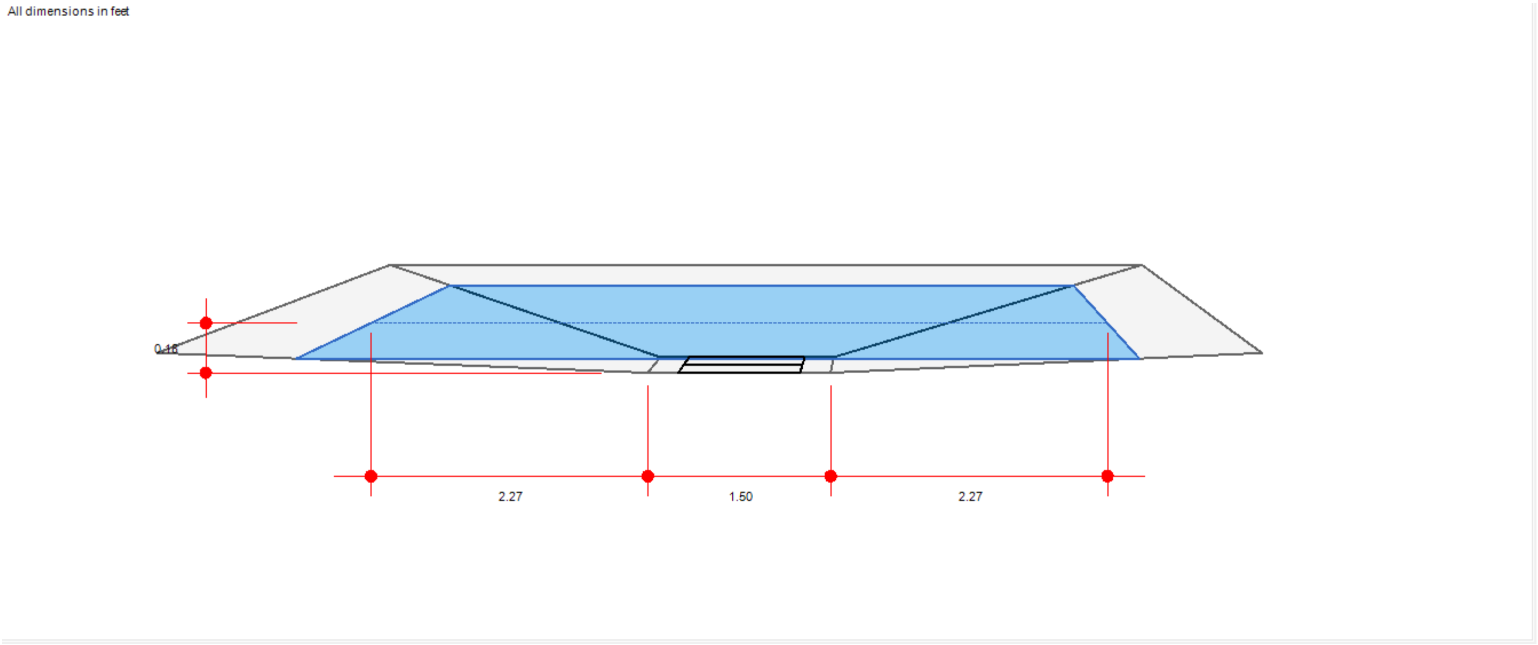
Slope, Sw (ft/ft) = 0.080
Slope, Sx (ft/ft) = 0.080
Local Depr (in) = -0-
Gutter Width (ft) = 1.50
Gutter Slope (%) = -0-
Gutter n-value = -0-

Calculations

Compute by: Known Q
Q (cfs) = 0.93

Highlighted

Q Total (cfs) = 0.93
Q Capt (cfs) = 0.93
Q Bypass (cfs) = -0-
Depth at Inlet (in) = 2.18
Efficiency (%) = 100
Gutter Spread (ft) = 6.04
Gutter Vel (ft/s) = -0-
Bypass Spread (ft) = -0-
Bypass Depth (in) = -0-

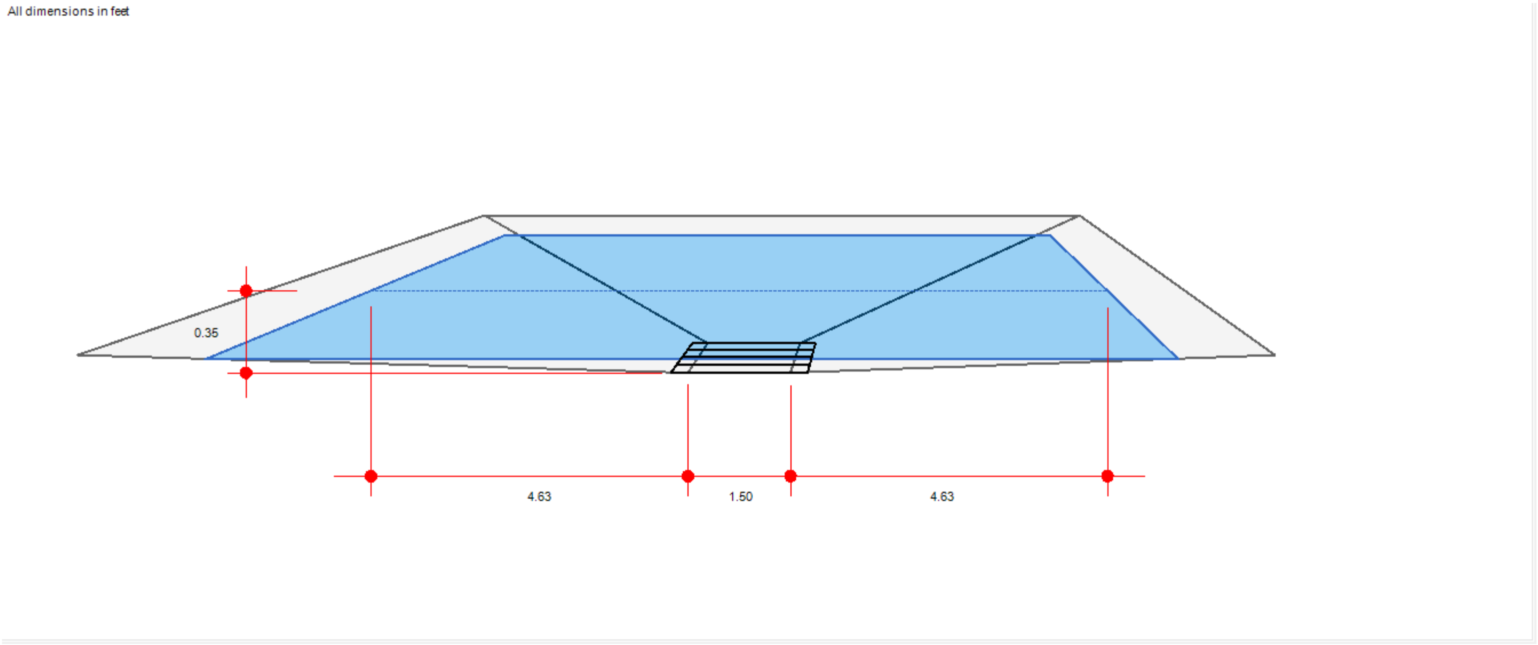


Inlet Report

Hydraflow Express Extension for AutoCAD® Civil 3D® 2013 by Autodesk, Inc. Friday, Jul 21 2017

Node 103 - Q10=4.99 cfs double 24-inch grate w 50% clog factor

Drop Grate Inlet		**Calculations**	
Location	= Sag	Compute by:	Known Q
Curb Length (ft)	= -0-	Q (cfs)	= 4.99
Throat Height (in)	= -0-		
Grate Area (sqft)	= 2.00	**Highlighted**	
Grate Width (ft)	= 2.00	Q Total (cfs)	= 4.99
Grate Length (ft)	= 2.00	Q Capt (cfs)	= 4.99
		Q Bypass (cfs)	= -0-
Gutter		Depth at Inlet (in)	= 4.21
Slope, Sw (ft/ft)	= 0.080	Efficiency (%)	= 100
Slope, Sx (ft/ft)	= 0.080	Gutter Spread (ft)	= 10.77
Local Depr (in)	= -0-	Gutter Vel (ft/s)	= -0-
Gutter Width (ft)	= 1.50	Bypass Spread (ft)	= -0-
Gutter Slope (%)	= -0-	Bypass Depth (in)	= -0-
Gutter n-value	= -0-		



Inlet Report

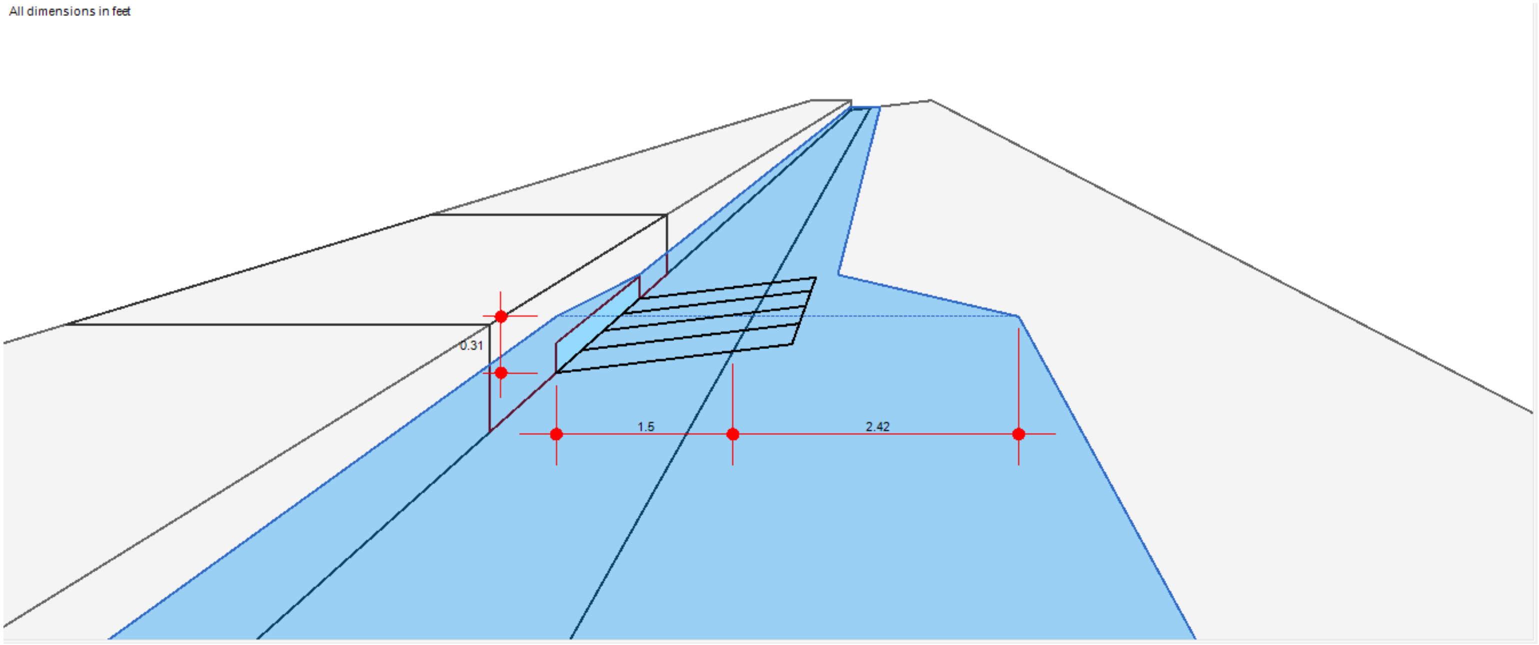
Node 105 - Q10=2.43 cfs double 24-inch grate w 50% clog factor

Combination Inlet
Location = On grade
Curb Length (ft) = 2.00
Throat Height (in) = 0.10
Grate Area (sqft) = -0-
Grate Width (ft) = 2.00
Grate Length (ft) = 2.00

Gutter
Slope, Sw (ft/ft) = 0.080
Slope, Sx (ft/ft) = 0.080
Local Depr (in) = -0-
Gutter Width (ft) = 1.50
Gutter Slope (%) = 1.50
Gutter n-value = 0.016

Calculations
Compute by: Known Q
Q (cfs) = 2.43

Highlighted
Q Total (cfs) = 2.43
Q Capt (cfs) = 1.88
Q Bypass (cfs) = 0.55
Depth at Inlet (in) = 3.77
Efficiency (%) = 77
Gutter Spread (ft) = 3.92
Gutter Vel (ft/s) = 3.94
Bypass Spread (ft) = 2.25
Bypass Depth (in) = 2.16



Inlet Report

Node 106 - 24-inch Grates - Q100 ≅ 10 cfs - Each of 4 Sumps ≅ 2.56 cfs

Drop Grate Inlet

Location = Sag

Curb Length (ft) = -0-

Throat Height (in) = -0-

Grate Area (sqft) = 1.00

Grate Width (ft) = 1.00

Grate Length (ft) = 1.00

Gutter

Slope, Sw (ft/ft) = 0.080

Slope, Sx (ft/ft) = 0.080

Local Depr (in) = -0-

Gutter Width (ft) = 1.50

Gutter Slope (%) = -0-

Gutter n-value = -0-

Calculations

Compute by: Known Q

Q (cfs) = 2.50

Highlighted

Q Total (cfs) = 2.50

Q Capt (cfs) = 2.50

Q Bypass (cfs) = -0-

Depth at Inlet (in) = 4.21

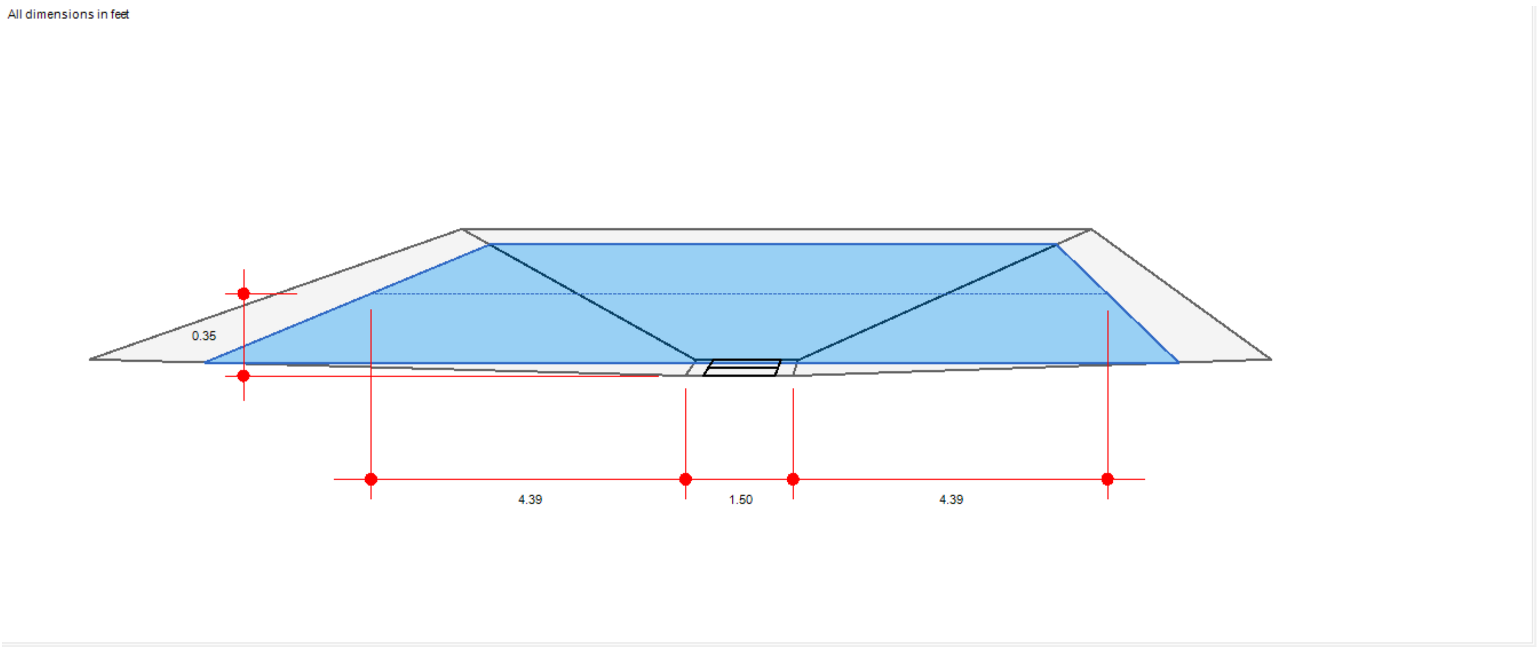
Efficiency (%) = 100

Gutter Spread (ft) = 10.28

Gutter Vel (ft/s) = -0-

Bypass Spread (ft) = -0-

Bypass Depth (in) = -0-



Inlet Report

Node 202 Sump Inlet 2-24-inch Grates

Drop Grate Inlet

Location = Sag
Curb Length (ft) = -0-
Throat Height (in) = -0-
Grate Area (sqft) = 4.00
Grate Width (ft) = 2.00
Grate Length (ft) = 2.00

Gutter

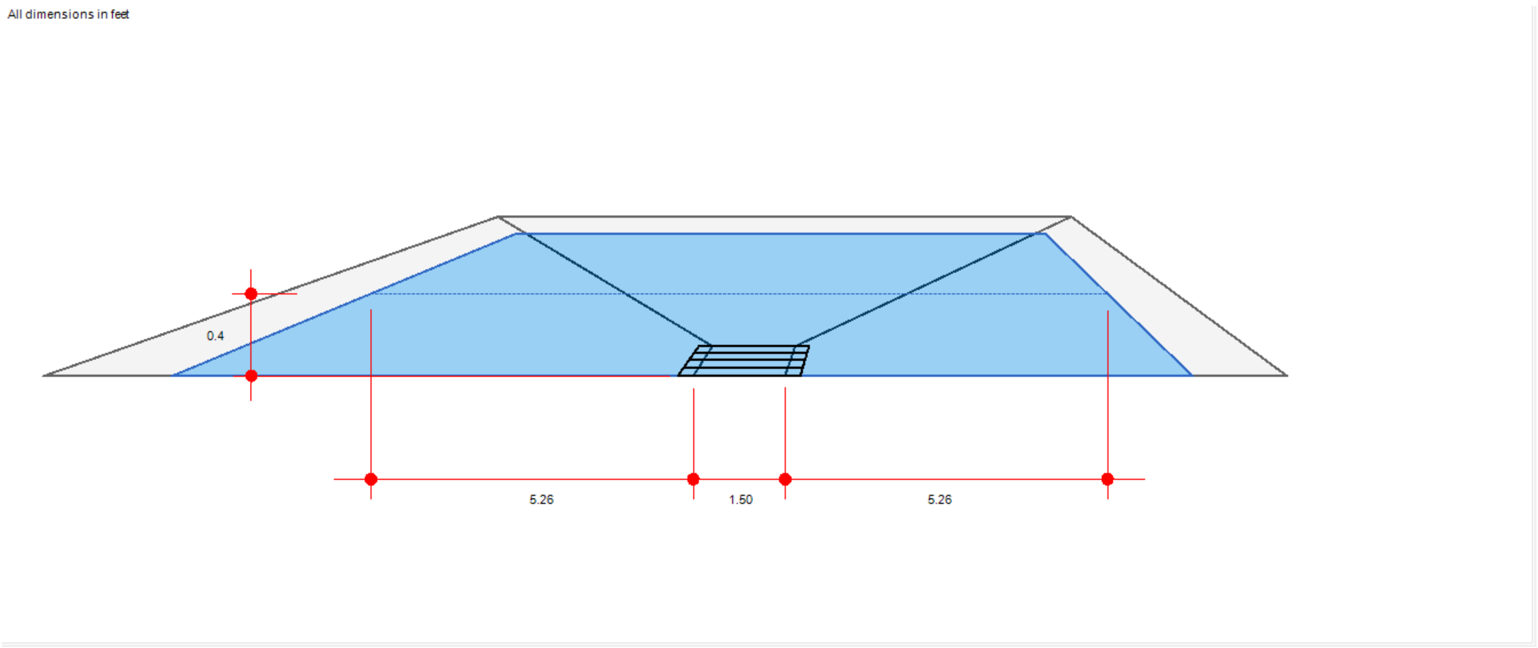
Slope, Sw (ft/ft) = 0.080
Slope, Sx (ft/ft) = 0.080
Local Depr (in) = -0-
Gutter Width (ft) = 1.50
Gutter Slope (%) = -0-
Gutter n-value = -0-

Calculations

Compute by: Known Q
Q (cfs) = 6.10

Highlighted

Q Total (cfs) = 6.10
Q Capt (cfs) = 6.10
Q Bypass (cfs) = -0-
Depth at Inlet (in) = 4.81
Efficiency (%) = 100
Gutter Spread (ft) = 12.03
Gutter Vel (ft/s) = -0-
Bypass Spread (ft) = -0-
Bypass Depth (in) = -0-



Inlet Report

Node 204 Sump Inlet 2-24-inch Grates

Drop Grate Inlet

Location = Sag
Curb Length (ft) = -0-
Throat Height (in) = -0-
Grate Area (sqft) = 4.00
Grate Width (ft) = 2.00
Grate Length (ft) = 2.00

Gutter

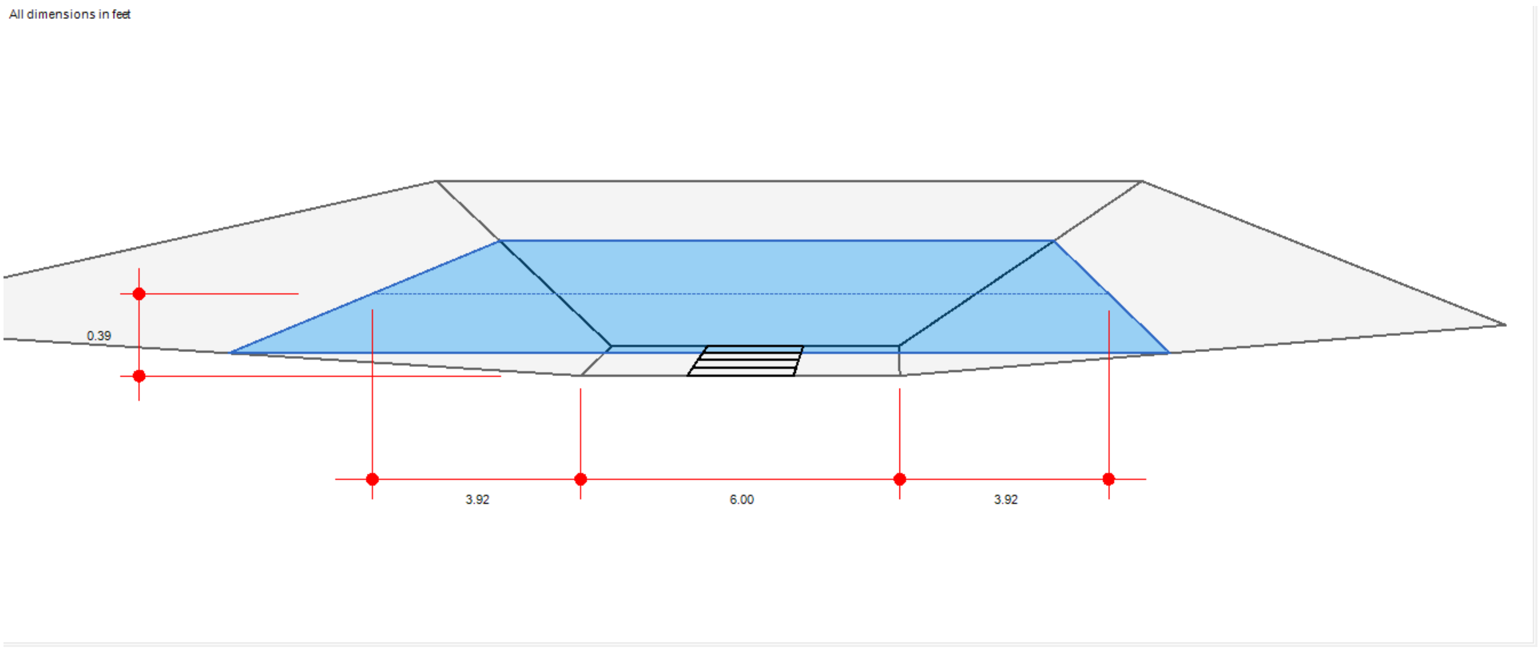
Slope, Sw (ft/ft) = 0.100
Slope, Sx (ft/ft) = 0.100
Local Depr (in) = -0-
Gutter Width (ft) = 6.00
Gutter Slope (%) = -0-
Gutter n-value = -0-

Calculations

Compute by: Known Q
Q (cfs) = 5.90

Highlighted

Q Total (cfs) = 5.90
Q Capt (cfs) = 5.90
Q Bypass (cfs) = -0-
Depth at Inlet (in) = 4.71
Efficiency (%) = 100
Gutter Spread (ft) = 13.84
Gutter Vel (ft/s) = -0-
Bypass Spread (ft) = -0-
Bypass Depth (in) = -0-

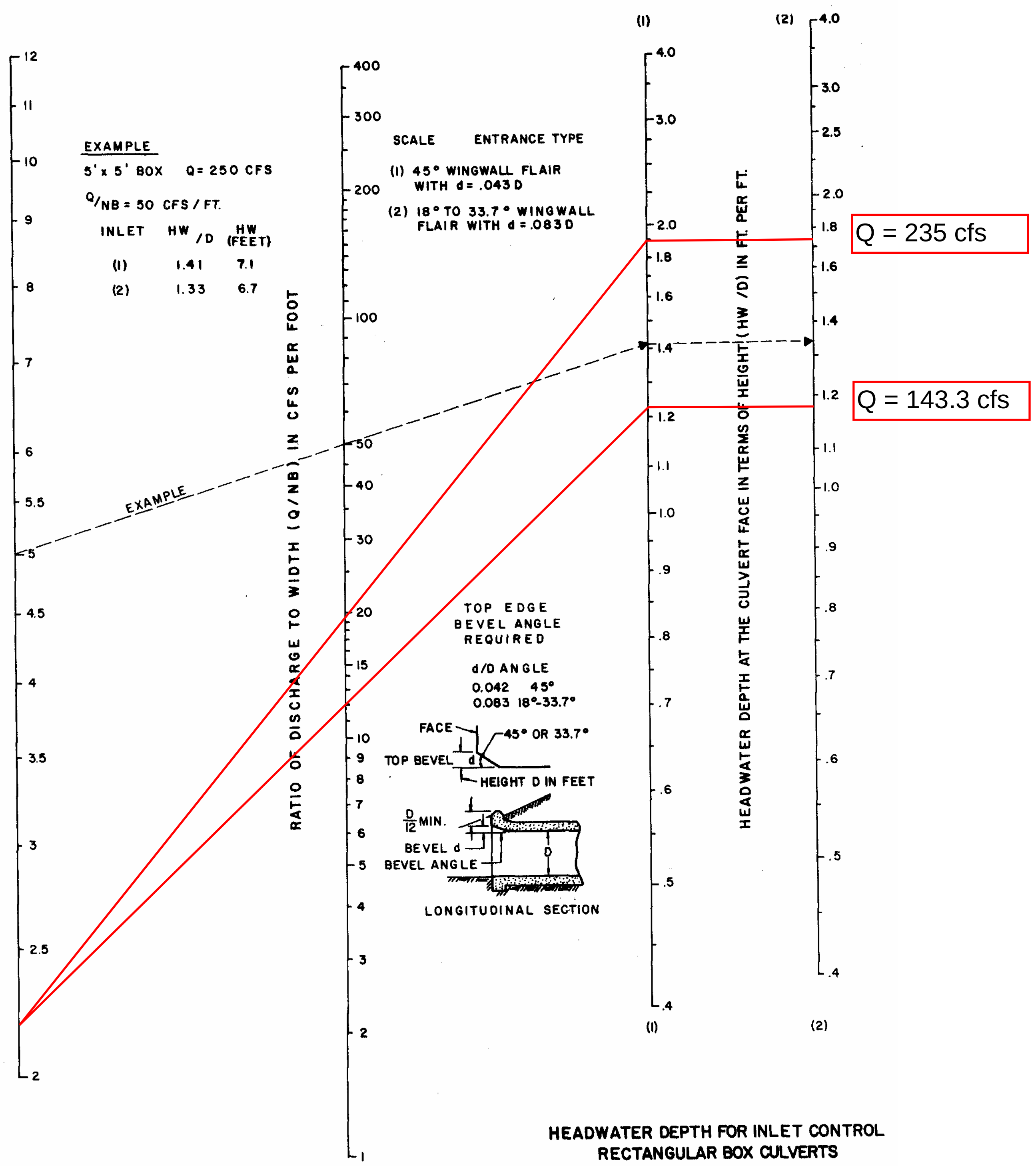


APPENDIX 5

Hydraulics (Culvert)

Caltrans Existing Triple Box Culvert
Inlet Control Calculations

CHART 9B

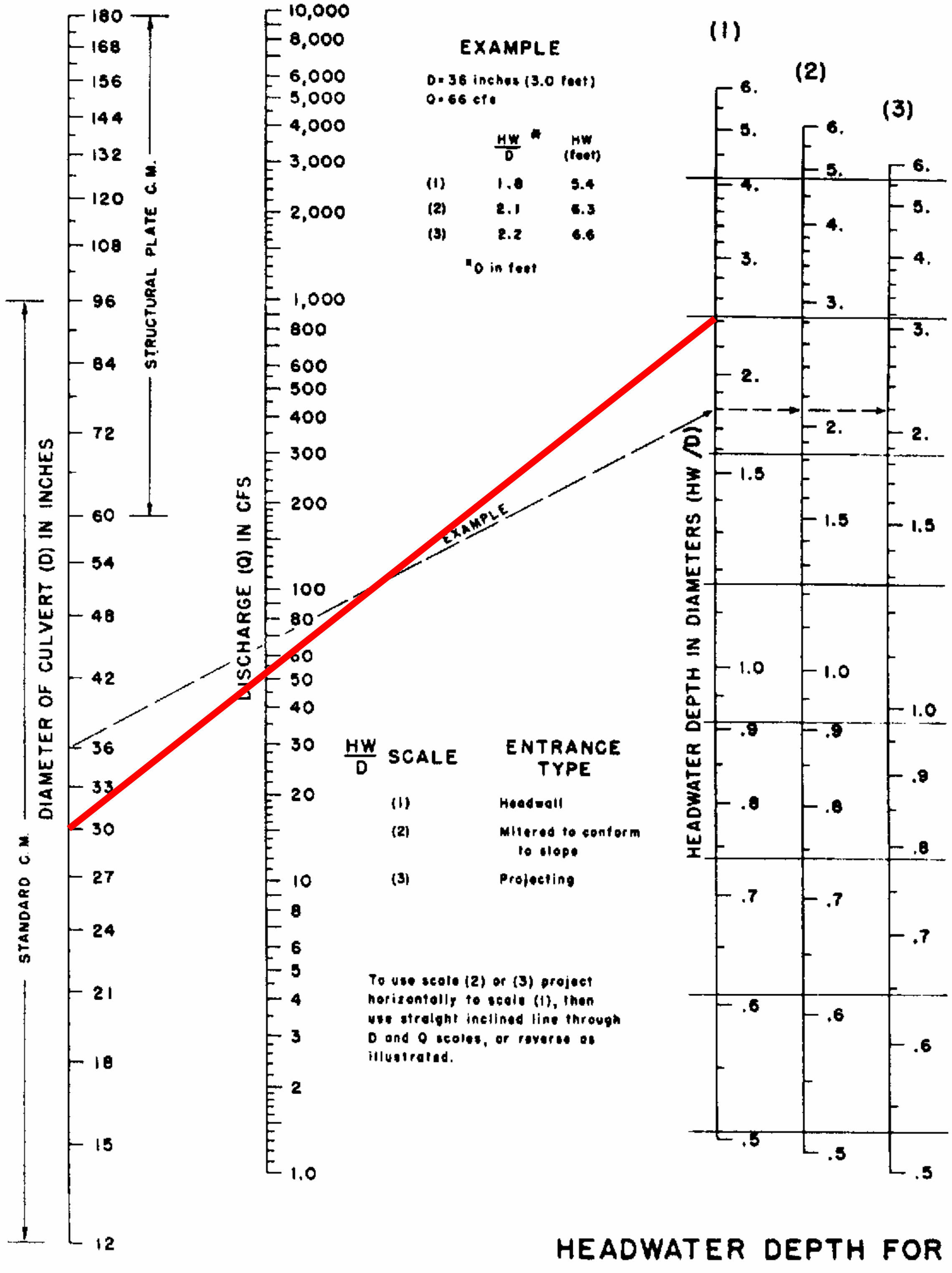


HEADWATER DEPTH FOR INLET CONTROL
RECTANGULAR BOX CULVERTS
FLARED WINGWALLS 18° TO 33.7° & 45°
WITH BEVELED EDGE AT TOP OF INLET

HW = 813.5' - 807.5' = 6.0'
D = 30" = 2.5'
HW/D = 2.4
Q > 45 cfs

Bypass Storm Drain System
Inlet Control Calculations

CHART 2B



HEADWATER DEPTH FOR
C. M. PIPE CULVERTS
WITH INLET CONTROL

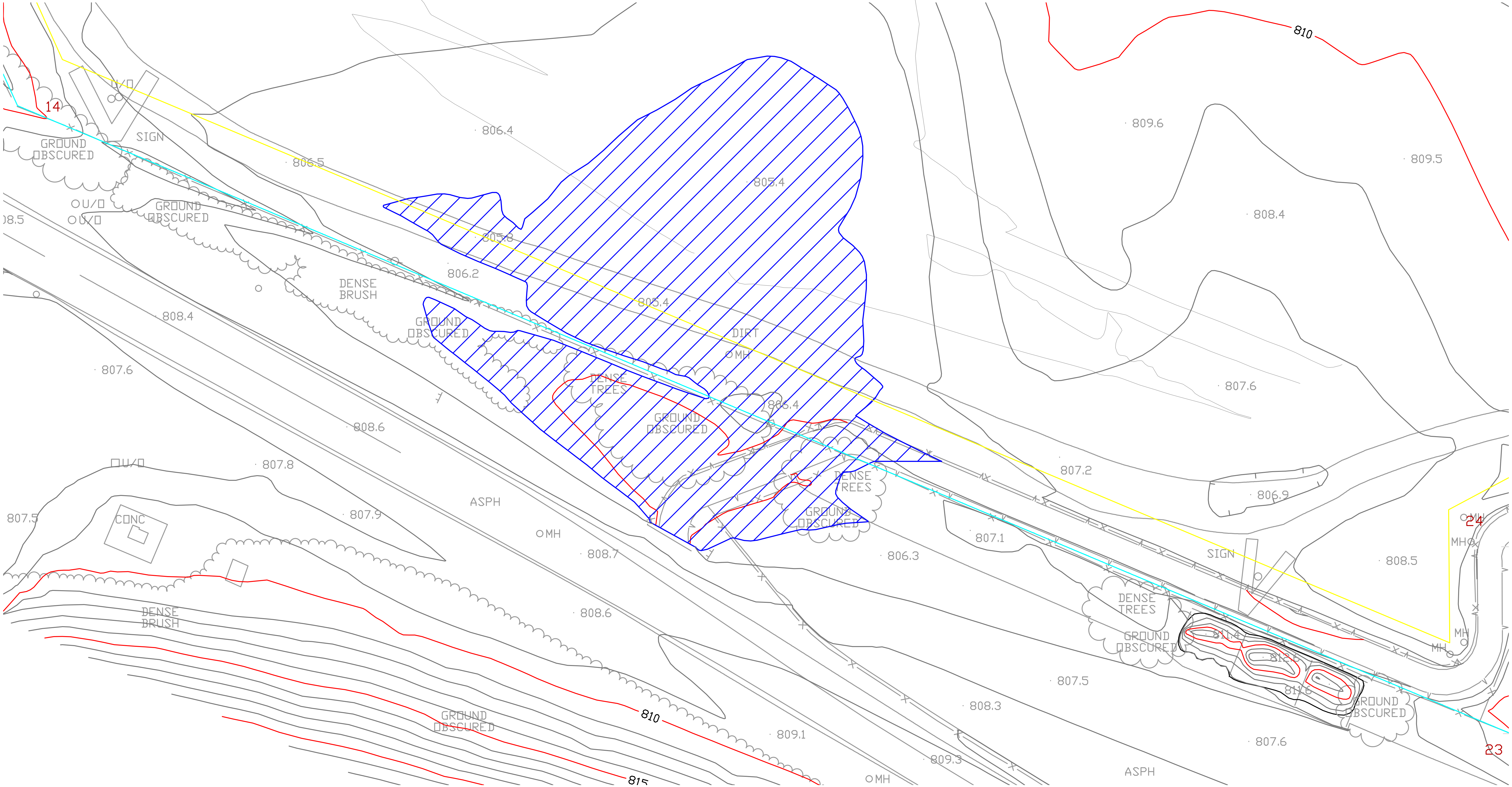
BUREAU OF PUBLIC ROADS JAN. 1963

```
*************************************
Water Surface Profile Gradient (WSPG)
XP WSPG
Engine Version 3.0         30/09/2011
XP Solutions        www.xpsolutions.com
*************************************


INPUT FILE
*************************************
X:\Projects2\156 (Steve Sommers)\16 (On Call As Needed)\Projects\Newcastle Eastvale\03 Analysis\H&H\XP\Culvert.wsx
Computed  10/13/17  11:59:49

TITLE INFORMATION
*************************************


WARNING SUMMARY
*************************************


RESULTS
*************************************




==============================================================
   Main Line
==============================================================

 Composite Profile:

ELEMENT    TYPE       STATION    INVERT   GROUND   W.S.      DEPTH    Q   BARREL VELOC.  VELOC. ENERGY     SUPER   CRITICAL FROUDE  SLOPE    NORMAL   CROSS
NAME                             ELEV     ELEV     ELEV                                    HEAD   GRADE LN   ELEV    DEPTH    NUMBER           DEPTH    SECTION
---------- ---------- ---------- -------- -------- --------  -------- ---------- ------- ------ ---------- ------  -------- ------  -------  ------   ---------
###
"Node2"    Outlet     0.00       801.07   805.50   *806.750  5.680   45.00   1   9.17    1.30   808.05     0.000   2.226    0.000   0.00000  0.000    Circular Pipe
"Link1"    Reach      28.84      801.36   0.00     *807.164  5.804   45.00   1   9.17    1.30   808.47     0.000   2.226    0.000   0.01006  1.900    Circular Pipe
"Link2"    Reach      49.01      801.56   0.00     *807.423  5.863   45.00   1   9.17    1.30   808.73     0.000   2.226    0.000   0.00992  1.912    Circular Pipe
"Link3"    Reach      245.71     803.53   0.00     *809.119  5.589   45.00   1   9.17    1.30   810.42     0.000   2.226    0.000   0.01002  1.903    Circular Pipe
"Link4"    Reach      297.99     804.05   0.00     *809.796  5.746   45.00   1   9.17    1.30   811.10     0.000   2.226    0.000   0.00995  1.909    Circular Pipe
"Link5"    Reach      643.25     807.50   813.50   812.771   5.271    45.00   1   9.17    1.30   814.08     0.000   2.226    0.000   0.00999  1.905    Circular Pipe
"Node6"    Headwrk    643.25     807.50   813.50   812.771   5.271    45.00   1   9.17    1.30   814.08     0.000   2.226    0.000   0.00000  0.000    Circular Pipe

 *) in the W.S.ELEV column indicates flooding, it is set whenever W.S.ELEV > GROUND ELEV
    i.p. = intermediate point processing results for reaches
```

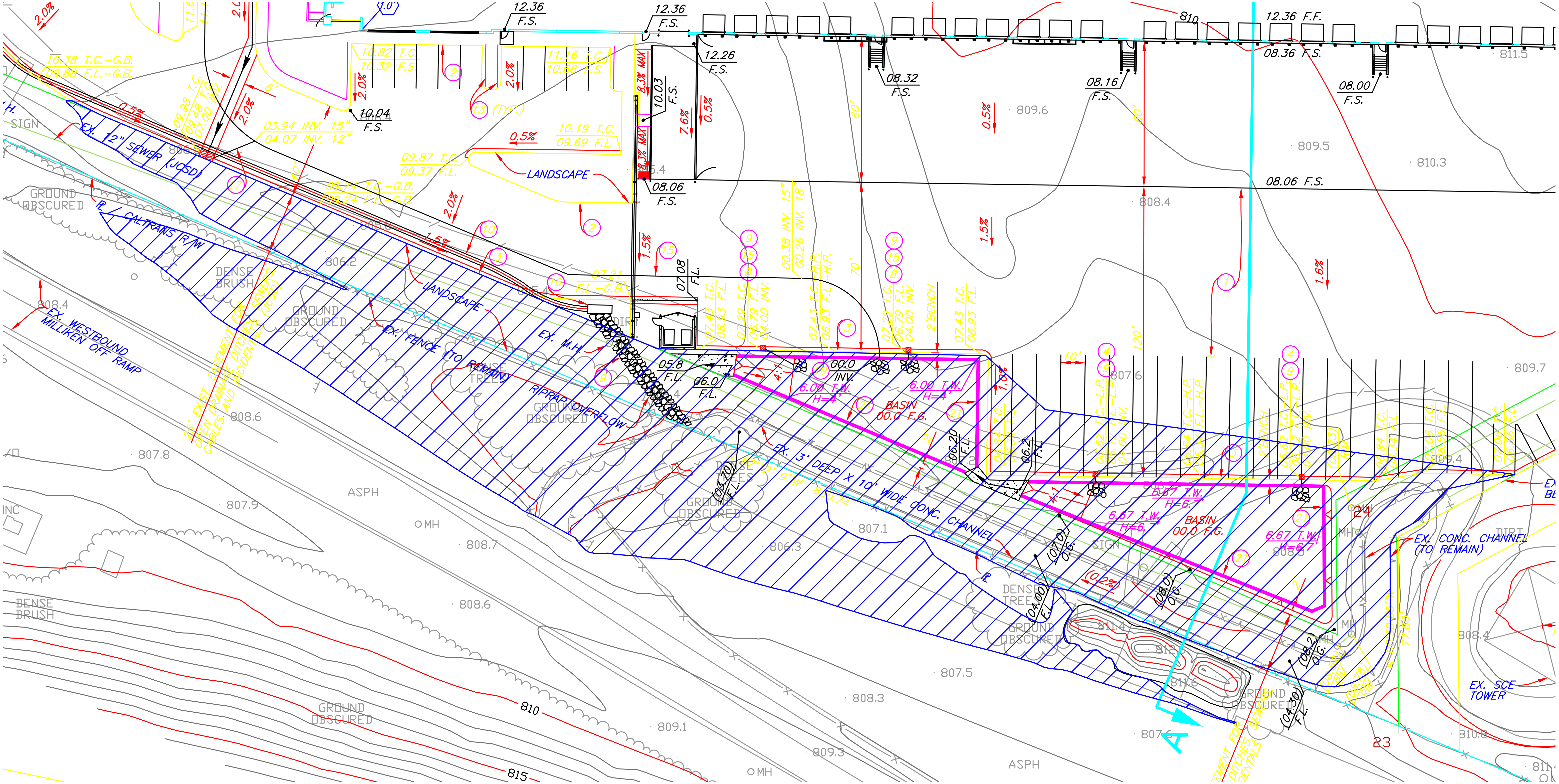
APPENDIX 6

Inundation Exhibit

Historical Condition
Q100 = 143.3 cfs



Build-Out Condition
Q100 = 235 cfs



APPENDIX 7

County of Riverside Drawing No. 901-PP

GENERAL NOTES

1. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF THE RIVERSIDE COUNTY TRANPORTATION DEPARTMENT IMPROVEMENT STANDARDS AND SPECIFICATIONS, LATEST EDITION, COUNTY ORDINANCE NO. 461 AND SUBSEQUENT AMENDMENTS.
2. THE DEVELOPER SHALL INSTALL STREET NAME SIGNS, IF ANY, CONFORMING TO COUNTY STANDARD NO. 816.
3. IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER/OWNER OR CONTRACTOR TO APPLY TO THE RIVERSIDE COUNTY TRANSPORTATION DEPARTMENT, PERMIT SECTION, FOR AN ENCROACHMENT PERMIT WITHIN PUBLIC RIGHT-OF-WAY, DEDICATED AND ACCEPTED FOR PUBLIC USE; AND TO BE RESPONSIBLE FOR SATISFACTORY COMPLIANCE FOR ALL CURRENT ENVIRONMENTAL REGULATIONS DURING THE LIFE OF CONSTRUCTION ACTIVITIES FOR THIS PROJECT. ADDITIONAL STUDIES AND/OR PERMITS MAY BE REQUIRED.
4. IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER OR CONTRACTOR TO APPLY TO STATE OF CA DEPARTMENT OF TRANSPORTATION (CALTRANS) FOR AN ENCROACHMENT PERMIT FOR ALL WORK PERFORMED WITHIN THE STATE RIGHT OF WAY.
5. IT SHALL BE THE RESPONSIBILITY OF THE DEVELOPER TO NOTIFY THE ENGINEER. TO INSTALL STREET CENTERLINE MONUMENTS AS REQUIRED BY RIVERSIDE COUNTY ORDINANCE NO. 461.
6. ALL UNDERGROUND FACILITIES. WITH LATERALS. SHALL BE IN PLACE PRIOR TO PAVING STREET SECTION INCLUDING, BUT NOT LIMITED TO. THE FOLLOWING: SEWER. WATER. ELECTRIC. GAS. STORM DRAINS.
7. ALL STREET SECTIONS ARE TENTATIVE. ADDITIONAL SOIL TESTS SHALL BE TAKEN AFTER ROUGH GRADING TO DETERMINE THE EXACT STREET SECTION REQUIREMENTS. USE STANDARD NO. 401 IF EXPANSIVE SOILS ARE ENCOUNTERED.
8. "ASPHALTIC EMULSION" (FOG SEAL) SHALL BE APPLIED NOT LESS THAN FOURTEEN DAYS FOLLOWING PLACEMENT OF THE ASPHALT SURFACING AND SHALL BE APPLIED AT A RATE OF 0.05 GALLON PER SQUARE YARD. ASPHALTIC EMULSION SHALL CONFORM TO SECTIONS 37. 39 AND 94 OF THE STATE STANDARD SPECIFICATIONS.
9. STREET LIGHTS SHALL BE INSTALLED IN ACCORDANCE WITH THE APPROVED STREET LIGHTING PLAN.
10. INSTALL STREET TREES IN ACCORDANCE WITH ORDINANCE NO. 460 AND 499, IF REQUIRED.
11. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE CLEARING OF THE PROPOSED WORK AREA AND RELOCATION COSTS OF ALL EXISTING UTILITIES. PERMITTEE MUST INFORM THE COUNTY OF CONSTRUCTION SCHEDULE AT LEAST 48 HOURS PRIOR TO BEGINNING OF CONSTRUCTION. PHONE: (909) 275-6790.
12. ALL PROPOSED STRIPING. PAVEMENT MARKINGS AND SIGNING SHALL BE IN ACCORDANCE WITH THE CALTRANS TRAFFIC MANUAL. STANDARD SPECIFICATIONS AND STANDARD PLANS.
13. CURB DEPRESSIONS AND DRIVEWAY APPROACHES WILL BE INSTALLED AND CONSTRUCTED ACCORDING TO COUNTY STD. NO. 207. AS DIRECTED IN THE FIELD.
14. ACCESS CONTROL WILL BE MANTAINED AT ALL TIMES (WORK INSIDE STATE RIGHT-OF-WAY MUST BE FENCED OFF WITH NO ACCESS TO WORK AREA FROM FREEWAY).
15. ALL FENCE RELOCATED TO FACILITATE CONSTRUCTION OF THIS PROJECT INSIDE STATE RIGHT-OF-WAY SHALL BE REPLACED WITH CL-6 FENCE TO STATE STANDARDS. OR BLOCK WALL AS PER RIVERSIDE COUNTY STANDARDS.
16. ALL WORK IN THE STATE RIGHT-OF-WAY WILL BE TO THE 1988 STATE STANDARD PLANS AND SPECIFICATIONS. OR AS DIRECTED BY THE STATE'S REPRESENTATIVE.
17. NO EQUIPMENT OR MATERIALS MAY BE STORED IN THE STATE RIGHT-OF-WAY.
18. ALL DISTURBED AREAS IN THE STATE RIGHT-OF-WAY MUST BE TREATED FOR EROSION CONTROL (HYDROSEEDING OR EQUIVALENT).
19. THE RESPONSIBILITY FOR MANTAINING EROSION CONTROL WILL NOT BE RELEASED. UNTIL THE SEEDING IS WELL ESTABLISHED. THE CONTRACTOR WILL BE RESPONSIBLE FOR THE COST OF CALTRANS CLEANING ANY SILTED UP DRAINAGE STRUCTURES AND CHANNELS RESULTING FROM. OR CAUSED BY. THE CONSTRUCTION PROJECT.
20. NO FREEWAY RAMPS OR FREEWAY LANES MAY BE CLOSED OR OBSTRUCTED AT ANY TIME. UNLESS SPECIFICATIONS ALLOWED IN THE ENCHROACHMENT PERMIT. AND/OR AS DIRECTED BY THE STATE'S REPRESENTITIVE.
21. AN ENCROACHMENT PERMIT IS REQUIRED BEFORE ANY WORK MAY BEGIN IN AND/OR NEAR THE STATE'S RIGHT-OF-WAY.
22. WHERE SURVEY MONUMENTS EXIST. SUCH MONUMENTS SHALL BE PROTECTED OR SHALL BE REFERENCED AND RESET. PURSUANT TO BUSINESS AND PROFESSIONS CODE. SECTIONS 8700 TO 8805 (LAND SURVEYOR'S ACT).
23. WHERE TYPE CL-6 (CHAIN LINK) DOES NOT EXIST. THE RIGHT-OF-WAY FENCE MUST UPGRADED TO STATE STANDARD PLANS TYPE CL-6 FENCE.
24. THE STATE DRAINAGE STRUCTURE WHICH IS TO BE CONNECTED TO. MUST FIRST BE COMPLETELY CLEANED OF DEBRIS. AND/OR SILT. PRIOR TO MAKING CONNECTION. THIS WORK IS TO BE PERFORMED AT NO COST TO THE STATE.
25. THE CONTRACTOR SHALL BE RESPONSIBLE FOR INSURING THAT STATE DRAINAGE FACILITY IS CLEAN AND OPERATIONAL PRIOR TO FINAL ACCEPTANCE OF PERMIT WORK BY THE STATE. ADEQUATE CLEANOUTS AND ACCESS OPENINGS SHALL BE PROVIDED FOR FUTURE MAINTENANCE AND REPAIR WORK. AS NEEDED. ALL THIS WORK SHALL BE FURNISHED AT NO COST TO THE STATE.
26. ALL SIGNS. ROADSIDE MARKERS. ELECTROLIERS. ETC.. SHALL BE PROTECTED AND/OR REPLACED IN KIND TO THE CURRENT STATE STANDARD PLANS AND CURRENT TRAFFIC MANUAL. AT NO COST TO THE STATE.
27. "AS DETERMINED BY THE TRANSPORTATION DIRECTOR. THE DEVELOPER IS RESPONSIBLE AS A MINIMUM FOR ROAD IMPROVEMENTS TO CENTERLINE AND MAY BE REQUIRED TO RECONSTRUCT EXISTING PAVEMENT. INCLUDING BASE. AND MATCHING OVERLAY REQUIRED TO MEET THE STRUCTURAL STANDARDS FOR THE CURRENT ASSIGNED TRAFFIC INDEX."
28. ONLY LANDSCAPING CONSISTING OF GRASS AND PARKWAY TREES MAY BE INSTALLED WITHIN PARKWAYS ON LOCAL RESIDENTIAL STREETS WITHOUT SEPARATE LANDSCAPE PLANS. ALL OTHER TYPES OF LANDSCAPING IN THESE AREAS. AND ALL OTHER LANDSCAPING ON ALL OTHER STREETS SHALL REQUIRE SEPARATE LANDSCAPE PLANS. ALL LANDSCAPING ENCROACHMENTS SHALL CONFORM TO RIVERSIDE COUNTY "STANDARDS RELATING TO THE ADMINISTRATION OF LANDSCAPE ENCROACHMENTS" DATED JUNE 1990.
29. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR OR DEVELOPER TO INSTALL AND MAINTAIN ALL CONSTRUCTION, REGULATORY, GUIDE AND WARNING SIGNS WITHIN THE PROJECT LIMITS AND IT'S SURROUNDINGS AND TO PROVIDE SAFE PASSAGE FOR THE TRAVELING PUBLIC AND WORKER'S UNTIL THE FINAL COMPLETION AND ACCEPTANCE OF THE PROJECT BY THE COUNTY.
30. AFTER OCTOBER 1, 1992, CONSTRUCTION PROJECTS THAT DISTURB MORE THAN FIVE ACRES MUST OBTAIN A NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT. OWNER'S AND DEVELOPER'S ARE REQUIRED TO FILE NOTICE OF INTENT (NOI) WITH STATE WATER RESOURCES CONTROL BOARD (SWRCB) AND PREPARE A STORM WATER POLLUTION PLAN (SWPPP) AND MONITORING PLAN FOR THE SITE.

* - INDICATES NOTES REQUIRED BY CALTRANS, DEPARTMENT OF TRANSPORTATION.

STORMDRAIN PLAN

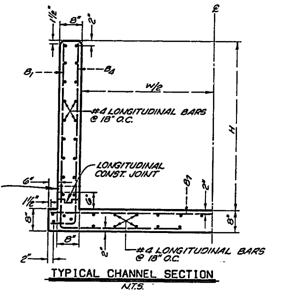
MIRA LOMA ASSEMBLY HALL OF JEHOVAH'S WITNESSES

CHANNEL NOTES

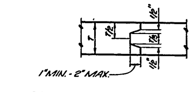
1. STRUCTURAL CONCRETE SHALL BE CLASS "A"
2. ALL LONGITUDINAL BARS SHALL BE #4 @ 18 INCHES UNLESS OTHERWISE NOTED. PLACE BARS IN BOTTOM SLAB SYMMETRICALLY ABOUT CENTERLINE. PLACE BARS IN WALLS STARTING AT TOP WITH 1 1/2 INCHES OF CLEAR COVER.
3. CLEAR COVER FOR STEEL SHALL BE 1 1/2 INCHES FOR WALLS AND 2 INCHES EACH FACE FOR BOTTOM SLAB.
4. STEEL IS DEMENSIONED TO BACK OF BAR BEND.
5. FOR CONSTRUCTION ON CURVES. STRAIGHT TRANSVERSE BARS SHALL BE ALIGNED RADICALLY WITH SPACING MEASURED AT FACE OF WALL. FOR L-BARS IN WALLS. SPACING SHALL BE MEASURED BETWEEN THE VERTICAL LEGS OF BARS.
6. ALL TRANSVERSE CONSTRUCTION JOINTS SHALL BE IN A VERTICAL PLANE NORMAL TO THE CENTERLINE AND THE SPACING THEREOF SHALL NOT EXCEED 50 FEET OR BE LESS THAN 10 FEET. CONTINUOUS KEYWAYS SHALL BE CONSTRUCTED AS SHOWN IN DETAIL A. A COMPLETE CURTAIN OF TRANVERSE STEEL SHALL BE PLACED 3 INCHES FROM EACH FACE OF THE JOINTS AND LONGITUDINAL STEEL WILL NOT BE CONTINUOUS THROUGH THE JOINTS. IN ADDITION. EXPANSION JOINTS SHALL BE CONSTRUCTED BETWEEN REINFORCED CONCRETE CHANNEL AND REINFORCED CONCRETE BOX SECTIONS AS SHOWN IN DETAIL B. DOWELS SHALL BE PLACED AT 12 INCHES SPACING CENTERED IN THE MIDDLE THIRD OF THE BOTTOM SLAB AND THE TOP THIRD OF SIDE WALLS. A MINIMUM OF 3 DOWELLS PER SLAB AND WALLS SHALL BE PLACED. WHERE APPLICABLE.
7. WEEPHOLES SHALL BE FORMED AS SHOWN IN BOTH WALLS AT A SPACING OF 10 FEET WITH ONE CUBIC FOOT OF FILTER MATERIAL PLACED AT EACH HOLE, *AND A 6"x6" #4x4 WIRE MESH PLACED BETWEEN EACH WEEPHOLE AND THE FILTER MATERIAL*
8. ALL QUANTITIES SHOWN ARE APPROXIMATE.
9. ALL SPLICES ARE SUBJECT TO APPROVAL BY THE ENGINEER.

REINFORCED CONCRETE RECTANGULAR CHANNEL

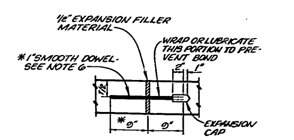
SECTION DATA					REINFORCEMENT STEEL SCHEDULE										
SECTION	STATION LIMITS		SIZE (FEET)		B_1			B_4			B_7		LONGITUDINAL BARS		
	FROM	TO	W	H	BAR NO.& SPACING	VERT. LENGTH	HORIZ. LENGTH	BAR NO. & SPACING	VERT. LENGTH	HORIZ. LENGTH	BAR NO. & SPACING	HORIZ. LENGTH	TOTAL	WALLS	SLAB
A	9+86.07	10+37.83	13.0	1.0	4@18	1.31'	7.04		1.38	.92	4@18	8.54	26	0	26
B	10+60.33	13+21.32	10.5	2.5	4@18	2.88	6.73	4@18	2.88	.92	4@18	6.29	24	4	20
C	13+31.32	14+28.27	10.5	3.0	4@18	3.33	6.73	4@18	3.38	.92	4@18	6.29	28	8	20



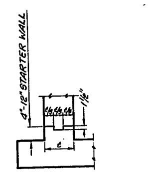
TYPICAL CHANNEL SECTION
N.T.S.



TRANSVERSE CONSTRUCTION JOINT
DETAIL A
N.T.S.

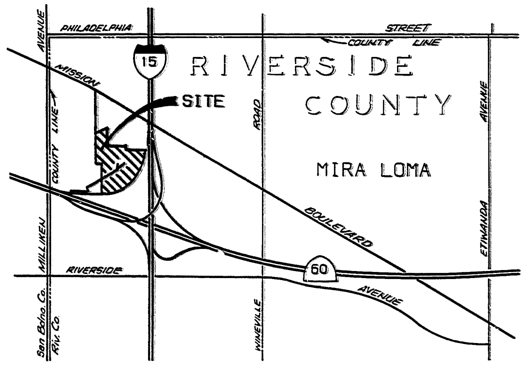


TRANSVERSE EXPANSION JOINT
DETAIL B
N.T.S.

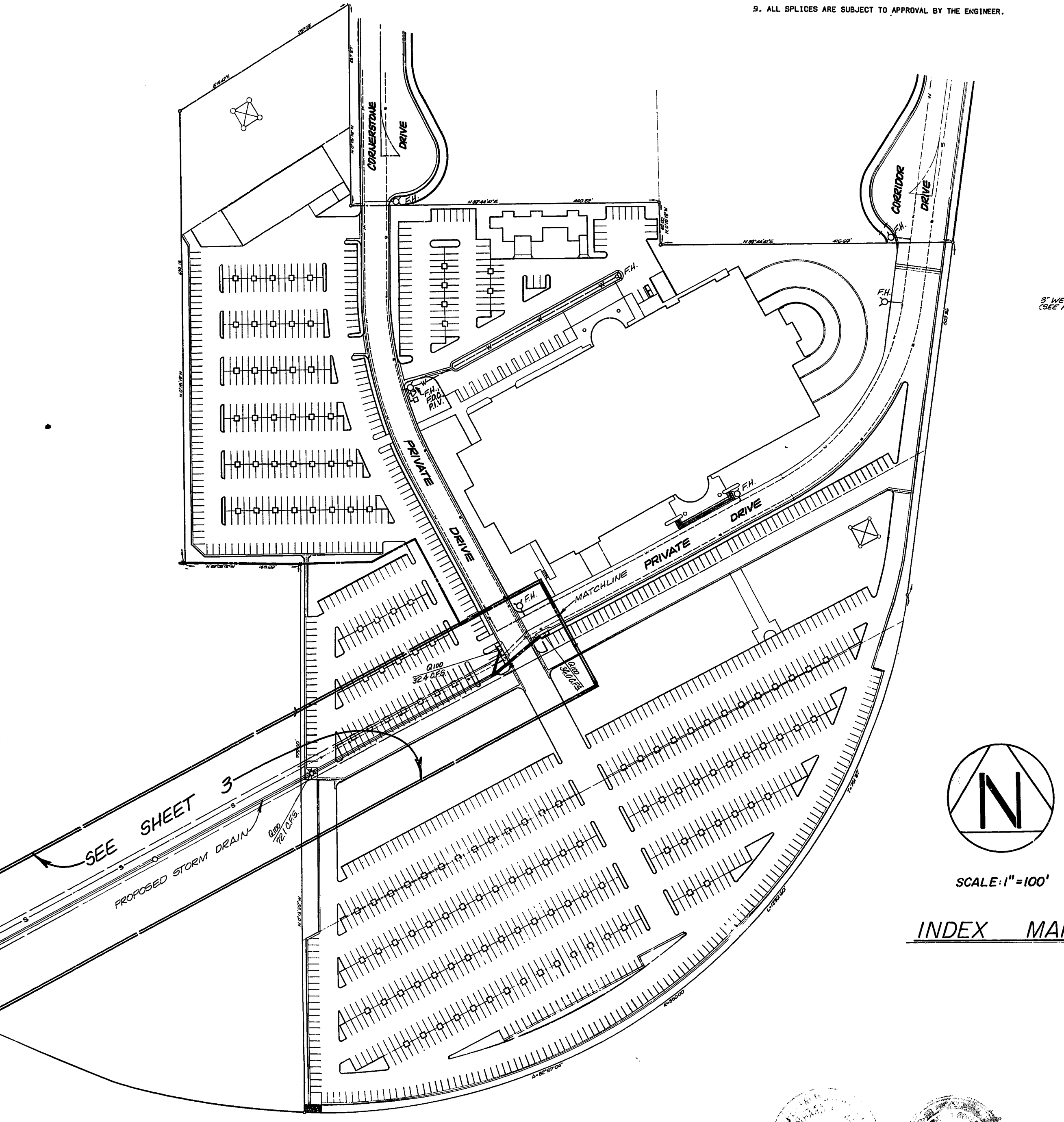


LONGITUDINAL CONSTRUCTION JOINT
DETAIL C
N.T.S.

*FOR CONNECTION TO EXISTING TRIPLE 2.2' X 4.0' R.C.B., BORE 9 INCHES INTO EXISTING CONCRETE. INSERT ANCHOR SLEEVE OR EPOXY AND 1" X 18" HALF THREADED DOWEL. ALL MATERIALS ARE SUBJECT TO APPROVAL BY THE ENGINEER. SEE NOTE 6 FOR ADDITIONAL INFORMATION.



VICINITY MAP
N.T.S.
SECTION 6. T. 2 S., R. 6 W.



INDEX MAP

CONSTRUCTION NOTES — "ESTIMATED QUANTITIES"

①	INSTALL 48" R.C.P. 1300 D.	811 L.F.
②	CONSTRUCT 3.0' X 10.5' REINFORCED CONCRETE RECTANGULAR CHANNEL AND WALL TRANSITION PER DETAIL ON SHEET 1	107 L.F.
③	CONSTRUCT 2.5' X 10.5' REINFORCED CONCRETE RECTANGULAR CHANNEL PER DETAIL ON SHEET 1	261 L.F.
④	CONSTRUCT 1.0' X 13.0' REINFORCED CONCRETE RECTANGULAR CHANNEL PER DETAIL ON SHEET 1	52 L.F.
⑤	CONSTRUCT REINFORCED CONCRETE TRANSITION CHANNEL	23 L.F.
⑥	CONSTRUCT HEADWALL AND VERTICAL WINGWALLS PER CALTRANS STD. NO. D86-B, (L=10', W=5.25', H=4.00', NO STIFFENING BEAM	1 EA.
⑦	CONSTRUCT CATCH BASIN PER COUNTY STD. NO. 300, (WIDTH AS SHOWN)	2 EA.
⑧	INSTALL 30" R.C.P. 2000 D.	122 L.F.
⑨	INSTALL MANHOLE PER RIVERSIDE COUNTY FLOOD CONTROL STD. NO. MH252	3 EA.
⑩	INSTALL MANHOLE FRAME AND COVER PER RIVERSIDE COUNTY FLOOD CONTROL STD. NO. MH255	3 EA.
⑪	INSTALL INLET TYPE X PER RIVERSIDE COUNTY FLOOD CONTROL STD. NO. CB108, (OMIT OPENINGS)	1 EA.
⑫	INSTALL 18" R.C.P. 1500 D.	4 L.F.

NOTE:

WORK CONTAINED WITHIN THESE PLANS SHALL NOT COMMENCE UNTIL AN ENCROACHMENT PERMIT AND/OR GRADING PERMIT HAS BEEN ISSUED.

P.U.P. – 746

6-30-96

THE PRIVATE ENGINEER SIGNING THESE PLANS IS RESPONSIBLE FOR ASSURING THE ACCURACY OF DESIGN AND ACCEPTABILITY OF THE WORK HEREON. IN THE EVENT OF DISCREPANCIES ARISING AFTER COUNTY APPROVAL OR DURING CONSTRUCTION, THE PRIVATE ENGINEER SHALL BE RESPONSIBLE FOR DETERMINING AN ACCEPTABLE SOLUTION AND REVISING THE PLANS FOR APPROVAL BY THE COUNTY.

DIGALERT
Call Toll Free
1-800-422-4133
TWO
WORKING DAYS
BEFORE YOU
DIG
Underground Service Alert
of Southern California

OWNER:
MIRA LOMA ASSEMBLY HALL
OF JEHOVAH'S WITNESSES
1155 S. MILLIKEN AVE., SUITE F
ONTARIO, CA. 91764
(909) 460-0067

SOILS ENGINEER:
LEIGHTON AND ASSOC.
1737 ATLANTIC AVE., SUITE I
RIVERSIDE, CA. 92507

REVISIONS:

APPROVED BY: B. May
REGISTERED CIVIL ENGINEER
R.C.E. 36866 EXP. 6-30-96
DATE 3-16-94

APPROVED:
RIVERSIDE COUNTY, CALIF.
FOR TRANSPORTATION DEPT.
DATE 5/4/94

SITETECH INC.
38248 POTATO CANYON RD., OAK GLEN, CALIFORNIA 92399
TELEPHONE (909) 797-5339

SCALE: 1"= 40'

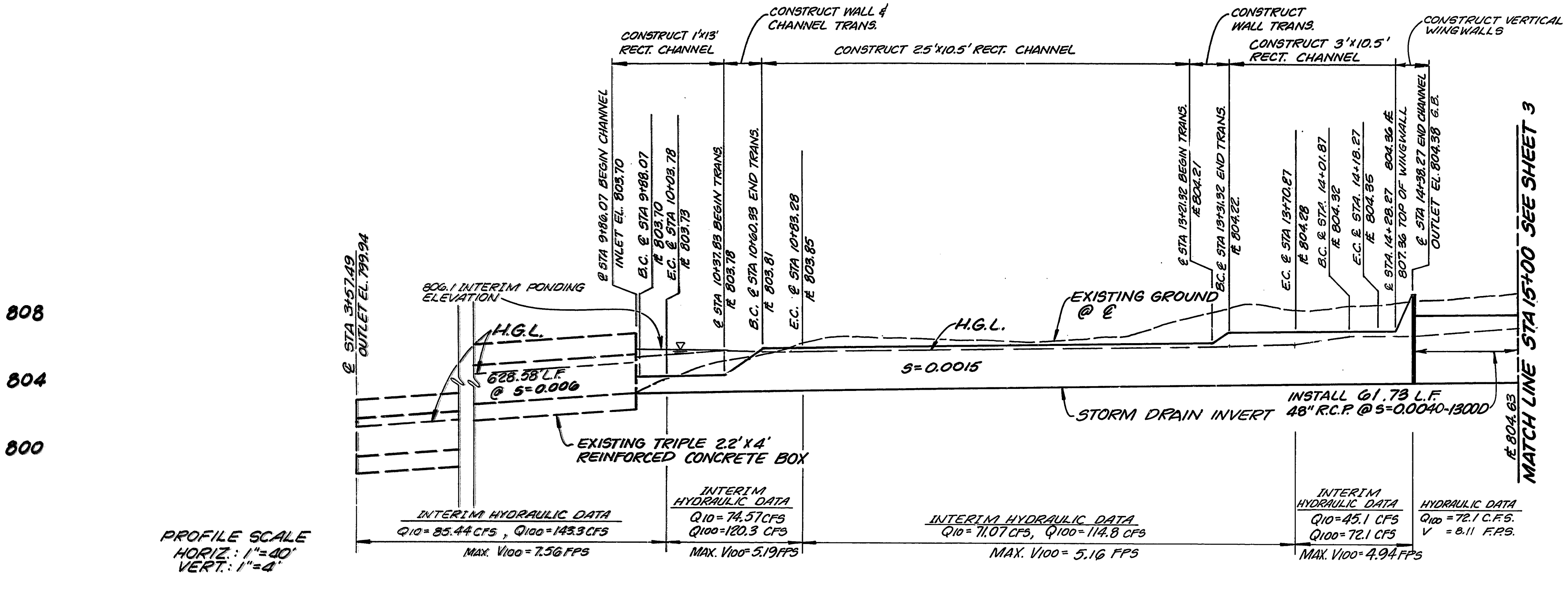
BENCHMARK: "SEE ABOVE"

STREET IMPROVEMENT PLAN
PARCEL F, P.M. 23914-1, P.U.P. NO. 746
COUNTY OF RIVERSIDE
STORM DRAIN
MIRA LOMA ASSEMBLY HALL

W.O.
FOR: "SEE OWNER"
F.B.

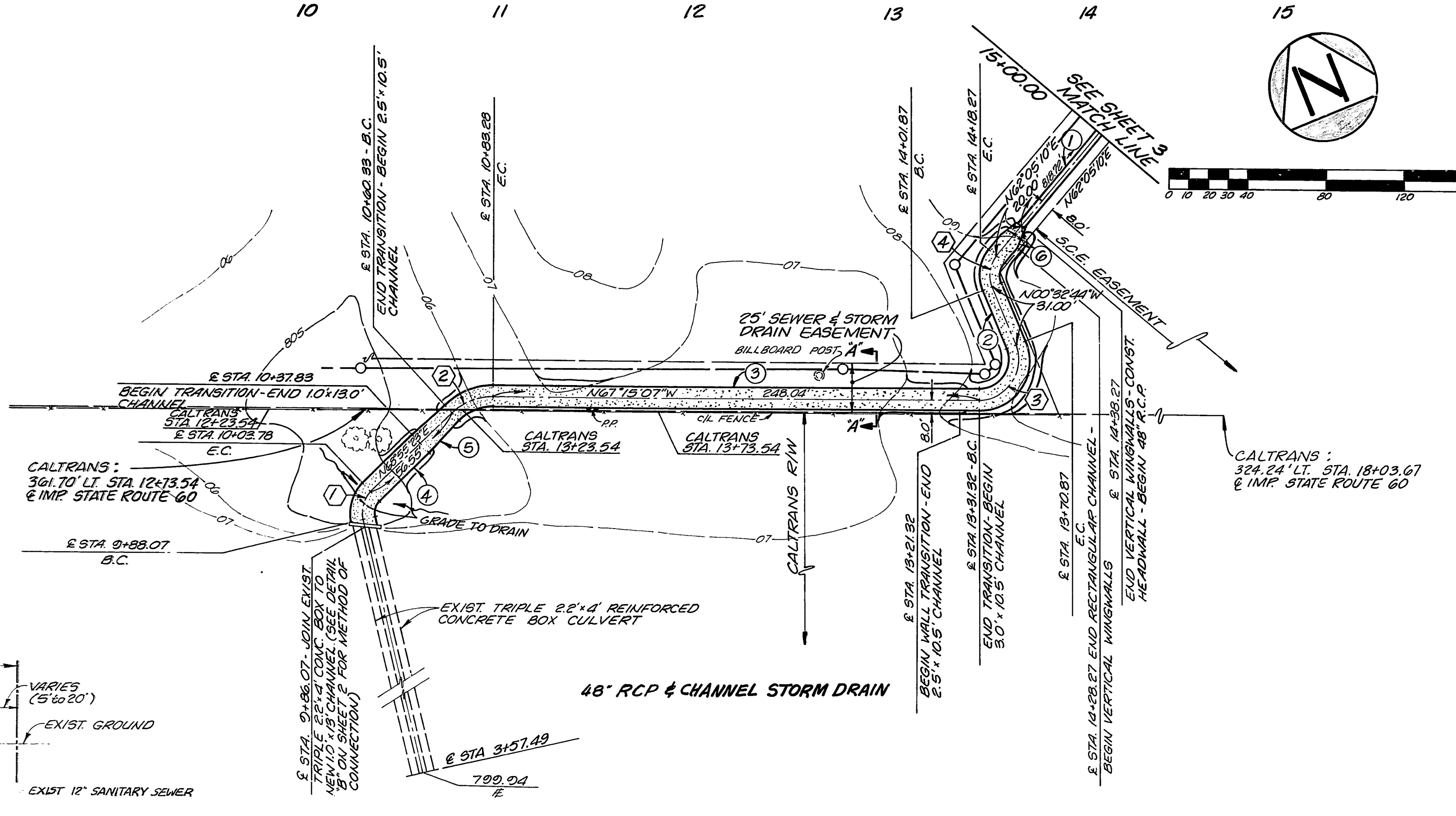
1 OF 3 SHTS.
FILE NO.

901-PP

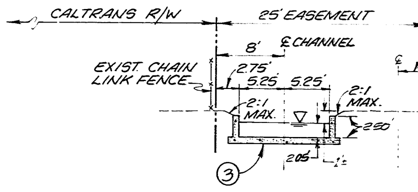


PROFILE SCALE
HORIZ.: 1"=40'
VERT.: 1"=4'

48" R.C.P & CHANNEL STORM DRAIN PROFILE



48" RCP & CHANNEL STORM DRAIN



SECTION "A-A"
1"=10'

CURVE DATA TABLE

NO.	RADIUS	DELTA	ARC LENGTH	TANGENT
①	15.00'	60°00'00"	15.71'	8.66'
②	30.00'	43°49'30"	22.95'	12.95'
③	20.00'	113°17'37"	39.55'	30.39'
④	15.00'	62°37'54"	16.40'	9.13'

CONSTRUCTION NOTES

① INSTALL 48" R.C.P. - 1300D.

② CONSTRUCT 3.0' X 10.5' REINFORCED CONCRETE RECTANGULAR CHANNEL *AND WALL TRANSITION PER DETAIL ON SHEET 2 (SECTION C)*

③ CONSTRUCT 2.5' X 10.5' REINFORCED CONCRETE RECTANGULAR CHANNEL PER DETAIL ON SHEET 2 (SECTION B).

④ CONSTRUCT 1.0' X *13.0'* REINFORCED CONCRETE RECTANGULAR CHANNEL PER DETAIL ON SHEET 2 (SECTION A).

⑤ CONSTRUCT REINFORCED CONCRETE TRANSITION CHANNEL.

⑥ CONSTRUCT *HEADWALL AND VERTICAL WINGWALLS PER CALTRANS STD. NO. D86-B (L=10', W=5.25', H=4.00', NO STIFFENING BEAM)*

RECOMMENDED FOR APPROVAL	SEAL COUNTY	SEAL
DATE 5/3/94 CHECKED BY: R. KLINE DATE 5/02/94		

6.30.96

3.16.94 B. May 36866 6/30/96

5/4/94 TRANSPORTATION DEPT.

SITETECH INC.

1"= 40'

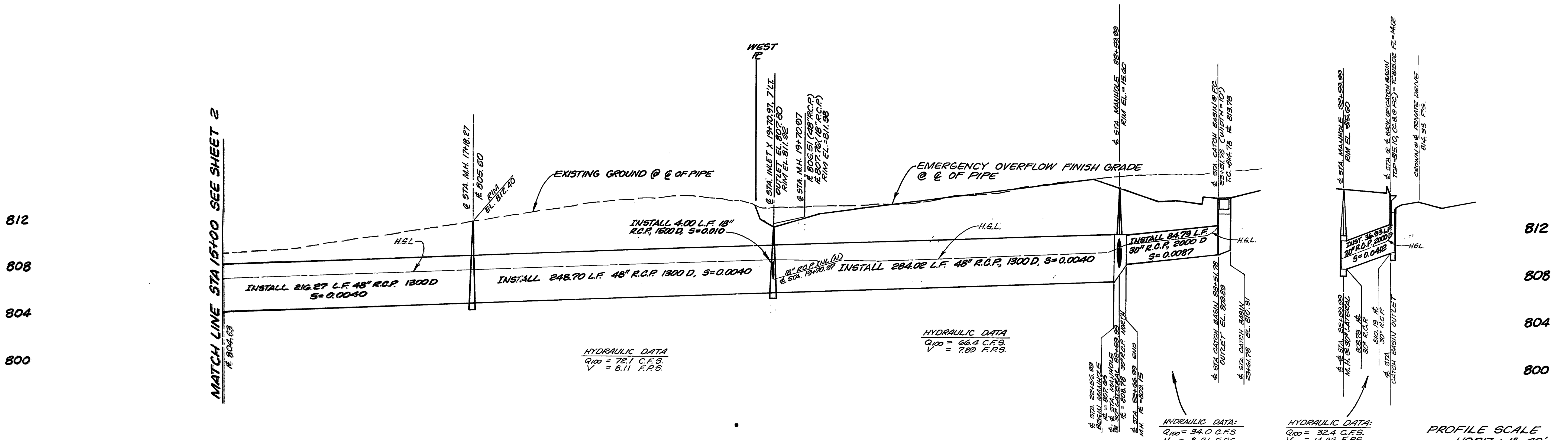
SEE SHEET 1

SCHEDULE "E"

STREET IMPROVEMENT PLAN
PARCEL F, P.M. 23914-1, P.U.P. NO. 746
COUNTY OF RIVERSIDE
STORM DRAIN
STA. 9+96.07 to STA. 15+00.00

2
3

901-PP

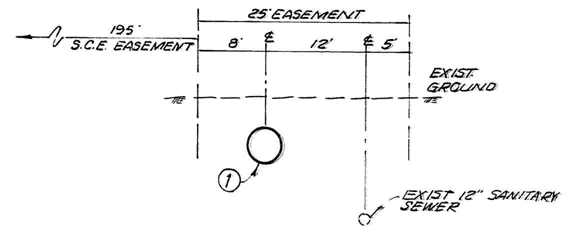


48" RCP STORM DRAIN PROFILE

30" R.C.P. STORM DRAIN PROFILES

PROFILE SCALE
HORIZ.: 1"=40'
VERT.: 1"=4'

15 16 17 18 19 20 21 22 23



SECTION "B-B"
SCALE: 1" = 10'

CONSTRUCTION NOTES

⑦ CONSTRUCT CATCH BASIN PER COUNTY STD. NO. 300. (WIDTH AS SHOWN)

⑧ INSTALL 30" R.C.P. - 2000D

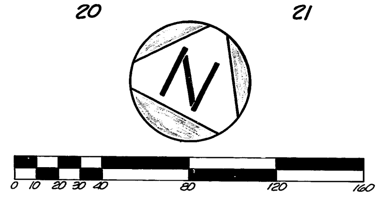
① INSTALL 48" R.C.P. - 1300D.

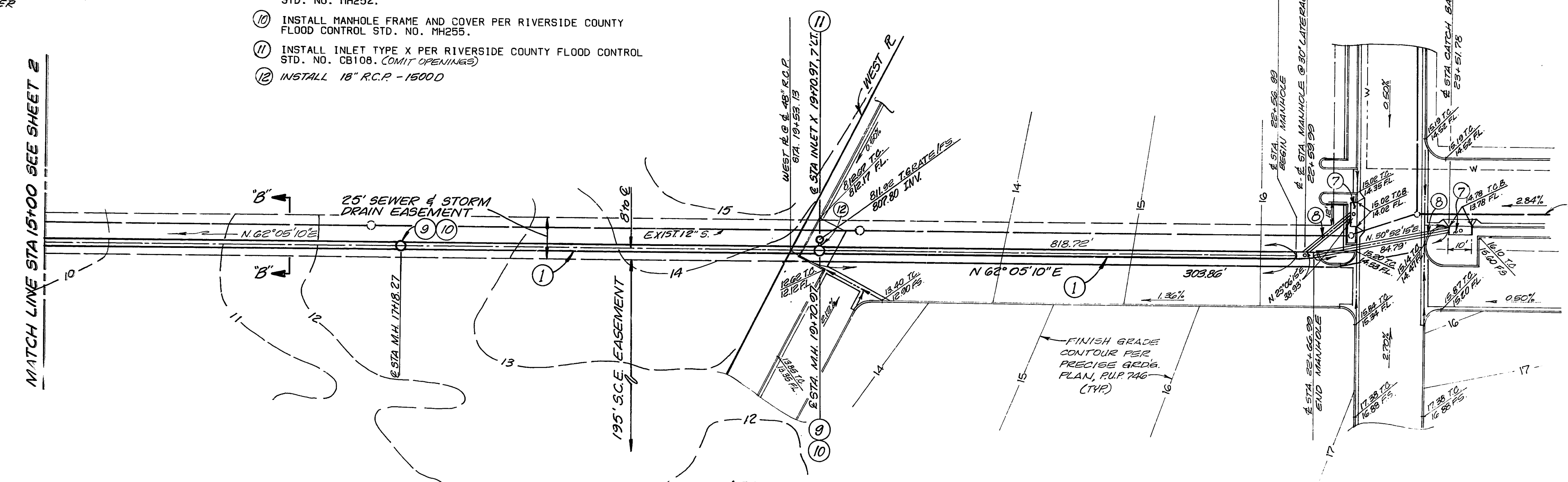
⑨ INSTALL MANHOLE PER RIVERSIDE COUNTY FLOOD CONTROL STD. NO. MH252.

⑩ INSTALL MANHOLE FRAME AND COVER PER RIVERSIDE COUNTY FLOOD CONTROL STD. NO. MH255.

⑪ INSTALL INLET TYPE X PER RIVERSIDE COUNTY FLOOD CONTROL STD. NO. CB108. (OMIT OPENINGS)

⑫ INSTALL 18" R.C.P. - 1500D





48" R.C.P. STORM DRAIN

RECOMMENDED FOR APPROVAL	SEAL COUNTY	SEAL
DATE 5/3/94		6-30-96
CHECKED BY R. KLINE		
DATE 5/02/94		

B. May
3-16-94
36866
6/30/96
5/4/94
TRANSPORTATION DEPT.

SITETECH INC.

1"= 40'

SEE SHEET 1

SCHEDULE "E"

STREET IMPROVEMENT PLAN
PARCEL F, P.M. 23914-1, P.U.P. NO. 746
COUNTY OF RIVERSIDE
STORM DRAIN
STA. 15+00.00 to STA. 23+51.78

3
3

901-PP

APPENDIX 8

RCFCWCD Drawing No. 2-332

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
STORM DRAIN PLANS FOR EASTVALE M.D.P. LINE "E-2, STAGE 4"
PLOT PLAN 15978

GENERAL NOTES

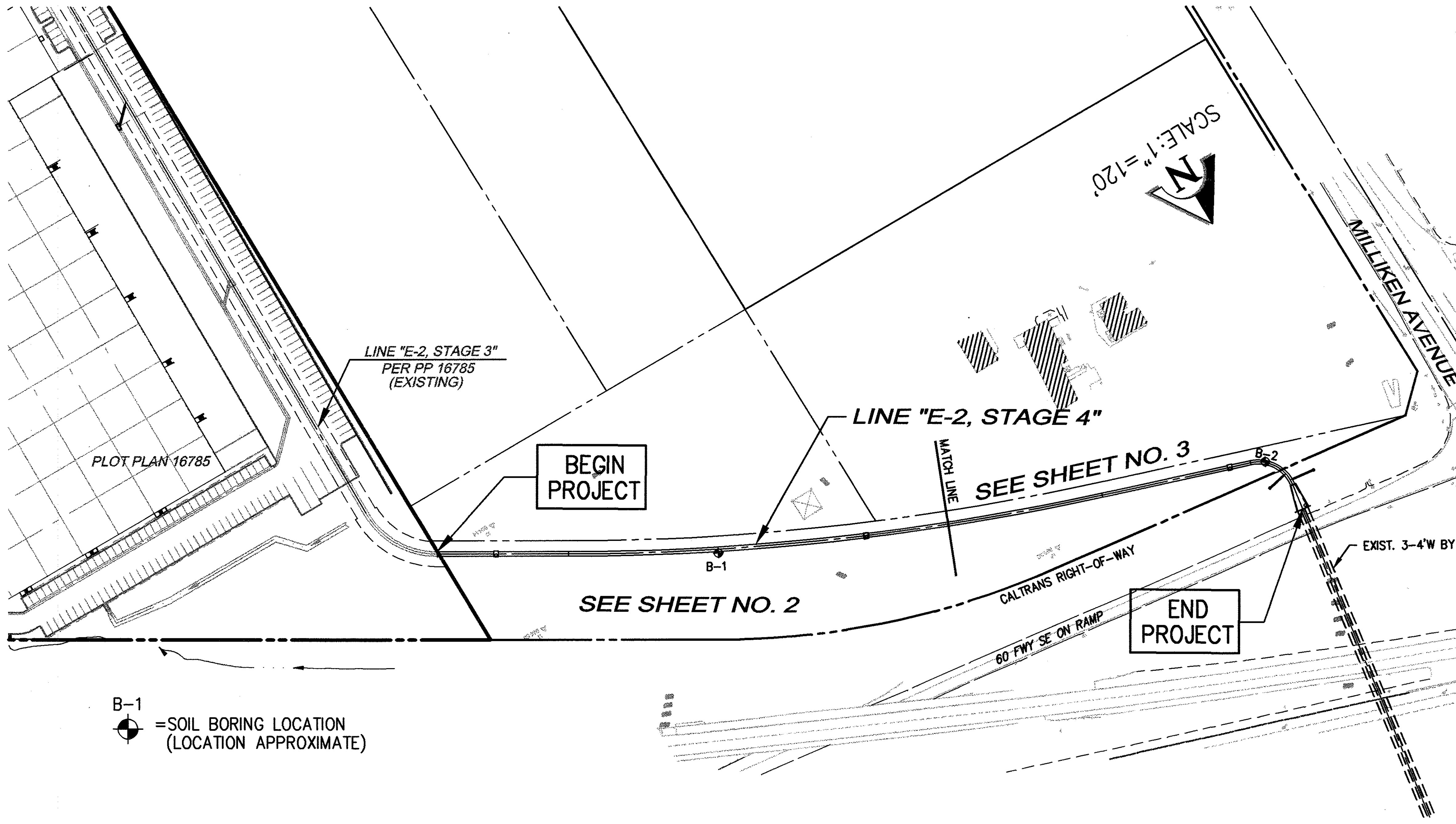
1. THE CONTRACTOR SHALL CONSTRUCT THE FLOOD CONTROL IMPROVEMENTS SHOWN ON THE DRAWINGS IN CONFORMANCE WITH THE REQUIREMENTS OF THE RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT'S M.O.U. STANDARD SPECIFICATIONS DATED SEPT. 1984, AND DESIGN MANUAL STANDARD DRAWINGS DATED MAY 1971 AND CALTRANS STANDARD SPECIFICATIONS, LATEST EDITION (WITHIN CALTRANS RIGHT-OF-WAY).
2. AN ENCROACHMENT PERMIT IS REQUIRED FROM RIVERSIDE COUNTY FLOOD CONTROL. CONTACT ED LOTZ AT (909) 955-1266. AFTER THE PERMIT IS ISSUED, THE DISTRICT MUST BE NOTIFIED ONE WEEK PRIOR TO CONSTRUCTION.
3. CONSTRUCTION INSPECTION WILL BE PERFORMED BY RIVERSIDE COUNTY FLOOD CONTROL. CONTACT DALE ANDERSON AT (909) 955-1288. THE DISTRICT MUST BE MUST BE NOTIFIED 20 DAYS 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 AT 1-800-227-2600.
7. ALL ELEVATIONS SHOWN ARE IN FEET AND DECIMALS THEREOF BASED ON U.S.C.&G.S. DATUM.
8. ALL CROSS SECTIONS ARE TAKEN LOOKING DOWNSTREAM.
9. ELEVATIONS OF UTILITIES ARE APPROXIMATE UNLESS OTHERWISE NOTED. 48 HOURS BEFORE EXCAVATION CALL UNDERGROUND SERVICE ALERT AT 1-800-227-2600. ALL UTILITIES SHALL BE PROTECTED IN PLACE EXCEPT AS NOTED ON PLANS AND SPECIFICATIONS.
10. 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.
11. PIPE CONNECTED TO THE MAINLINE PIPE SHALL CONFORM TO JUNCTION STRUCTURE NO. 4 (JS229) UNLESS OTHERWISE NOTED.
12. BEDDING PIPE SHALL CONFORM TO RCFC&WCD STD. M815, EXCEPT FOR COVER LESS THAN 2 FEET. FOR COVER LESS THAN 2 FEET, CONCRETE SLURRY (2,000 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.
13. B-1 INDICATES SOIL BORING LOCATIONS BASED ON THE SOILS REPORT DATED APRIL 24, 2003 BY PETRA GEOTECHNICAL, INC. LOCATIONS SHOWN ARE APPROXIMATE.
14. "V" IS THE DEPTH OF INLET OF CATCH BASINS MEASURED FROM THE TOP OF CURB TO INVERT OF CONNECTOR PIPE.
15. CATCH BASINS SHALL BE LOCATED SO THAT LOCAL DEPRESSION SHALL BEGIN AT EXISTING CURB RETURN JOINT, UNLESS OTHERWISE SPECIFIED.
16. 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.
17. STANDARD DRAWINGS CALLED FOR ON THE PLAN AND PROFILE SHALL CONFORM TO RCFC&WCD STD. DRAWINGS OR COUNT/CITY/CALTRANS/APWA STANDARD PLANS.
18. ALL WORK WITHIN CALTRANS RIGHT-OF-WAY: UNLESS OTHERWISE SHOWN ON THE PLANS OR SPECIFIED IN THE SPECIFICATIONS, ALL MATERIAL FOR STRUCTURE BACKFILL TO BE COMPACTED TO A RELATIVE COMPACTION OF NOT LESS THAN 95 PERCENT IN ACCORDANCE WITH SECTION 19 OF CALTRANS STANDARD SPECIFICATIONS, LATEST EDITION.
19. ALL WORK WITHIN CALTRANS RIGHT-OF-WAY: CONSTRUCTION INSPECTION WILL BE DONE BY RIVERSIDE COUNTY FLOOD CONTROL AND WILL BE MONITORED BY STATE REPRESENTATIVE.

20 ALL WORK WITHIN CALTRANS RIGHT-OF-WAY MUST CONFORM TO CALTRANS STANDARD SPECIFICATIONS DATED JULY 1999.

21. AN ENCROACHMENT PERMIT FROM CALTRANS IS REQUIRED FOR WORK WITHIN CALTRANS RIGHT-OF-WAY. (ENCROACHMENT PERMIT #: 08-02-6-DM-1556, 08-RIV-60-pm 0.34)

MAINTENANCE NOTE:

RIVERSIDE COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT WILL INSPECT AND MAINTAIN THE STORM DRAIN LINE "E-2 STAGE 4" ALL MAINLINE PIPE AND STRUCTURES, AND CONNECTOR PIPES FROM STATION 22+28.22 TO STATION 33+20.10.



SHEET INDEX MAP

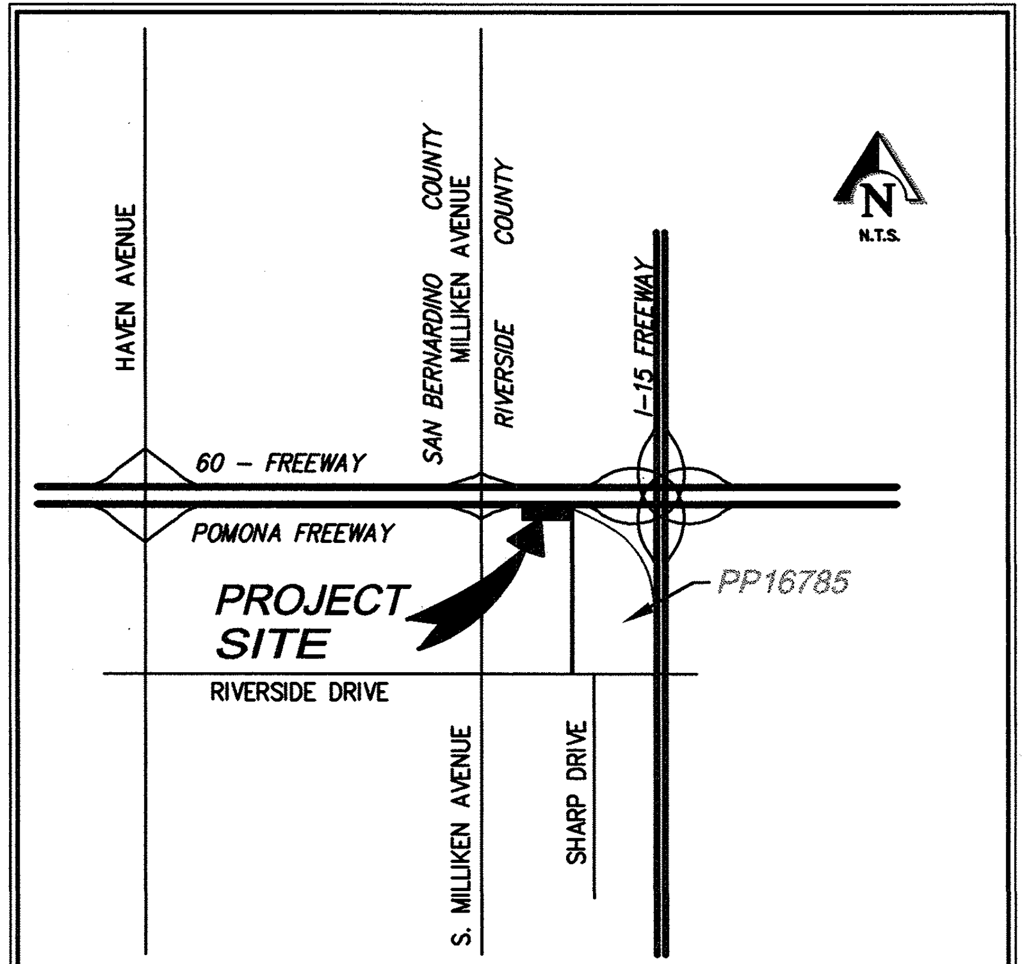
SCALE: 1"=120'

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

JS229	JUNCTION STRUCTURE NO. 4.
MH252	MANHOLE NO. 2
TS301	TRANSITION STRUCTURE NO. 1.
M801	CHAIN LINK FENCE DETAILS
M803	CONCRETE COLLAR
M815	BEDDING AND PAY LINES

CALTRANS STANDARD DRAWINGS

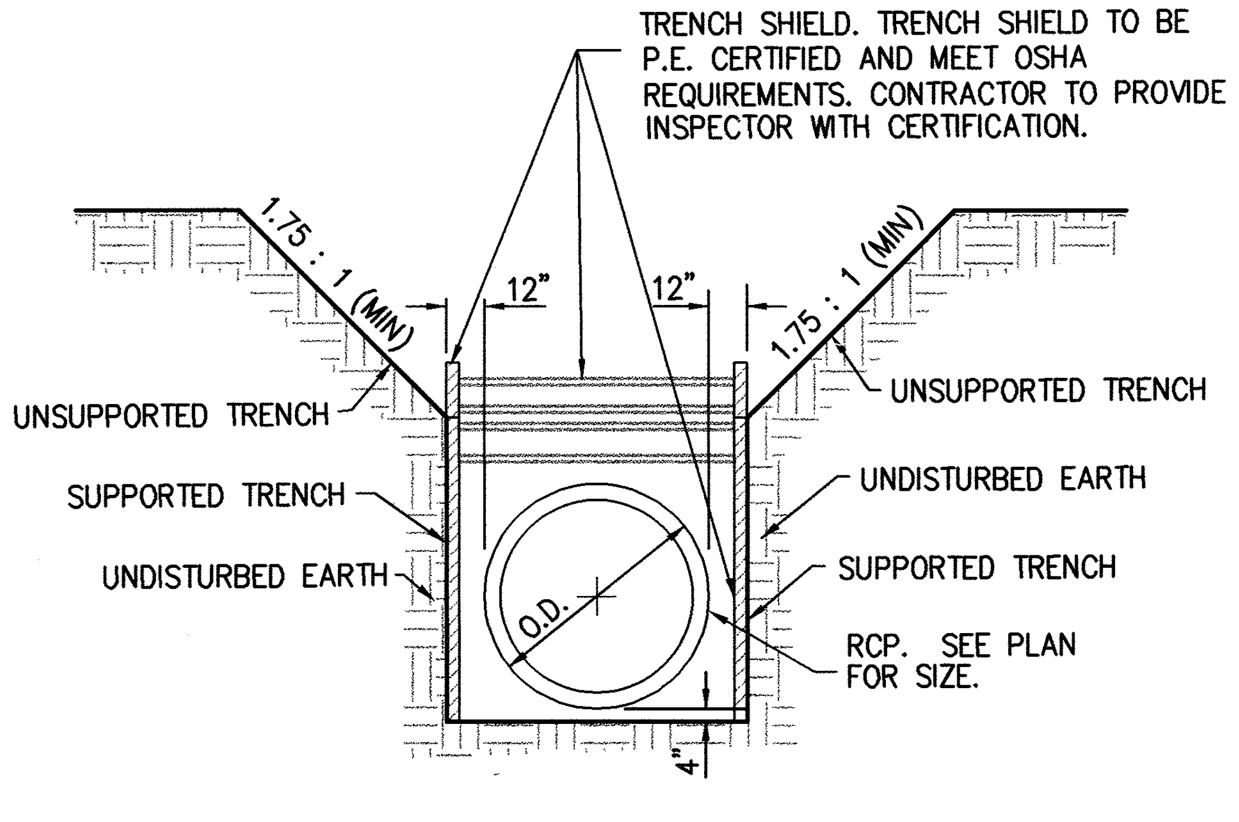
A85	CHAIN LINK FENCE
D75	PIPE INLET
D80	CAST-IN-PLACE REINFORCED CONCRETE SINGLE BOX CULVERT
D82	CAST-IN-PLACE REINFORCED CONCRETE SINGLE BOX CULVERT MISCELLANEOUS DETAILS



VICINITY MAP

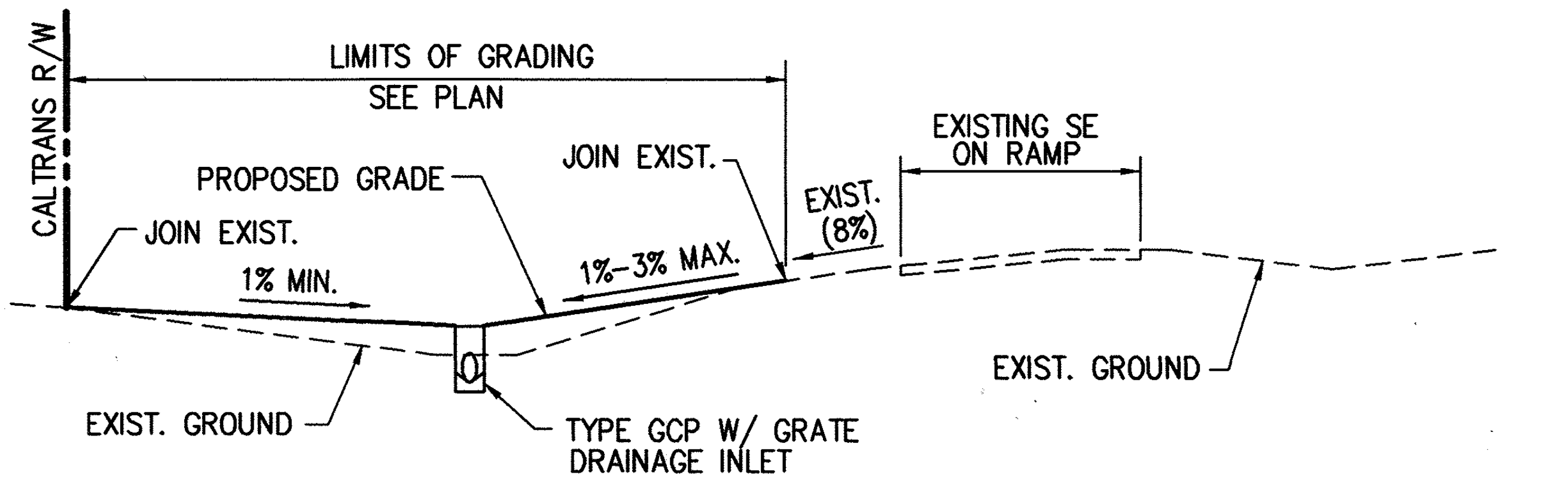
NOT TO SCALE

THE THOMAS GUIDE, 2000 EDITION, RIVERSIDE PAGE 643, E-6. SECTION 6 (POR.), TOWNSHIP 2 SOUTH, RANGE 6 WEST.



TRENCH SHORING DETAIL

NOT TO SCALE



SECTION B -

NOT TO SCALE

AS BUILT
APPROVED BY Teresit Tabiolo
DATE 1-20-04

CALTRANS PERMIT #: 08-02-6-DM-1556, 08-RIV-60-pm 0.34

Underground Service Alert
Call: TOLL FREE
1-800
227-2600
TWO WORKING DAYS BEFORE YOU DIG

KCT CONSULTANTS, INC.
Civil Engineers - Surveyors - Planners
P.O. Box 5705 Riverside, CA 92517-5705
4344 Latham St., Suite 200, Riverside, CA 92501
Phone: 909/341-8940 Fax: 909/341-8945
e-mail: kctinc@tstonramp.com

PREPARED UNDER THE SUPERVISION OF:
Teresit Tabiolo DATE 7-25-03
TERESITO N. TABIOLO, R.C.E. NO. 38826 EXP. DATE 3-31-05

TERESITO N. TABIOLO
RCE No. 38826
Exp. 3-31-05

BENCHMARK:
AT THE S.E. CORNER OF THE INTERSECTION OF HAMNER AVE. AND RIVERSIDE AVE., 47.0' EAST OF HAMNER AVE., 30.0' SOUTH OF RIVERSIDE AVE., 5.0' NORTH OF POWER POLE #674422E, 4.0' S.E. OF A SIGNAL LIGHT STANDARD, 1.0' WEST OF A MARKER POST, A BRASS DISK SET IN THE TOP OF CONC. POST AND STAMPED M.L. 38 APRIL 1964.
M.L. 38-64 ELEV.=794.579

REVISIONS

REF.	DESCRIPTION	APPR	DATE	APPR	DATE

RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY: Stuart McKibb
PLANNING ENGINEER
DATE: 10-17-2003

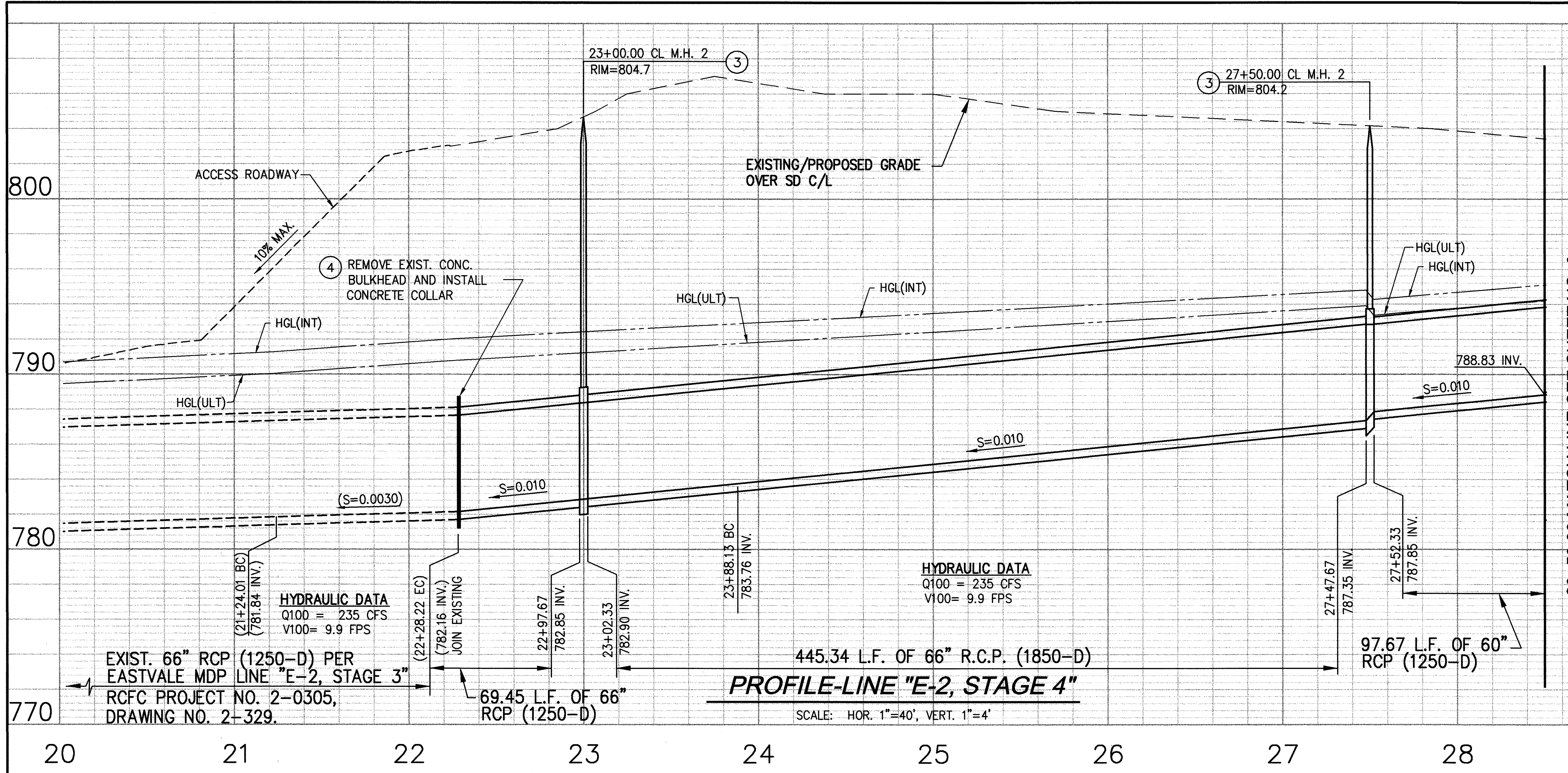
APPROVED BY:
CHIEF ENGINEER
DATE: 10-17-03

EASTVALE M.D.P.
LINE "E-2, STAGE 4"
PLOT PLAN 15978
TITLE SHEET

PROJECT NO. 2-0305
DRAWING NO. 2-332
SHEET NO. 1 OF 4

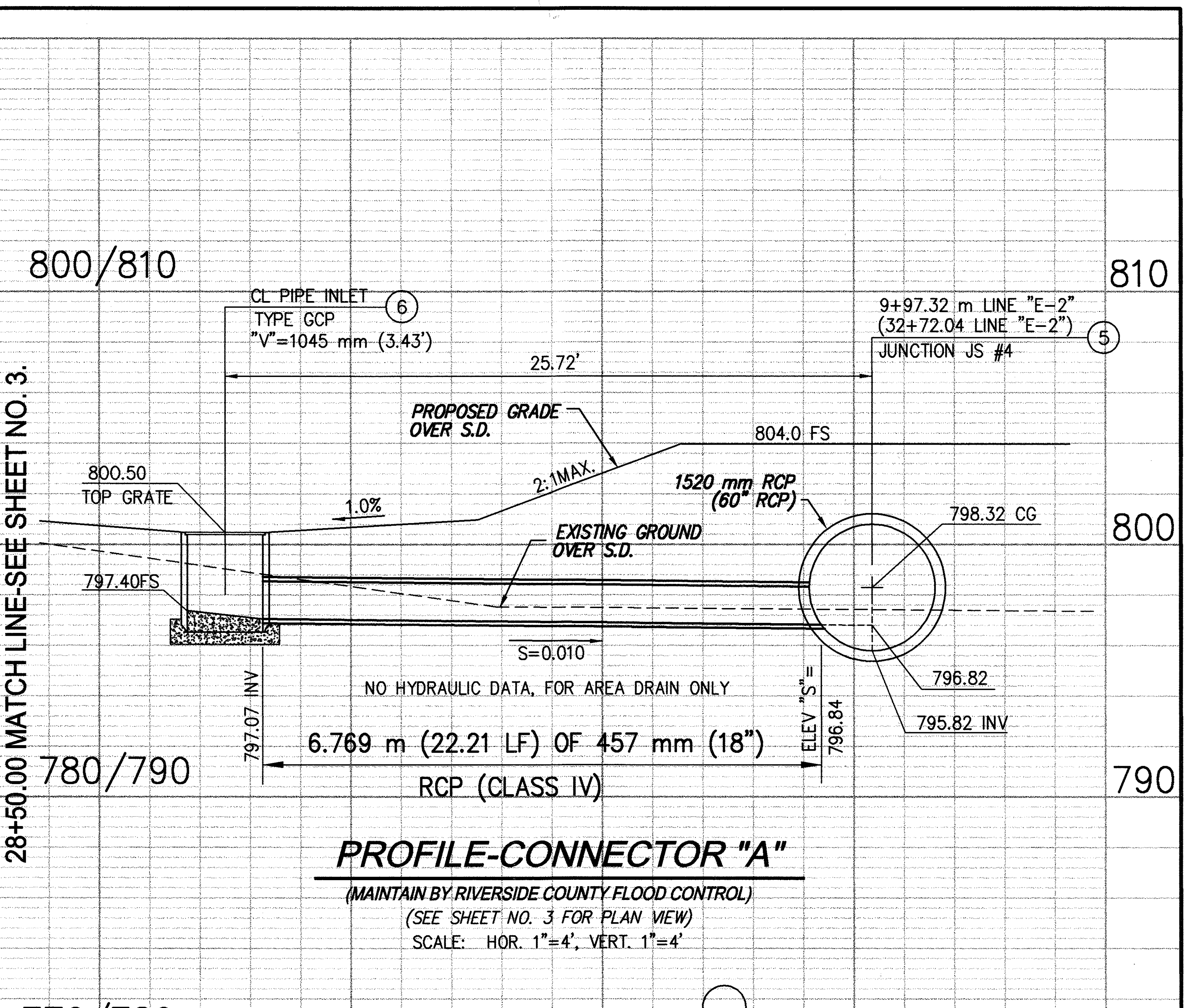
SITE [H: \1117\02-MasterSD\STORM DRAIN\02-line-e2sd-eng.dwg]
RCFC-TB [H: \1117\02-MasterSD\STORM DRAIN\rcfc-tb.dwg]
LSTOPO [H: \1117\02-MasterSD\02-LS-topo.dwg]

H: \1117\02-MasterSD\STORM DRAIN\02-sdTI-01.dwg
Plot Date: Jul 25, 2003 - 9:08am | Terry



PROFILE-LINE "E-2, STAGE 4"

SCALE: HOR. 1"=40', VERT. 1"=4'



PROFILE-CONNECTOR "A"

(MAINTAIN BY RIVERSIDE COUNTY FLOOD CONTROL)

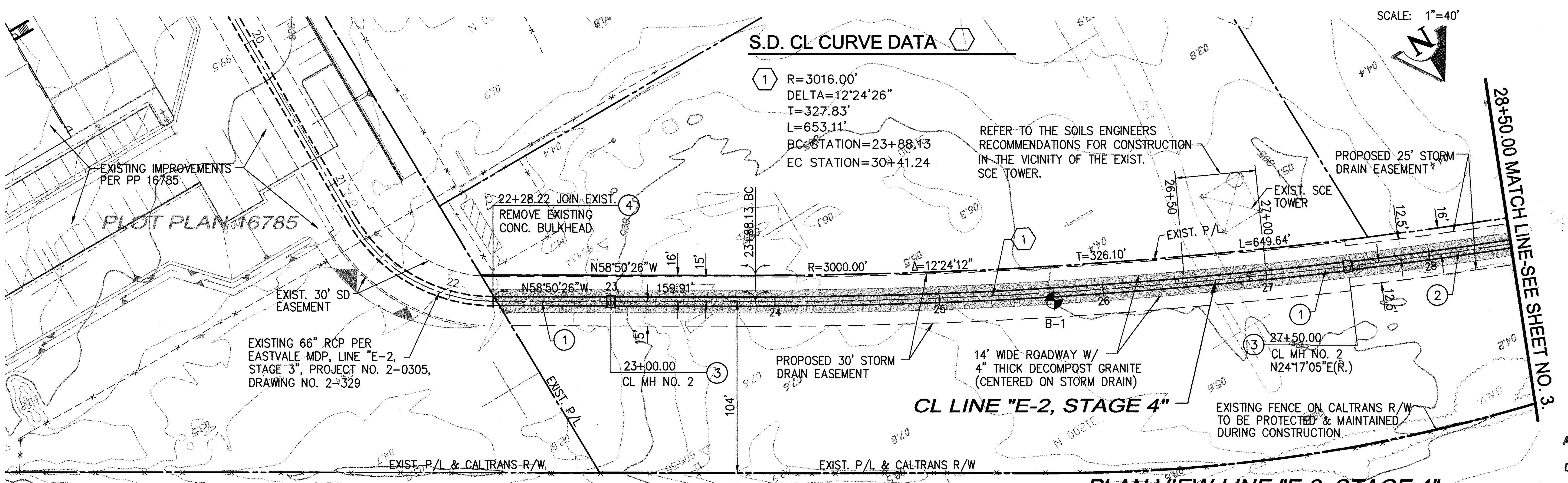
(SEE SHEET NO. 3 FOR PLAN VIEW)

SCALE: HOR. 1"=4', VERT. 1"=4'

29

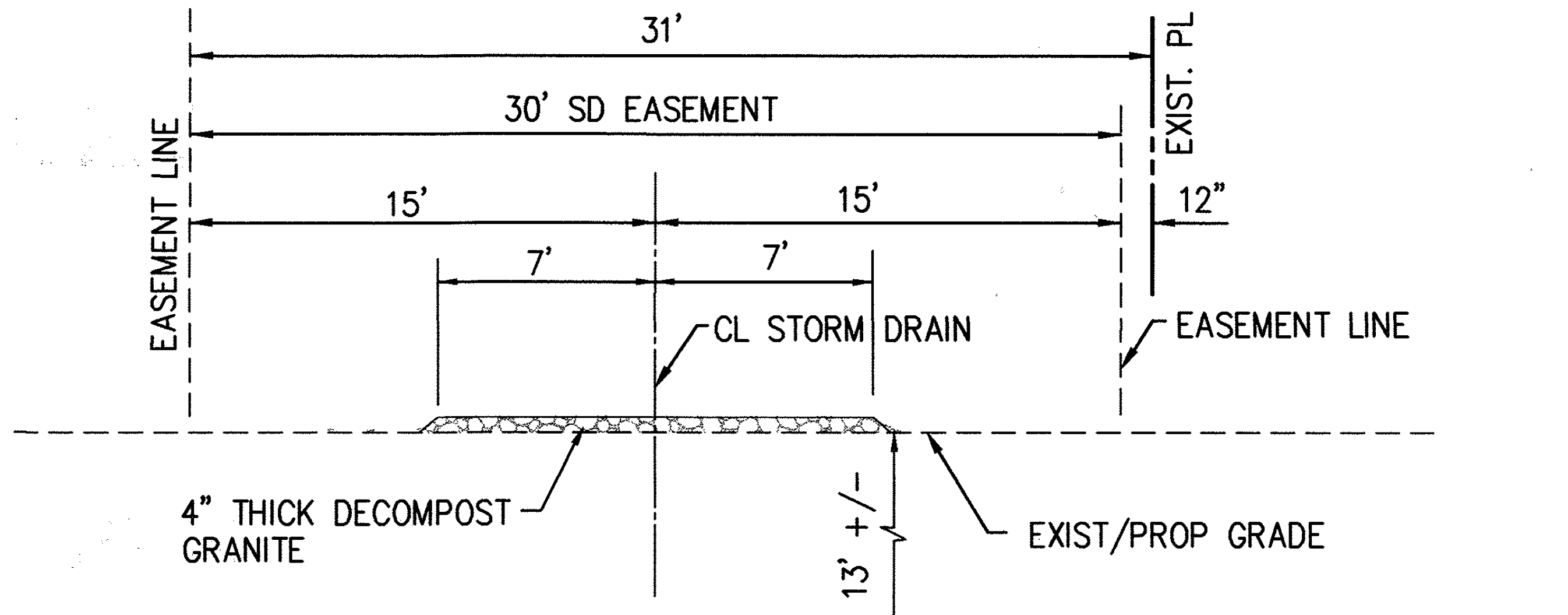
CONSTRUCTION NOTES: ○

1. ① 66" RCP (1850-D) SEE TRENCH SHORING DETAIL ON SHEET 1.
2. ② 60" RCP (1250-D). SEE TRENCH SHORING DETAIL ON SHEET 1.
3. ③ MANHOLE NO. 2 PER RIVERSIDE COUNTY FLOOD CONTROL STD. DWG. MH252 AND MH DETAIL "A" ON SHEET 3.
4. ④ CONCRETE COLLAR PER RIVERSIDE COUNTY FLOOD CONTROL STD. DWG. NO. M803.
5. ⑤ CONSTRUCT JUNCTION STRUCTURE NO. 4 PER RIVERSIDE COUNTY FLOOD CONTROL STD. DWG. JS229.
6. ⑥ CONSTRUCT TYPE GCP WITH GRATE PER CALTRANS STD. D75.



PLAN VIEW-LINE "E-2, STAGE 4"

SCALE: 1"=40'



AS BUILT

APPROVED BY: Teresito Tabiolo

DATE 7-20-04

SECTION AT STATION 26+00

SCALE: 1"=6'

DEM

Underground Service Alert
Call: TOLL FREE
1-800
227-2600
TWO WORKING DAYS BEFORE YOU DIG

KCT CONSULTANTS, INC.
Civil Engineers - Surveyors - Planners
P.O. Box 5705 Riverside, CA 92517-5705
4344 Latham St., Suite 200, Riverside, CA 92501
Phone: 909/341-8940 Fax: 909/341-8945
e-mail: kctinc@tstonramp.com

PREPARED UNDER THE SUPERVISION OF:
Teresito Tabiolo DATE 7-25-03
TERESITO N. TABIOLO, R.C.E. NO. 38826 EXP. DATE 3-31-05

TERESITO N. TABIOLO
RCE No. 38826
Exp. 3-31-05

BENCHMARK:
AT THE S.E. CORNER OF THE INTERSECTION OF HAMNER AVE. AND RIVERSIDE AVE., 47.0' EAST OF HAMNER AVE., 30.0' SOUTH OF RIVERSIDE AVE., 5.0' NORTH OF POWER POLE #674422E, 4.0' S.E. OF A SIGNAL LIGHT STANDARD, 1.0' WEST OF A MARKER POST, A BRASS DISK SET IN THE TOP OF CONC. POST AND STAMPED M.L. 38 APRIL 1964.
M.L. 38-64 ELEV.=794.579

REVISIONS					
REF.	DESCRIPTION	APPR	DATE	APPR	DATE

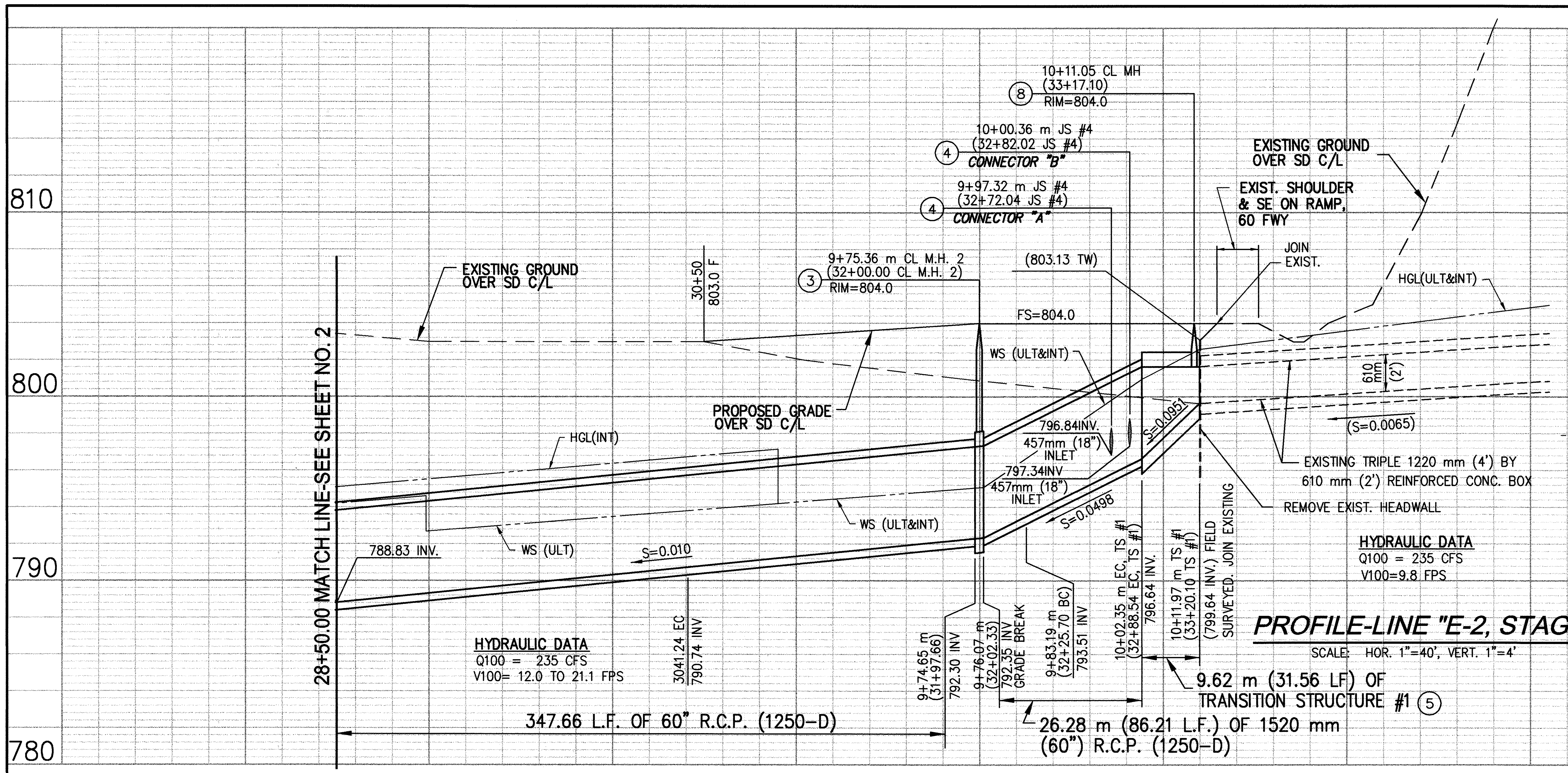
RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY:
DATE: 16-OCT-2003

APPROVED BY: Stuart McKibbin
DATE: 10-17-2003

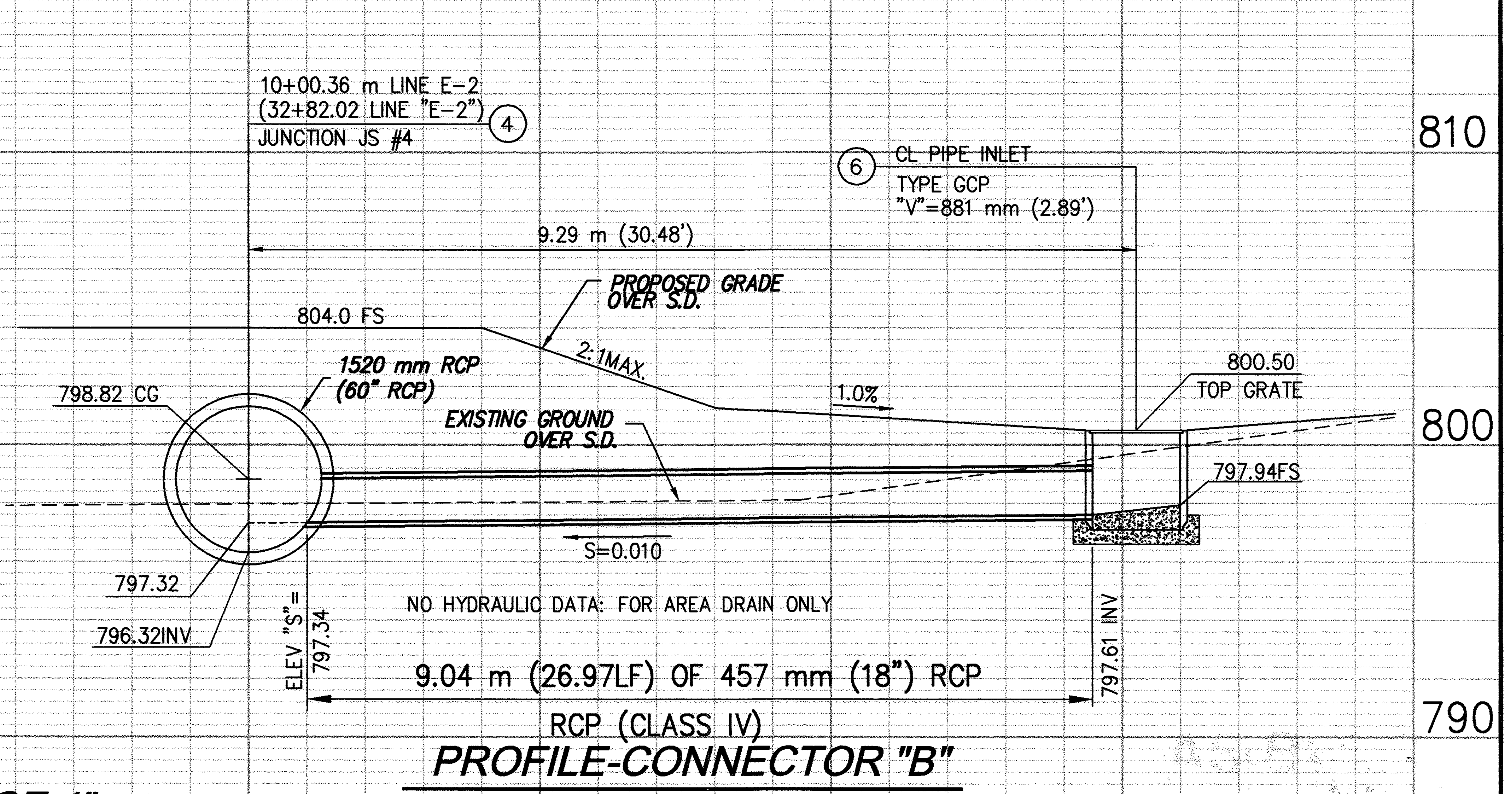
EASTVALE M.D.P.
LINE "E-2, STAGE 4"
PLOT PLAN 15978
FROM STA. 22+28.22 TO STA. 28+50.00

PROJECT NO.
2-0305
DRAWING NO.
2-332
SHEET NO.
2 OF 4



PROFILE-LINE "E-2, STAGE 4"

SCALE: HOR. 1"=40', VERT. 1"=4'



PROFILE-CONNECTOR "B"

MAINTAIN BY RIVERSIDE COUNTY FLOOD CONTROL

SCALE: HOR. 1"=4', VERT. 1"=4'

CONSTRUCTION NOTES: ○

① 1520 mm (60") RCP (1250-D). SEE TRENCH SHORING DETAIL ON SHEET 1.

② 457 mm (18") RCP (CLASS IV). SEE TRENCH SHORING DETAIL ON SHEET 1.

③ MANHOLE NO. 2 PER RIVERSIDE COUNTY FLOOD CONTROL STD. DWG. MH252 AND MH DETAIL "A" THIS SHEET.

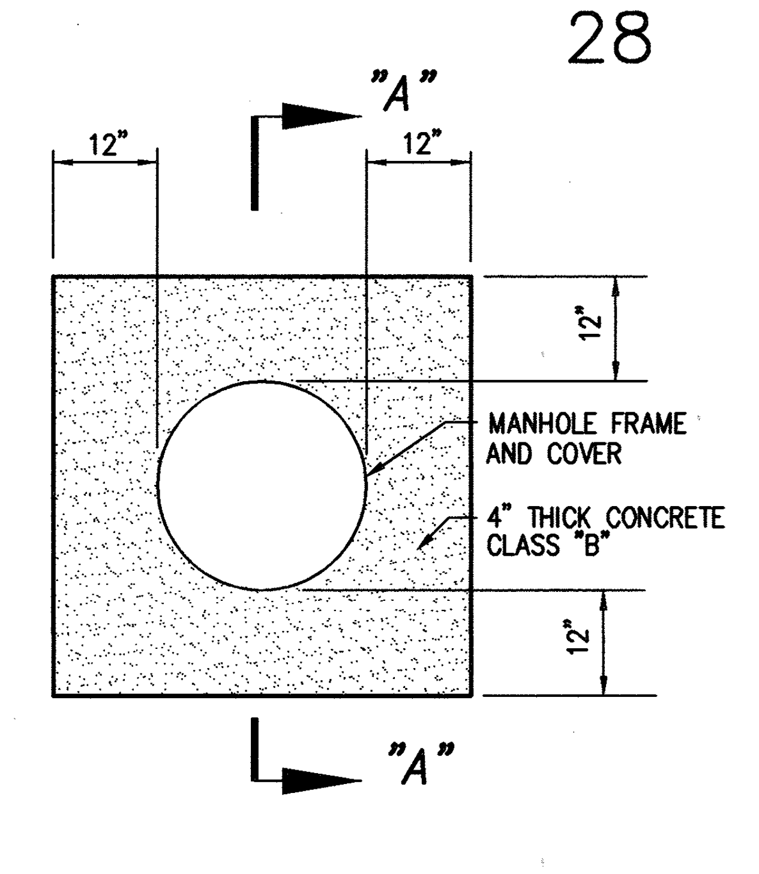
④ CONSTRUCT JUNCTION STRUCTURE NO. 4 PER RIVERSIDE COUNTY FLOOD CONTROL STD. DWG. NO. JS229.

⑤ CONSTRUCT TRANSITION STRUCTURE FROM RCP TO RCB. SEE SHEET 4 FOR DETAILS. TRANSITION STRUCTURE PER RCFC STD. DWG. TS301.

⑥ CONSTRUCT TYPE GCP W/ GRATE PIPE INLET PER CALTRANS STD. D75.

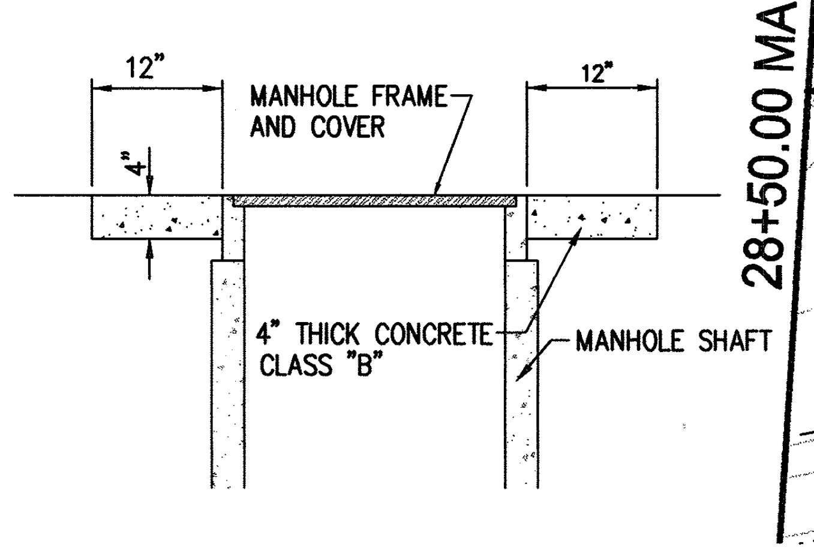
△1 ⑦ CONSTRUCT ~~14'~~ 20' DOUBLE DRIVE GATE PER CALTRANS STD. DWG. A85. GATE TO BE PLACED WITHIN CALTRANS R/W AND IN ALIGNMENT WITH THE EXISTING CHAIN LINK FENCE. GATE TO OPEN INTO CALTRANS R/W.

⑧ CONSTRUCT MANHOLE PER CALTRANS STD. D82.



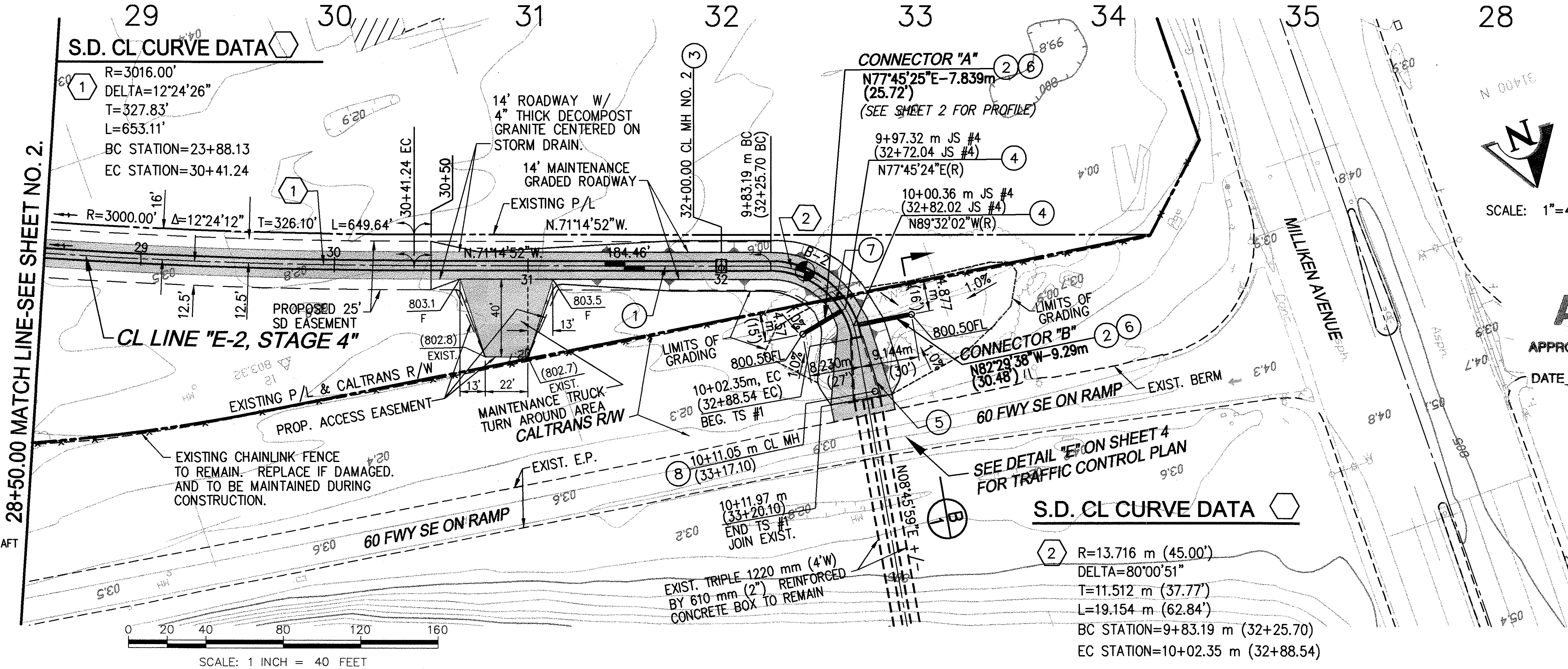
MH DETAIL "A"

NOT TO SCALE



SECTION A-A

NOT TO SCALE

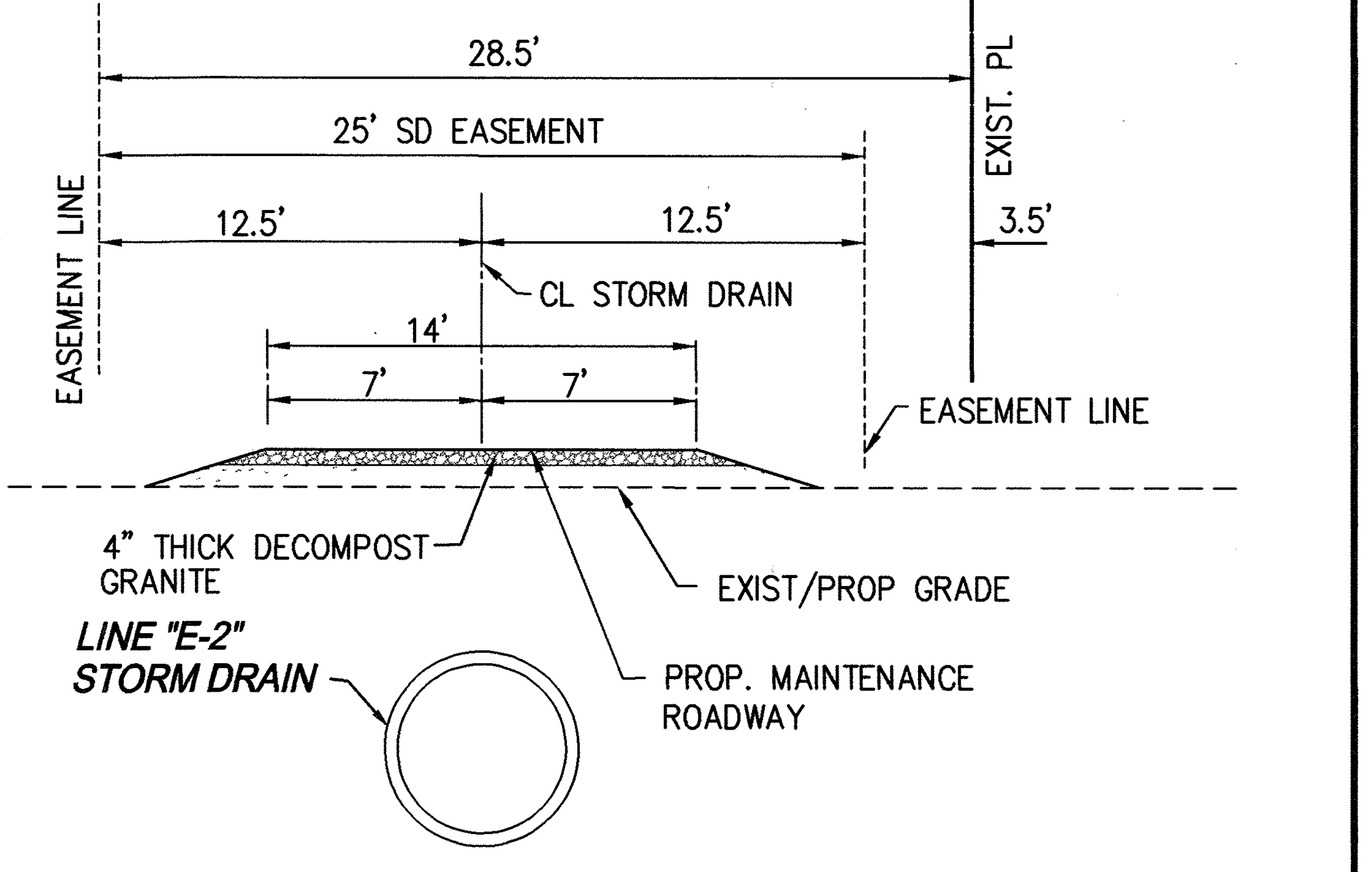


S.D. CL CURVE DATA ②

R=13.716 m (45.00')
DELTA=80°00'51"
T=11.512 m (37.77')
L=19.154 m (62.84')
BC STATION=9+83.19 m (32+25.70)
EC STATION=10+02.35 m (32+88.54)

SCALE: 1 INCH = 40 FEET

AS BUILT
APPROVED BY Teresit Tabiolo
DATE 1-20-04



SECTION AT STATION 31+50

SCALE: 1"=6'

OEM
CALTRANS PERMIT #: 08-02-6-DM-1556, 08-RIV-60-pm 0.34

Underground Service Alert
Call: TOLL FREE
1-800
227-2600
TWO WORKING DAYS BEFORE YOU DIG

KCT CONSULTANTS, INC.
Civil Engineers - Surveyors - Planners
P.O. Box 5705 Riverside, CA 92517-5705
4344 Latham St., Suite 200, Riverside, CA 92501
Phone: 909/341-8940 Fax: 909/341-8945
e-mail: kctinc@tstonramp.com

PREPARED UNDER THE SUPERVISION OF:
Teresit Tabiolo DATE 7-25-03
TERESITO N. TABIOLO, R.C.E. NO. 38826 EXP. DATE 3-31-05

TERESITO N. TABIOLO
RCE No. 38826
Exp. 3-31-05

BENCHMARK:
AT THE S.E. CORNER OF THE INTERSECTION OF HAMNER AVE. AND RIVERSIDE AVE., 47.0' EAST OF HAMNER AVE., 30.0' SOUTH OF RIVERSIDE AVE., 5.0' NORTH OF POWER POLE #674422E, 4.0' S.E. OF A SIGNAL LIGHT STANDARD, 1.0' WEST OF A MARKER POST, A BRASS DISK SET IN THE TOP OF CONC. POST AND STAMPED M.L. 38 APRIL 1964.
M.L. 38-64 ELEV.=794.579

REVISIONS					
REF.	DESCRIPTION	APPR	DATE	APPR	DATE
△1	AS-BUILT	T.T.	1-20-04		

RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

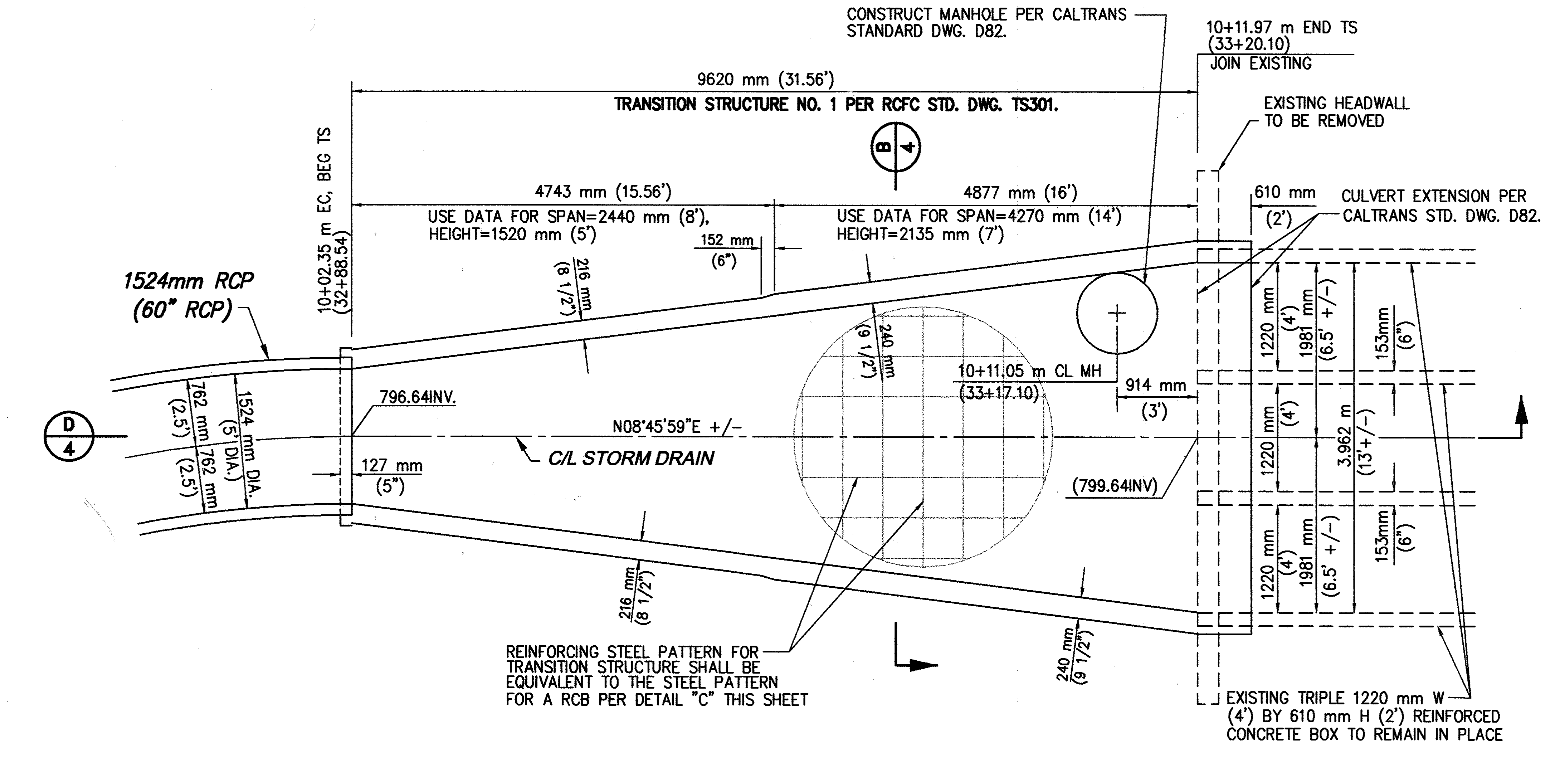
RECOMMENDED FOR APPROVAL BY:
DATE: 16-OCT-2003

APPROVED BY: Stuart McKibbin
DATE: 10-17-2003

EASTVALE M.D.P.
LINE "E-2, STAGE 4"
PLOT PLAN 15978
FROM STA. 22+28.22 TO STA. 28+50.00

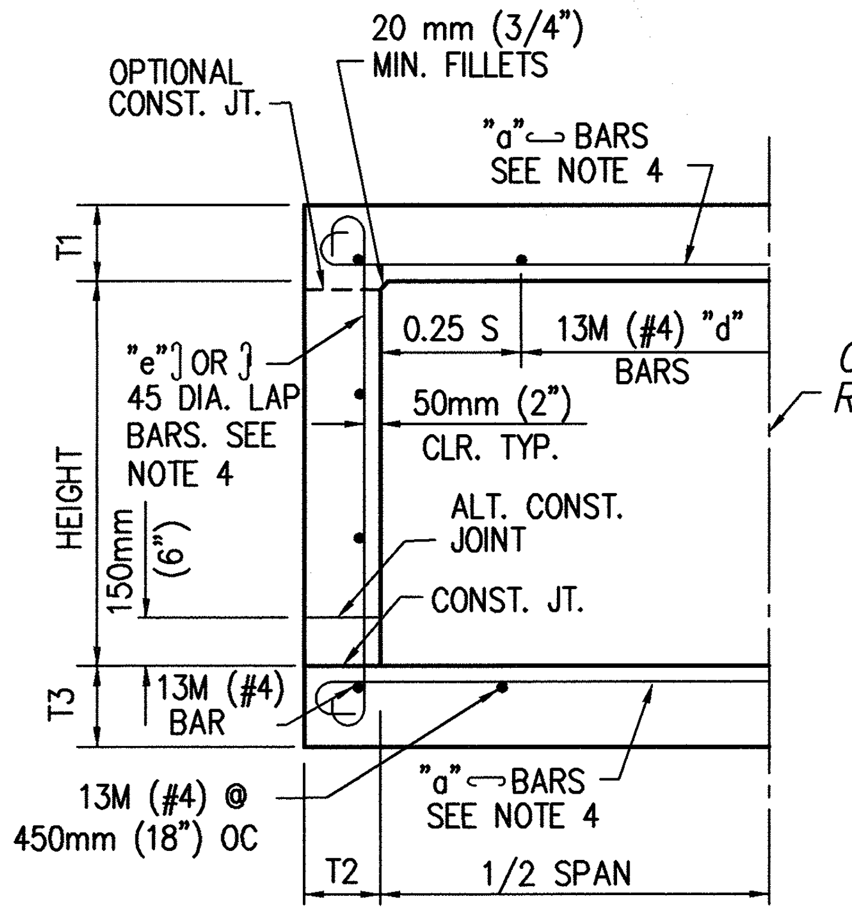
PROJECT NO. 2-0305
DRAWING NO. 2-332
SHEET NO. 3 OF 4

H:\1117\02-MasterSD\STORM DRAIN\02-sd-03.dwg
Plot Date: Jul 25, 2003 - 9:10am | Ernie
SITE [H:\1117\02-MasterSD\STORM DRAIN\02-line-e2sd-eng.dwg]
RCFC-TB [D:\07-Riverside\Engr\StromDrain\rcfc-tb.dwg]
PRO-GRID [D:\07-Riverside\Engr\StromDrain\pro-grid.dwg]
07PATOPO [H:\1128\07-Riverside\07PAtopo.dwg]
PROFILE [H:\1117\02-MasterSD\STORM DRAIN\sd-profile-main.dwg]
MSDTOPO [H:\1117\02-MasterSD\02-LS-topo.dwg]



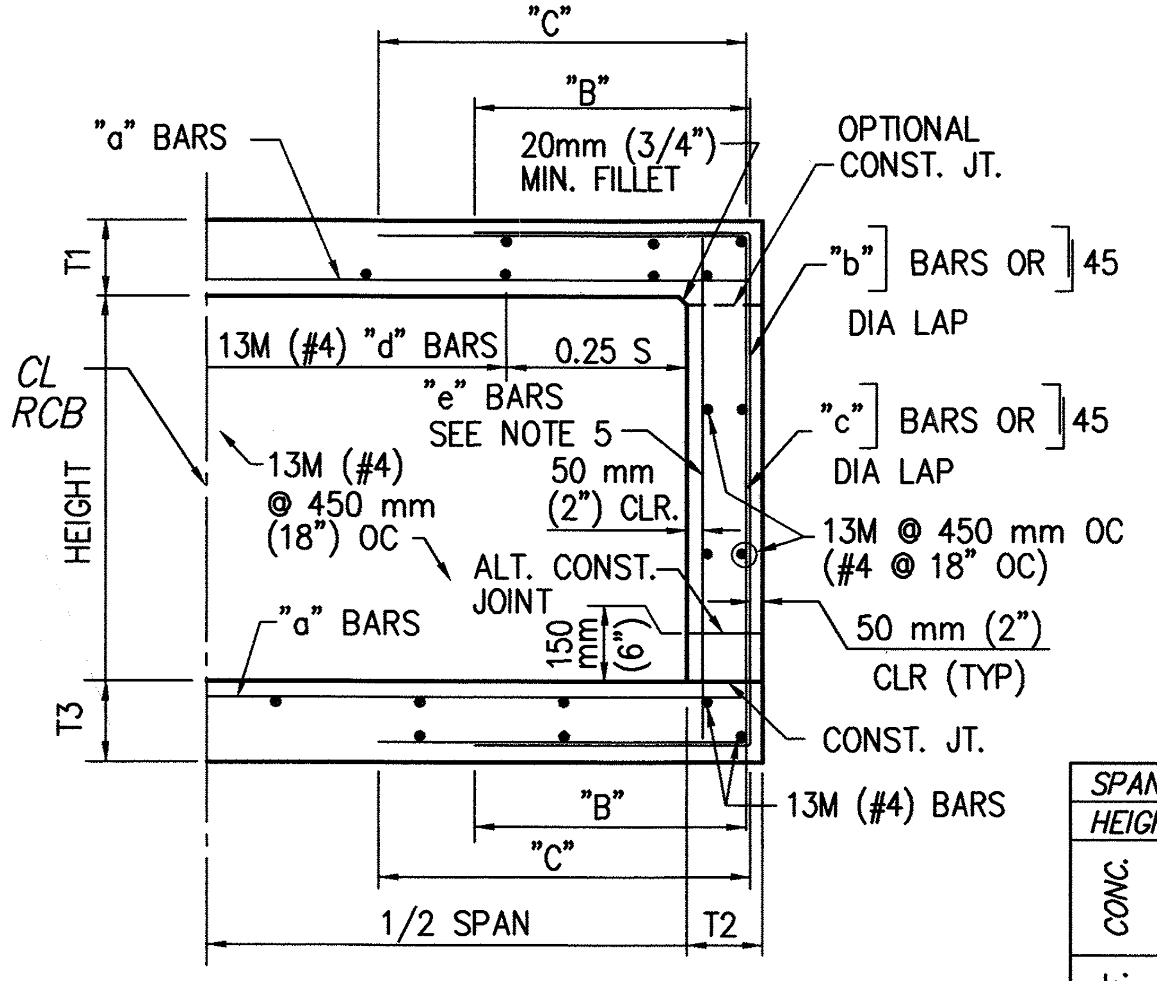
DETAIL -TRANSITION STRUCTURE #1

SCALE: 1"=4' **A**



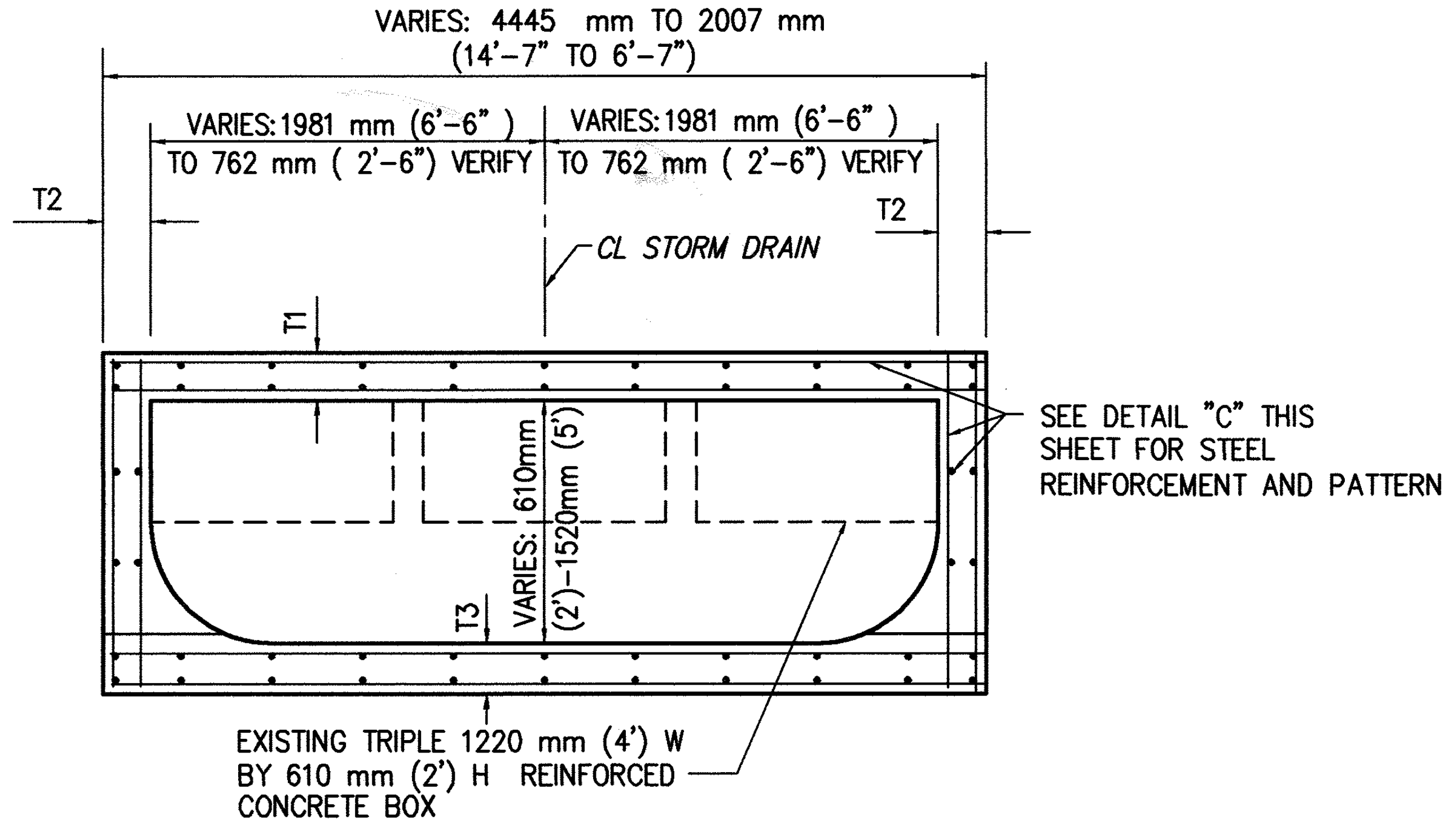
TYPICAL SECTION

SPANS 1220 mm THRU 2440 mm (4' THRU 8')



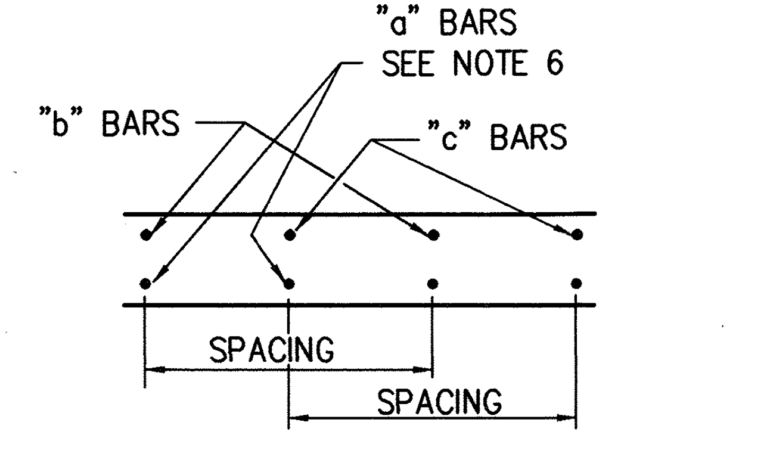
TYPICAL SECTION

SPANS 3050 mm THRU 4270 mm (10' THRU 14')



SECTION

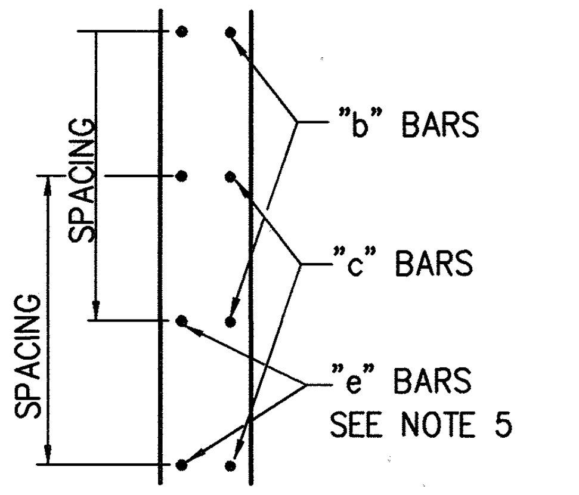
SCALE: 1"=2' **B**



ROOF SECTION-SPANS 3050 mm - 4270 mm

(SPANS 10' - 14') NTS

INVERT SIMILAR



WALL SECTION-SPANS 3050 mm - 4270 mm

(SPANS 10' - 14') NTS

SPAN mm (FT)			2440 (8)
HEIGHT mm (FT)			1520 (5)
CONC.	ROOF, T1 mm (INCHES)		215 (8 1/2)
	WALLS, T2 mm (INCHES)		165 (6 1/2)
	INVERT, T3 mm (INCHES)		205 (8)
REINF.	SPACING mm (INCHES)		150 (6)
	"a"	SIZE BAR #	22M (7)
	"e"	SIZE BAR #	16M (5)

"d" BARS		
SPAN mm (FT)	2440 (8)	4270 (14)
NUMBER	9	16

SPAN mm (FT)			4270 (14)
HEIGHT mm (FT)			2135 (7)
CONC.	ROOF, T1 mm (INCHES)		240 (9 1/2)
	WALLS, T2 mm (INCHES)		240 (9 1/2)
	INVERT, T3 mm (INCHES)		255 (10)
REINF.	SPACING mm (INCHES)		255 (10)
	"a"	SIZE BAR #	22M (7)
	"b"	SIZE BAR #	19M (6)
		DIM. "B" mm (FT-IN)	840 (2-9)
	"c"	SIZE BAR #	22M (7)
		DIM. "C" mm (FT-IN)	1220 (4-0)
	"e"	SIZE BAR #	13M (4)

NOTES:

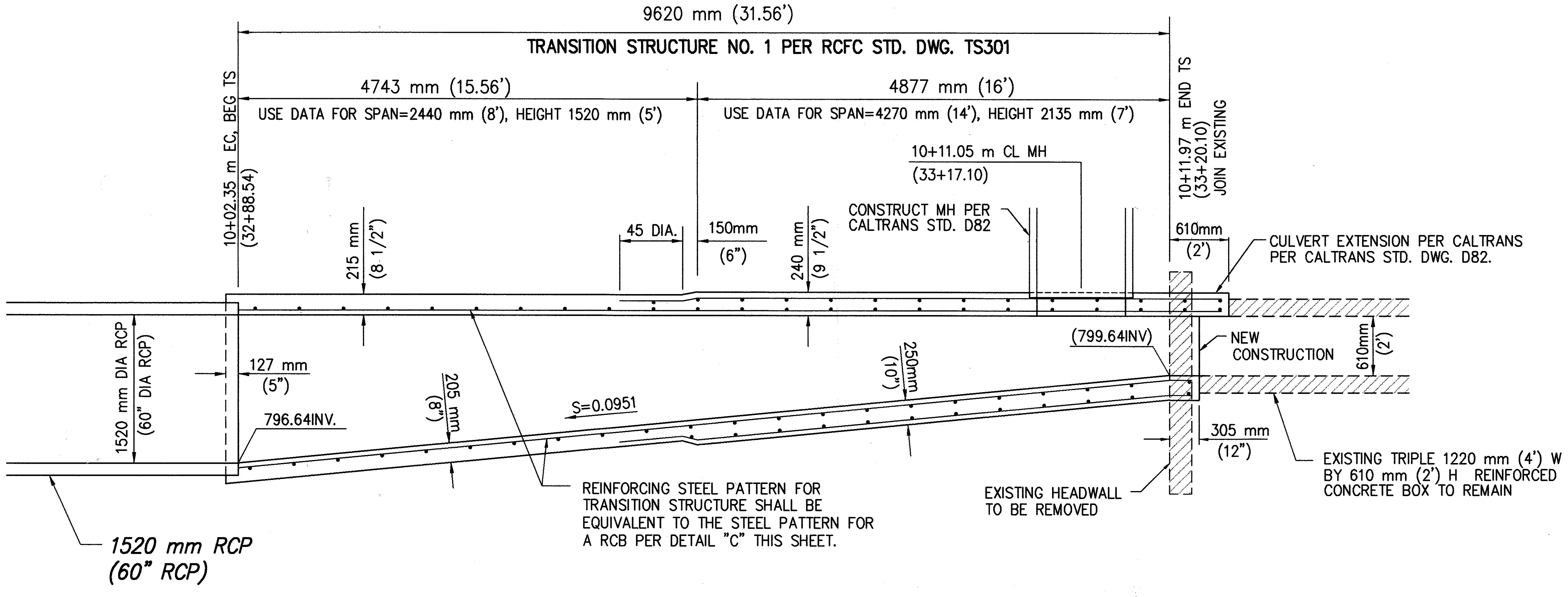
1. FOR BOXES WITH SPAN OR HEIGHT LESS THAN ANY OF THOSE SHOWN IN TABLE, USE NEXT GREATER SIZE BOX CONCRETE DIMENSIONS AND REINFORCEMENT. MAKE NECESSARY CHANGES IN BAR LENGTHS AND QUANTITIES.
2. QUANTITIES ARE APPROXIMATE AND FOR DESIGN PURPOSES ONLY.
3. FOR BOXES WITH SPAN OR HEIGH OR COVER GREATER THAN THOSE SHOWN IN IN TABLES, A SPECIAL DESIGN IS REQUIRED.
4. IT IS PERMISSABLE TO ELIMINATE THE 180 DEGREE HOOKS ON EVERY OTHER BAR.
5. "e" BARS AT HALF SPACING, SPANS 3050 mm – 4270 mm (10' – 14') ONLY.
6. "a" BARS AT HALF SPACING, SPANS 3050 mm – 4270 mm (10' – 14') ONLY.
7. FOR DESIGN AND DETAILS NOT SHOWN, SEE CALTRANS STD. PLAN D82.

AS BUILT
APPROVED BY: Tereat Tabiolo
DATE 1-20-04

CAST-IN-PLACE REINFORCED CONCRETE SINGLE BOX

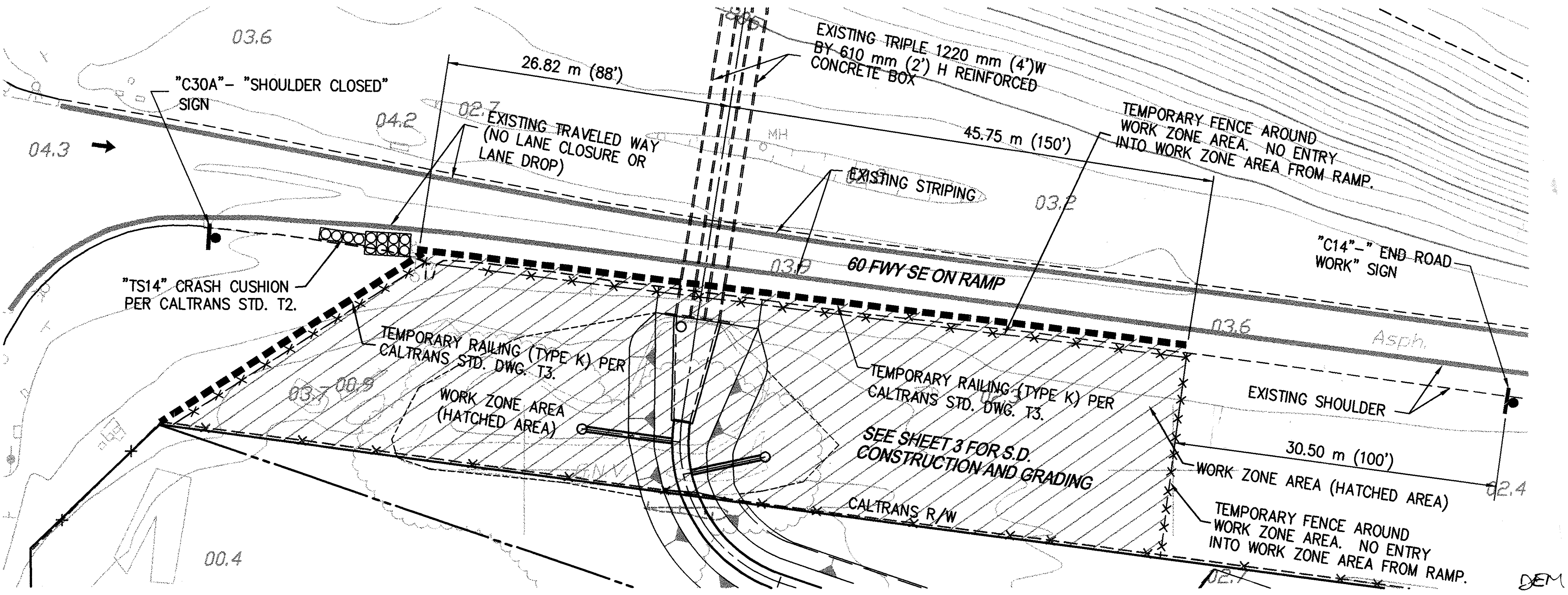
PER CALTRANS STD. DWG. D80

SCALE: NTS **C**



SECTION

SCALE: 1"=3' **D**



CALTRANS PERMIT #: 08-02-6-DM-1556, 08-RIV-60-pm 0.34

TRAFFIC CONTROL PLAN

SCALE: 1"=30' **E**

H:\1117\02-MasterSD\STORM DRAIN\02-sd-04.dwg
Plot Date: Jul 25, 2003 - 9:11am | Terry

Underground Service Alert
Call: TOLL FREE
1-800
227-2600
TWO WORKING DAYS BEFORE YOU DIG

KCT CONSULTANTS, INC.
Civil Engineers - Surveyors - Planners
P.O. Box 5705 Riverside, CA 92517-5705
4344 Latham St., Suite 200, Riverside, CA 92501
Phone: 909/341-8940 Fax: 909/341-8945
e-mail: kctinc@tstonramp.com

PREPARED UNDER THE SUPERVISION OF:
Tereat Tabiolo DATE 7-25-03
TERESITO N. TABIOLO, R.C.E. NO. 38826 EXP. DATE 3-31-05

TERESITO N. TABIOLO
RCE No. 38826
Exp. 3-31-05

BENCHMARK:
AT THE S.E. CORNER OF THE INTERSECTION OF HAMNER AVE. AND RIVERSIDE AVE., 47.0' EAST OF HAMNER AVE., 30.0' SOUTH OF RIVERSIDE AVE., 5.0' NORTH OF POWER POLE #674422E, 4.0' S.E. OF A SIGNAL LIGHT STANDARD, 1.0' WEST OF A MARKER POST, A BRASS DISK SET IN THE TOP OF CONC. POST AND STAMPED M.L. 38 APRIL 1964.
M.L. 38-64 ELEV.=794.579

REVISIONS					
REF.	DESCRIPTION	APPR	DATE	APPR	DATE

RIVERSIDE COUNTY FLOOD CONTROL
AND
WATER CONSERVATION DISTRICT

RECOMMENDED FOR APPROVAL BY:
DATE: 16-OCT-2003

APPROVED BY: Stuart McKibbin
DATE: 10-17-2003

EASTVALE M.D.P.
LINE "E-2, STAGE 4"
PLOT PLAN 15978
DETAILS/SECTIONS

PROJECT NO.
2-0305
DRAWING NO.
2-332
SHEET NO.
4 OF 4

APPENDIX 9

Offsite Short Cut Runoff Hydrograph Data

Offsite Basin

Depth (ft)	Area (ft^2)	Volume (ft^3)	Volume (ac-ft)
0.00	54969	0	0.00
0.50	57382	11476	0.26
1.00	59796	23436	0.54
1.50	62209	35877	0.82
2.00	64622	48802	1.12
2.50	67036	62209	1.43
3.00	69449	76099	1.75
3.50	71862	90471	2.08
4.00	74276	105327	2.42
4.50	76689	120664	2.77
5.00	79103	136485	3.13
5.50	81516	152788	3.51
6.00	83929	169574	3.89
6.50	86343	186842	4.29
7.00	88756	204594	4.70
7.50	91169	222827	5.12
8.00	93583	241544	5.55
8.50	95996	260743	5.99
9.00	98409	280425	6.44
9.50	100823	300590	6.90
10.00	103236	321237	7.37

Offsite Northern Property (Pre-Developed)

Drainage Area	1,800,000	sf	
	41.32	ac	
A_i	0	sf	
	0%	imp	
Runoff Index	67		Note: Plate E-6.1: Row Crops (Good); Soil Type A
F_p	0.21	in/hr	Note: Plate E-6.2: AMC III

$$F = F_p(1 - 0.9A_i)$$

F = 0.210 in/hr

For 24-hr storms, F_T is variable loss rate

$F_T = C[24 - (T/60)]^{1.55} + F_M$	**F_T =**	**0.371**
$C = (F - F_M)/54$	**C =**	**0.0019**
$T = \text{Unit Time}/2$	**T =**	**7.5**
$F_M = 0.5F$	**F_M =**	**0.105**

R C F C & W C D
HYDROLOGY
MANUAL

"SHORTCUT METHOD"
SYNTHETIC UNIT HYDROGRAPH METHOD
Unit Hydrograph and Effective Rain Calculation Form

Project SMDC (Offsite North, Pre-Developed)
By AJS Date 10/16/2017
Checked__________ Date______________

Sheet 1 / 1

[1] CONCENTRATION POINT	---	[2] AREA DESIGNATION	---
[3] DRAINAGE AREA-ACRES	41.32	[4] ULTIMATE DISCHARGE-CFS-HRS/IN (645*[3])	N/A
[5] UNIT TIME-MINUTES	15	[6] LAG TIME-MINUTES	---
[7] UNIT TIME-PERCENT OF LAG (100*[5]/[6])	---	[8] S-CURVE	N/A
[9] STORM FREQUENCY & DURATION	100-YR, 24-HR	[10] TOTAL ADJUSTED STORM RAIN-INCHES	6
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR	0.210	[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.105
[13] CONSTANT LOSS RATE-INCHES/HOUR	---	[14] LOW LOSS RATE-PERCENT	85

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[16] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[17] UNIT HYDROGRAPH CFS-HRS/IN [4]*[18] 100.000	[20] PATTERN PERCENT (PL E-5.9)	[21] STORM RAIN IN/HR 60[10][20] 100[5]	[22] LOSS RATE IN/HR		[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
							MAX	LOW		
1					0.2	0.048	0.371	0.041	0.007	0.30
2					0.3	0.072	0.367	0.061	0.011	0.45
3					0.3	0.072	0.362	0.061	0.011	0.45
4					0.4	0.096	0.358	0.082	0.014	0.60
5					0.3	0.072	0.354	0.061	0.011	0.45
6					0.3	0.072	0.350	0.061	0.011	0.45
7					0.3	0.072	0.345	0.061	0.011	0.45
8					0.4	0.096	0.341	0.082	0.014	0.60
9					0.4	0.096	0.337	0.082	0.014	0.60
10					0.4	0.096	0.333	0.082	0.014	0.60
11					0.5	0.120	0.329	0.102	0.018	0.75
12					0.5	0.120	0.325	0.102	0.018	0.75
13					0.5	0.120	0.321	0.102	0.018	0.75
14					0.5	0.120	0.317	0.102	0.018	0.75
15					0.5	0.120	0.313	0.102	0.018	0.75
16					0.6	0.144	0.309	0.122	0.022	0.90
17					0.6	0.144	0.305	0.122	0.022	0.90
18					0.7	0.168	0.301	0.143	0.025	1.05
19					0.7	0.168	0.297	0.143	0.025	1.05
20					0.8	0.192	0.293	0.163	0.029	1.20
21					0.6	0.144	0.290	0.122	0.022	0.90
22					0.7	0.168	0.286	0.143	0.025	1.05
23					0.8	0.192	0.282	0.163	0.029	1.20
24					0.8	0.192	0.278	0.163	0.029	1.20
25					0.9	0.216	0.275	0.184	0.032	1.35
26					0.9	0.216	0.271	0.184	0.032	1.35
27					1.0	0.240	0.267	0.204	0.036	1.50
28					1.0	0.240	0.264	0.204	0.036	1.50
29					1.0	0.240	0.260	0.204	0.036	1.50
30					1.1	0.264	0.257	0.224	0.007	0.30
31					1.2	0.288	0.253	0.245	0.035	1.45
32					1.3	0.312	0.250	0.265	0.062	2.60
33					1.5	0.360	0.246	0.306	0.114	4.74
34					1.5	0.360	0.243	0.306	0.117	4.88
35					1.6	0.384	0.239	0.326	0.145	6.03
36					1.7	0.408	0.236	0.347	0.172	7.17
37					1.9	0.456	0.233	0.388	0.223	9.31
38					2.0	0.480	0.229	0.408	0.251	10.44
39					2.1	0.504	0.226	0.428	0.278	11.58
40					2.2	0.528	0.223	0.449	0.305	12.72
41					1.5	0.360	0.220	0.306	0.140	5.85
42					1.5	0.360	0.216	0.306	0.144	5.98
43					2.0	0.480	0.213	0.408	0.267	11.11
44					2.0	0.480	0.210	0.408	0.270	11.24
45					1.9	0.456	0.207	0.388	0.249	10.37
46					1.9	0.456	0.204	0.388	0.252	10.50
47					1.7	0.408	0.201	0.347	0.207	8.63
48					1.8	0.432	0.198	0.367	0.234	9.75
49					2.5	0.600	0.195	0.510	0.405	16.87
50					2.6	0.624	0.192	0.530	0.432	17.99
51					2.8	0.672	0.189	0.571	0.483	20.11
52					2.9	0.696	0.186	0.592	0.510	21.23
53					3.4	0.816	0.184	0.694	0.632	26.35
54					3.4	0.816	0.181	0.694	0.635	**26.47**
55					2.3	0.552	0.178	0.469	0.374	15.58
56					2.3	0.552	0.175	0.469	0.377	15.69
57					2.7	0.648	0.173	0.551	0.475	19.81
58					2.6	0.624	0.170	0.530	0.454	18.92
59					2.6	0.624	0.167	0.530	0.457	19.02
60					2.5	0.600	0.165	0.510	0.435	18.13
61					2.4	0.576	0.162	0.490	0.414	17.24
62					2.3	0.552	0.160	0.469	0.392	16.34
63					1.9	0.456	0.157	0.388	0.299	12.44
64					1.9	0.456	0.155	0.388	0.301	12.54

R C F C & W C D
HYDROLOGY MANUAL

"SHORTCUT METHOD"
SYNTHETIC UNIT HYDROGRAPH METHOD
Unit Hydrograph and Effective Rain Calculation Form

Project SMDC (Offsite North, Pre-Developed)
By AJS **Date** 10/16/2017
Checked___________ **Date**_______________

Sheet 1 / 1

[1] CONCENTRATION POINT	---	**[2] AREA DESIGNATION**	---
[3] DRAINAGE AREA-ACRES	41.32	**[4] ULTIMATE DISCHARGE-CFS-HRS/IN (645*[3])**	N/A
[5] UNIT TIME-MINUTES	15	**[6] LAG TIME-MINUTES**	---
[7] UNIT TIME-PERCENT OF LAG (100*[5]/[6])	---	**[8] S-CURVE**	N/A
[9] STORM FREQUENCY & DURATION	100-YR, 24-HR	**[10] TOTAL ADJUSTED STORM RAIN-INCHES**	6
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR	0.210	**[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR**	0.105
[13] CONSTANT LOSS RATE-INCHES/HOUR	---	**[14] LOW LOSS RATE-PERCENT**	85

	UNIT HYDROGRAPH				**EFFECTIVE RAIN**					**FLOOD HYDROGRAPH**
[15] UNIT TIME PERIOD m	**[16] TIME PERCENT OF LAG [7]*[15]**	**[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)**	**[16] DISTRIB GRAPH PERCENT [17]m-[17]m-1**	**[17] UNIT HYDROGRAPH CFS-HRS/IN [4]*[18] 100.000**	**[20] PATTERN PERCENT (PL E-5.9)**	**[21] STORM RAIN IN/HR 60[10][20] 100[5]**	**[22] LOSS RATE IN/HR**		**[23] EFFECTIVE RAIN IN/HR [21]-[22]**	**[24] FLOW CFS**
							MAX	**LOW**		
65					0.4	0.096	0.153	0.082	0.014	0.60
66					0.4	0.096	0.150	0.082	0.014	0.60
67					0.3	0.072	0.148	0.061	0.011	0.45
68					0.3	0.072	0.146	0.061	0.011	0.45
69					0.5	0.120	0.144	0.102	0.018	0.75
70					0.5	0.120	0.141	0.102	0.018	0.75
71					0.5	0.120	0.139	0.102	0.018	0.75
72					0.4	0.096	0.137	0.082	0.014	0.60
73					0.4	0.096	0.135	0.082	0.014	0.60
74					0.4	0.096	0.133	0.082	0.014	0.60
75					0.3	0.072	0.131	0.061	0.011	0.45
76					0.2	0.048	0.129	0.041	0.007	0.30
77					0.3	0.072	0.128	0.061	0.011	0.45
78					0.4	0.096	0.126	0.082	0.014	0.60
79					0.3	0.072	0.124	0.061	0.011	0.45
80					0.2	0.048	0.122	0.041	0.007	0.30
81					0.3	0.072	0.121	0.061	0.011	0.45
82					0.3	0.072	0.119	0.061	0.011	0.45
83					0.3	0.072	0.118	0.061	0.011	0.45
84					0.2	0.048	0.116	0.041	0.007	0.30
85					0.3	0.072	0.115	0.061	0.011	0.45
86					0.2	0.048	0.114	0.041	0.007	0.30
87					0.3	0.072	0.112	0.061	0.011	0.45
88					0.2	0.048	0.111	0.041	0.007	0.30
89					0.3	0.072	0.110	0.061	0.011	0.45
90					0.2	0.048	0.109	0.041	0.007	0.30
91					0.2	0.048	0.108	0.041	0.007	0.30
92					0.2	0.048	0.107	0.041	0.007	0.30
93					0.2	0.048	0.107	0.041	0.007	0.30
94					0.2	0.048	0.106	0.041	0.007	0.30
95					0.2	0.048	0.105	0.041	0.007	0.30
96					0.2	0.048	0.105	0.041	0.007	0.30
TOTALS					100.0				11.50	479.14

EFFECTIVE RAIN = 2.87 INCHES
TOTAL RUNOFF VOLUME = 9.90 AC-FT

R C F C & W C D
HYDROLOGY
MANUAL

"SHORTCUT METHOD"
SYNTHETIC UNIT HYDROGRAPH METHOD
Unit Hydrograph and Effective Rain Calculation Form

Project SMDC (Offsite North, Pre-Developed)
By AJS **Date** 10/16/2017
Checked__________ **Date**_______________
Sheet 1 / 1

[1] CONCENTRATION POINT ---
[3] DRAINAGE AREA-ACRES 41.32
[5] UNIT TIME-MINUTES 10
[7] UNIT TIME-PERCENT OF LAG (100*[5]/[6]) ---
[9] STORM FREQUENCY & DURATION 100-YR, 6-HR
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR ---
[13] CONSTANT LOSS RATE-INCHES/HOUR 0.210
[2] AREA DESIGNATION ---
[4] ULTIMATE DISCHARGE-CFS-HRS/IN (645*[3]) ---
[6] LAG TIME-MINUTES ---
[8] S-CURVE ---
[10] TOTAL ADJUSTED STORM RAIN-INCHES 3.5
[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR ---
[14] LOW LOSS RATE-PERCENT 85

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[16] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[17] UNIT HYDROGRAPH CFS-HRS/IN [4]*[18] 100.000	[20] PATTERN PERCENT (PL E-5.9)	[21] STORM RAIN IN/HR 60[10][20] 100[5]	[22] LOSS RATE IN/HR		[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
							MAX	LOW		
1					1.1	0.231	0.210	0.196	0.035	1.44
2					1.2	0.252	0.210	0.214	0.042	1.75
3					1.3	0.273	0.210	0.232	0.063	2.62
4					1.4	0.294	0.210	0.250	0.084	3.50
5					1.4	0.294	0.210	0.250	0.084	3.50
6					1.5	0.315	0.210	0.268	0.105	4.37
7					1.6	0.336	0.210	0.286	0.126	5.25
8					1.6	0.336	0.210	0.286	0.126	5.25
9					1.6	0.336	0.210	0.286	0.126	5.25
10					1.6	0.336	0.210	0.286	0.126	5.25
11					1.6	0.336	0.210	0.286	0.126	5.25
12					1.7	0.357	0.210	0.303	0.147	6.12
13					1.7	0.357	0.210	0.303	0.147	6.12
14					1.8	0.378	0.210	0.321	0.168	7.00
15					1.8	0.378	0.210	0.321	0.168	7.00
16					1.8	0.378	0.210	0.321	0.168	7.00
17					2.0	0.420	0.210	0.357	0.210	8.75
18					2.0	0.420	0.210	0.357	0.210	8.75
19					2.1	0.441	0.210	0.375	0.231	9.62
20					2.2	0.462	0.210	0.393	0.252	10.50
21					2.5	0.525	0.210	0.446	0.315	13.12
22					2.8	0.588	0.210	0.500	0.378	15.75
23					3.0	0.630	0.210	0.536	0.420	17.50
24					3.2	0.672	0.210	0.571	0.462	19.25
25					3.5	0.735	0.210	0.625	0.525	21.87
26					3.9	0.819	0.210	0.696	0.609	25.37
27					4.2	0.882	0.210	0.750	0.672	28.00
28					4.5	0.945	0.210	0.803	0.735	30.62
29					4.8	1.008	0.210	0.857	0.798	33.25
30					5.1	1.071	0.210	0.910	0.861	35.87
31					6.7	1.407	0.210	1.196	1.197	49.87
32					8.1	1.701	0.210	1.446	1.491	62.12
33					10.3	2.163	0.210	1.839	1.953	**81.37**
34					2.8	0.588	0.210	0.500	0.378	15.75
35					1.1	0.231	0.210	0.196	0.035	1.44
36					0.5	0.105	0.210	0.089	0.016	0.66
TOTALS					100.0				13.59	566.17

EFFECTIVE RAIN = 2.26 INCHES
TOTAL RUNOFF VOLUME = 7.80 AC-FT

R C F C & W C D **HYDROLOGY** **MANUAL**	**"SHORTCUT METHOD"** **SYNTHETIC UNIT HYDROGRAPH METHOD** **Unit Hydrograph and Effective Rain Calculation Form**	**Project** SMDC (Offsite North, Pre-Developed) **By**______AJS **Date**______10/16/2017 **Checked**__________ **Date**____________	**Sheet** 1 / 1

[1] CONCENTRATION POINT	---	**[2] AREA DESIGNATION**	---
[3] DRAINAGE AREA-ACRES	41.32	**[4] ULTIMATE DISCHARGE-CFS-HRS/IN (645*[3])**	---
[5] UNIT TIME-MINUTES	5	**[6] LAG TIME-MINUTES**	---
[7] UNIT TIME-PERCENT OF LAG (100*[5]/[6])	---	**[8] S-CURVE**	---
[9] STORM FREQUENCY & DURATION	100-YR, 3-HR	**[10] TOTAL ADJUSTED STORM RAIN-INCHES**	2.25
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR	---	**[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR**	---
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.210	**[14] LOW LOSS RATE-PERCENT**	85

	UNIT HYDROGRAPH				**EFFECTIVE RAIN**					**FLOOD HYDROGRAPH**
[15] UNIT TIME PERIOD m	**[16] TIME PERCENT OF LAG [7]*[15]**	**[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)**	**[16] DISTRIB GRAPH PERCENT [17]m-[17]m-1**	**[17] UNIT HYDROGRAPH CFS-HRS/IN [4]*[18] 100.000**	**[20] PATTERN PERCENT (PL E-5.9)**	**[21] STORM RAIN IN/HR 60[10][20] 100[5]**	**[22] LOSS RATE IN/HR**		**[23] EFFECTIVE RAIN IN/HR [21]-[22]**	**[24] FLOW CFS**
							MAX	**LOW**		
1					1.3	0.351	0.210	0.298	0.141	5.87
2					1.3	0.351	0.210	0.298	0.141	5.87
3					1.1	0.297	0.210	0.252	0.087	3.62
4					1.5	0.405	0.210	0.344	0.195	8.12
5					1.5	0.405	0.210	0.344	0.195	8.12
6					1.8	0.486	0.210	0.413	0.276	11.50
7					1.5	0.405	0.210	0.344	0.195	8.12
8					1.8	0.486	0.210	0.413	0.276	11.50
9					1.8	0.486	0.210	0.413	0.276	11.50
10					1.5	0.405	0.210	0.344	0.195	8.12
11					1.6	0.432	0.210	0.367	0.222	9.25
12					1.8	0.486	0.210	0.413	0.276	11.50
13					2.2	0.594	0.210	0.505	0.384	16.00
14					2.2	0.594	0.210	0.505	0.384	16.00
15					2.2	0.594	0.210	0.505	0.384	16.00
16					2.0	0.540	0.210	0.459	0.330	13.75
17					2.6	0.702	0.210	0.597	0.492	20.50
18					2.7	0.729	0.210	0.620	0.519	21.62
19					2.4	0.648	0.210	0.551	0.438	18.25
20					2.7	0.729	0.210	0.620	0.519	21.62
21					3.3	0.891	0.210	0.757	0.681	28.37
22					3.1	0.837	0.210	0.711	0.627	26.12
23					2.9	0.783	0.210	0.666	0.573	23.87
24					3.0	0.810	0.210	0.689	0.600	25.00
25					3.1	0.837	0.210	0.711	0.627	26.12
26					4.2	1.134	0.210	0.964	0.924	38.50
27					5.0	1.350	0.210	1.148	1.140	47.50
28					3.5	0.945	0.210	0.803	0.735	30.62
29					6.8	1.836	0.210	1.561	1.626	67.75
30					7.3	1.971	0.210	1.675	1.761	73.37
31					8.2	2.214	0.210	1.882	2.004	**83.50**
32					5.9	1.593	0.210	1.354	1.383	57.62
33					2.0	0.540	0.210	0.459	0.330	13.75
34					1.8	0.486	0.210	0.413	0.276	11.50
35					1.8	0.486	0.210	0.413	0.276	11.50
36					0.6	0.162	0.210	0.138	0.024	1.01
TOTALS					100.0				19.51	813.01

EFFECTIVE RAIN = 1.63 INCHES

TOTAL RUNOFF VOLUME = 5.60 AC-FT

R C F C & W C D
HYDROLOGY
MANUAL

"SHORTCUT METHOD"
SYNTHETIC UNIT HYDROGRAPH METHOD
Unit Hydrograph and Effective Rain Calculation Form

Project SMDC (Offsite North, Pre-Developed)
By AJS **Date** 10/16/2017
Checked___________ **Date**________________

Sheet 1 / 1

[1] CONCENTRATION POINT	---	**[2] AREA DESIGNATION**	---
[3] DRAINAGE AREA-ACRES	41.32	**[4] ULTIMATE DISCHARGE-CFS-HRS/IN (645*[3])**	---
[5] UNIT TIME-MINUTES	5	**[6] LAG TIME-MINUTES**	---
[7] UNIT TIME-PERCENT OF LAG (100*[5]/[6])	---	**[8] S-CURVE**	---
[9] STORM FREQUENCY & DURATION	100-YR, 1-HR	**[10] TOTAL ADJUSTED STORM RAIN-INCHES**	1.3
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR	---	**[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR**	---
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.210	**[14] LOW LOSS RATE-PERCENT**	85

	UNIT HYDROGRAPH				**EFFECTIVE RAIN**					**FLOOD HYDROGRAPH**
[15] UNIT TIME PERIOD m	**[16] TIME PERCENT OF LAG [7]*[15]**	**[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)**	**[16] DISTRIB GRAPH PERCENT [17]m-[17]m-1**	**[17] UNIT HYDROGRAPH CFS-HRS/IN [4]*[18] 100.000**	**[20] PATTERN PERCENT (PL E-5.9)**	**[21] STORM RAIN IN/HR 60[10][20] 100[5]**	**[22] LOSS RATE IN/HR**		**[23] EFFECTIVE RAIN IN/HR [21]-[22]**	**[24] FLOW CFS**
							MAX	**LOW**		
1					4.2	0.655	0.210	0.557	0.445	18.55
2					4.3	0.671	0.210	0.570	0.461	19.20
3					5.0	0.780	0.210	0.663	0.570	23.75
4					5.0	0.780	0.210	0.663	0.570	23.75
5					5.8	0.905	0.210	0.769	0.695	28.95
6					6.5	1.014	0.210	0.862	0.804	33.50
7					7.4	1.154	0.210	0.981	0.944	39.35
8					8.6	1.342	0.210	1.140	1.132	47.15
9					12.3	1.919	0.210	1.631	1.709	71.20
10					29.1	4.540	0.210	3.859	4.330	**180.40**
11					6.8	1.061	0.210	0.902	0.851	35.45
12					5.0	0.780	0.210	0.663	0.570	23.75
TOTALS					100.0				13.08	545.00

EFFECTIVE RAIN = 1.09 INCHES
TOTAL RUNOFF VOLUME = 3.75 AC-FT

Offsite Northern Property (Developed)

Drainage Area	1,800,000	sf
	41.32	ac
A_i	1,620,000	sf
	90%	imp
Runoff Index	32	Note: Plate E-6.1: Residential or Commercial Landscaping (Good); Soil Type A
F_p	0.54 in/hr	Note: Plate E-6.2: AMC III

$F = F_p(1 - 0.9A_i)$ **F = 0.103 in/hr**

For 24-hr storms, F_T is variable loss rate

$F_T = C[24 - (T/60)]^{1.55} + F_M$	**F_T =**	**0.181**
$C = (F - F_M)/54$	**C =**	**0.0010**
$T = \text{Unit Time}/2$	**T =**	**7.5**
$F_M = 0.5F$	**F_M =**	**0.051**

R C F C & W C D
HYDROLOGY
MANUAL

"SHORTCUT METHOD"
SYNTHETIC UNIT HYDROGRAPH METHOD
Unit Hydrograph and Effective Rain Calculation Form

Project
SMDC (Offsite North, Developed)
By AJS Date 10/16/2017
Checked__________ Date_______________

Sheet 1 / 1

[1] CONCENTRATION POINT	---	[2] AREA DESIGNATION	---
[3] DRAINAGE AREA-ACRES	41.32	[4] ULTIMATE DISCHARGE-CFS-HRS/IN (645*[3])	N/A
[5] UNIT TIME-MINUTES	15	[6] LAG TIME-MINUTES	---
[7] UNIT TIME-PERCENT OF LAG (100*[5]/[6])	---	[8] S-CURVE	N/A
[9] STORM FREQUENCY & DURATION	100-YR, 24-HR	[10] TOTAL ADJUSTED STORM RAIN-INCHES	6
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR	0.103	[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	0.051
[13] CONSTANT LOSS RATE-INCHES/HOUR	---	[14] LOW LOSS RATE-PERCENT	85

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[16] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[17] UNIT HYDROGRAPH CFS-HRS/IN [4]*[18] 100.000	[20] PATTERN PERCENT (PL E-5.9)	[21] STORM RAIN IN/HR 60[10][20] 100[5]	[22] LOSS RATE IN/HR		[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
							MAX	LOW		
1					0.2	0.048	0.181	0.041	0.007	0.30
2					0.3	0.072	0.179	0.061	0.011	0.45
3					0.3	0.072	0.177	0.061	0.011	0.45
4					0.4	0.096	0.175	0.082	0.014	0.60
5					0.3	0.072	0.173	0.061	0.011	0.45
6					0.3	0.072	0.171	0.061	0.011	0.45
7					0.3	0.072	0.169	0.061	0.011	0.45
8					0.4	0.096	0.167	0.082	0.014	0.60
9					0.4	0.096	0.165	0.082	0.014	0.60
10					0.4	0.096	0.163	0.082	0.014	0.60
11					0.5	0.120	0.161	0.102	0.018	0.75
12					0.5	0.120	0.159	0.102	0.018	0.75
13					0.5	0.120	0.157	0.102	0.018	0.75
14					0.5	0.120	0.155	0.102	0.018	0.75
15					0.5	0.120	0.153	0.102	0.018	0.75
16					0.6	0.144	0.151	0.122	0.022	0.90
17					0.6	0.144	0.149	0.122	0.022	0.90
18					0.7	0.168	0.147	0.143	0.021	0.87
19					0.7	0.168	0.145	0.143	0.023	0.95
20					0.8	0.192	0.143	0.163	0.049	2.03
21					0.6	0.144	0.142	0.122	0.002	0.10
22					0.7	0.168	0.140	0.143	0.028	1.18
23					0.8	0.192	0.138	0.163	0.054	2.26
24					0.8	0.192	0.136	0.163	0.056	2.33
25					0.9	0.216	0.134	0.184	0.082	3.41
26					0.9	0.216	0.132	0.184	0.084	3.48
27					1.0	0.240	0.131	0.204	0.109	4.56
28					1.0	0.240	0.129	0.204	0.111	4.63
29					1.0	0.240	0.127	0.204	0.113	4.70
30					1.1	0.264	0.125	0.224	0.139	5.77
31					1.2	0.288	0.124	0.245	0.164	6.85
32					1.3	0.312	0.122	0.265	0.190	7.92
33					1.5	0.360	0.120	0.306	0.240	9.99
34					1.5	0.360	0.119	0.306	0.241	10.06
35					1.6	0.384	0.117	0.326	0.267	11.13
36					1.7	0.408	0.115	0.347	0.293	12.20
37					1.9	0.456	0.114	0.388	0.342	14.26
38					2.0	0.480	0.112	0.408	0.368	15.33
39					2.1	0.504	0.110	0.428	0.394	16.40
40					2.2	0.528	0.109	0.449	0.419	17.46
41					1.5	0.360	0.107	0.306	0.253	10.53
42					1.5	0.360	0.106	0.306	0.254	10.59
43					2.0	0.480	0.104	0.408	0.376	15.66
44					2.0	0.480	0.103	0.408	0.377	15.72
45					1.9	0.456	0.101	0.388	0.355	14.78
46					1.9	0.456	0.100	0.388	0.356	14.85
47					1.7	0.408	0.098	0.347	0.310	12.91
48					1.8	0.432	0.097	0.367	0.335	13.97
49					2.5	0.600	0.095	0.510	0.505	21.03
50					2.6	0.624	0.094	0.530	0.530	22.09
51					2.8	0.672	0.092	0.571	0.580	24.15
52					2.9	0.696	0.091	0.592	0.605	25.21
53					3.4	0.816	0.090	0.694	0.726	30.26
54					3.4	0.816	0.088	0.694	0.728	**30.32**
55					2.3	0.552	0.087	0.469	0.465	19.38
56					2.3	0.552	0.086	0.469	0.466	19.43
57					2.7	0.648	0.084	0.551	0.564	23.49
58					2.6	0.624	0.083	0.530	0.541	22.54
59					2.6	0.624	0.082	0.530	0.542	22.59
60					2.5	0.600	0.081	0.510	0.519	21.64
61					2.4	0.576	0.079	0.490	0.497	20.70
62					2.3	0.552	0.078	0.469	0.474	19.75
63					1.9	0.456	0.077	0.388	0.379	15.80
64					1.9	0.456	0.076	0.388	0.380	15.84

R C F C & W C D HYDROLOGY MANUAL	**"SHORTCUT METHOD"** **SYNTHETIC UNIT HYDROGRAPH METHOD** **Unit Hydrograph and Effective Rain Calculation Form**	**Project** SMDC (Offsite North, Developed) **By** AJS **Date** 10/16/2017 **Checked**__________ **Date**__________	**Sheet** 1 / 1

[1] CONCENTRATION POINT	---	**[2] AREA DESIGNATION**	---
[3] DRAINAGE AREA-ACRES	41.32	**[4] ULTIMATE DISCHARGE-CFS-HRS/IN (645*[3])**	N/A
[5] UNIT TIME-MINUTES	15	**[6] LAG TIME-MINUTES**	---
[7] UNIT TIME-PERCENT OF LAG (100*[5]/[6])	---	**[8] S-CURVE**	N/A
[9] STORM FREQUENCY & DURATION	100-YR, 24-HR	**[10] TOTAL ADJUSTED STORM RAIN-INCHES**	6
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR	0.103	**[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR**	0.051
[13] CONSTANT LOSS RATE-INCHES/HOUR	---	**[14] LOW LOSS RATE-PERCENT**	85

	UNIT HYDROGRAPH				**EFFECTIVE RAIN**					**FLOOD HYDROGRAPH**
[15] UNIT TIME PERIOD m	**[16] TIME PERCENT OF LAG [7]*[15]**	**[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)**	**[16] DISTRIB GRAPH PERCENT [17]m-[17]m-1**	**[17] UNIT HYDROGRAPH CFS-HRS/IN [4]*[18] 100.000**	**[20] PATTERN PERCENT (PL E-5.9)**	**[21] STORM RAIN IN/HR 60[10][20] 100[5]**	**[22] LOSS RATE IN/HR**		**[23] EFFECTIVE RAIN IN/HR [21]-[22]**	**[24] FLOW CFS**
							MAX	**LOW**		
65					0.4	0.096	0.075	0.082	0.021	0.89
66					0.4	0.096	0.073	0.082	0.023	0.94
67					0.3	0.072	0.072	0.061	0.011	0.45
68					0.3	0.072	0.071	0.061	0.001	0.03
69					0.5	0.120	0.070	0.102	0.050	2.08
70					0.5	0.120	0.069	0.102	0.051	2.12
71					0.5	0.120	0.068	0.102	0.052	2.16
72					0.4	0.096	0.067	0.082	0.029	1.21
73					0.4	0.096	0.066	0.082	0.030	1.25
74					0.4	0.096	0.065	0.082	0.031	1.29
75					0.3	0.072	0.064	0.061	0.008	0.33
76					0.2	0.048	0.063	0.041	0.007	0.30
77					0.3	0.072	0.062	0.061	0.010	0.40
78					0.4	0.096	0.062	0.082	0.034	1.44
79					0.3	0.072	0.061	0.061	0.011	0.47
80					0.2	0.048	0.060	0.041	0.007	0.30
81					0.3	0.072	0.059	0.061	0.013	0.54
82					0.3	0.072	0.058	0.061	0.014	0.57
83					0.3	0.072	0.058	0.061	0.014	0.60
84					0.2	0.048	0.057	0.041	0.007	0.30
85					0.3	0.072	0.056	0.061	0.016	0.66
86					0.2	0.048	0.056	0.041	0.007	0.30
87					0.3	0.072	0.055	0.061	0.017	0.71
88					0.2	0.048	0.054	0.041	0.007	0.30
89					0.3	0.072	0.054	0.061	0.018	0.76
90					0.2	0.048	0.053	0.041	0.007	0.30
91					0.2	0.048	0.053	0.041	0.007	0.30
92					0.2	0.048	0.052	0.041	0.007	0.30
93					0.2	0.048	0.052	0.041	0.007	0.30
94					0.2	0.048	0.052	0.041	0.007	0.30
95					0.2	0.048	0.052	0.041	0.007	0.30
96					0.2	0.048	0.051	0.041	0.007	0.30
TOTALS					100.0				15.70	654.05

EFFECTIVE RAIN = 3.92 INCHES

TOTAL RUNOFF VOLUME = 13.51 AC-FT

R C F C & W C D HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD Unit Hydrograph and Effective Rain Calculation Form	Project SMDC (Offsite North, Developed) By AJS Date 10/16/2017 Checked__________ Date______________	Sheet 1 / 1

[1] CONCENTRATION POINT	---	[2] AREA DESIGNATION	---
[3] DRAINAGE AREA-ACRES	41.32	[4] ULTIMATE DISCHARGE-CFS-HRS/IN (645*[3])	---
[5] UNIT TIME-MINUTES	10	[6] LAG TIME-MINUTES	---
[7] UNIT TIME-PERCENT OF LAG (100*[5]/[6])	---	[8] S-CURVE	---
[9] STORM FREQUENCY & DURATION	100-YR, 6-HR	[10] TOTAL ADJUSTED STORM RAIN-INCHES	3.5
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR	---	[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR	---
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.103	[14] LOW LOSS RATE-PERCENT	85

	UNIT HYDROGRAPH				EFFECTIVE RAIN					FLOOD HYDROGRAPH
[15] UNIT TIME PERIOD m	[16] TIME PERCENT OF LAG [7]*[15]	[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)	[16] DISTRIB GRAPH PERCENT [17]m-[17]m-1	[17] UNIT HYDROGRAPH CFS-HRS/IN $\frac{[4]*[18]}{100.000}$	[20] PATTERN PERCENT (PL E-5.9)	[21] STORM RAIN IN/HR $\frac{60[10][20]}{100[5]}$	[22] LOSS RATE IN/HR MAX	LOW	[23] EFFECTIVE RAIN IN/HR [21]-[22]	[24] FLOW CFS
1					1.1	0.231	0.103	0.196	0.128	5.35
2					1.2	0.252	0.103	0.214	0.149	6.22
3					1.3	0.273	0.103	0.232	0.170	7.10
4					1.4	0.294	0.103	0.250	0.191	7.97
5					1.4	0.294	0.103	0.250	0.191	7.97
6					1.5	0.315	0.103	0.268	0.212	8.85
7					1.6	0.336	0.103	0.286	0.233	9.72
8					1.6	0.336	0.103	0.286	0.233	9.72
9					1.6	0.336	0.103	0.286	0.233	9.72
10					1.6	0.336	0.103	0.286	0.233	9.72
11					1.6	0.336	0.103	0.286	0.233	9.72
12					1.7	0.357	0.103	0.303	0.254	10.60
13					1.7	0.357	0.103	0.303	0.254	10.60
14					1.8	0.378	0.103	0.321	0.275	11.47
15					1.8	0.378	0.103	0.321	0.275	11.47
16					1.8	0.378	0.103	0.321	0.275	11.47
17					2.0	0.420	0.103	0.357	0.317	13.22
18					2.0	0.420	0.103	0.357	0.317	13.22
19					2.1	0.441	0.103	0.375	0.338	14.10
20					2.2	0.462	0.103	0.393	0.359	14.97
21					2.5	0.525	0.103	0.446	0.422	17.60
22					2.8	0.588	0.103	0.500	0.485	20.22
23					3.0	0.630	0.103	0.536	0.527	21.97
24					3.2	0.672	0.103	0.571	0.569	23.72
25					3.5	0.735	0.103	0.625	0.632	26.35
26					3.9	0.819	0.103	0.696	0.716	29.85
27					4.2	0.882	0.103	0.750	0.779	32.47
28					4.5	0.945	0.103	0.803	0.842	35.10
29					4.8	1.008	0.103	0.857	0.905	37.72
30					5.1	1.071	0.103	0.910	0.968	40.35
31					6.7	1.407	0.103	1.196	1.304	54.35
32					8.1	1.701	0.103	1.446	1.598	66.60
33					10.3	2.163	0.103	1.839	2.060	**85.85**
34					2.8	0.588	0.103	0.500	0.485	20.22
35					1.1	0.231	0.103	0.196	0.128	5.35
36					0.5	0.105	0.103	0.089	0.016	0.66
TOTALS					100.0				17.32	721.66

EFFECTIVE RAIN = 2.89 INCHES

TOTAL RUNOFF VOLUME = 9.94 AC-FT

R C F C & W C D HYDROLOGY MANUAL	**"SHORTCUT METHOD"** **SYNTHETIC UNIT HYDROGRAPH METHOD** **Unit Hydrograph and Effective Rain Calculation Form**	**Project** SMDC (Offsite North, Developed) **By**__________AJS **Date**______10/16/2017 **Checked**__________ **Date**______________	**Sheet** 1 / 1

[1] CONCENTRATION POINT	---	**[2] AREA DESIGNATION**	---
[3] DRAINAGE AREA-ACRES	41.32	**[4] ULTIMATE DISCHARGE-CFS-HRS/IN (645*[3])**	---
[5] UNIT TIME-MINUTES	5	**[6] LAG TIME-MINUTES**	---
[7] UNIT TIME-PERCENT OF LAG (100*[5]/[6])	---	**[8] S-CURVE**	---
[9] STORM FREQUENCY & DURATION	100-YR, 3-HR	**[10] TOTAL ADJUSTED STORM RAIN-INCHES**	2.25
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR	---	**[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR**	---
[13] CONSTANT LOSS RATE-INCHES/HOUR	0.103	**[14] LOW LOSS RATE-PERCENT**	85

	UNIT HYDROGRAPH				**EFFECTIVE RAIN**					**FLOOD HYDROGRAPH**
[15] UNIT TIME PERIOD m	**[16] TIME PERCENT OF LAG [7]*[15]**	**[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)**	**[16] DISTRIB GRAPH PERCENT [17]m-[17]m-1**	**[17] UNIT HYDROGRAPH CFS-HRS/IN [4]*[18] / 100.000**	**[20] PATTERN PERCENT (PL E-5.9)**	**[21] STORM RAIN IN/HR 60[10][20] / 100[5]**	**[22] LOSS RATE IN/HR**		**[23] EFFECTIVE RAIN IN/HR [21]-[22]**	**[24] FLOW CFS**
							MAX	**LOW**		
1					1.3	0.351	0.103	0.298	0.248	10.35
2					1.3	0.351	0.103	0.298	0.248	10.35
3					1.1	0.297	0.103	0.252	0.194	8.10
4					1.5	0.405	0.103	0.344	0.302	12.60
5					1.5	0.405	0.103	0.344	0.302	12.60
6					1.8	0.486	0.103	0.413	0.383	15.97
7					1.5	0.405	0.103	0.344	0.302	12.60
8					1.8	0.486	0.103	0.413	0.383	15.97
9					1.8	0.486	0.103	0.413	0.383	15.97
10					1.5	0.405	0.103	0.344	0.302	12.60
11					1.6	0.432	0.103	0.367	0.329	13.72
12					1.8	0.486	0.103	0.413	0.383	15.97
13					2.2	0.594	0.103	0.505	0.491	20.47
14					2.2	0.594	0.103	0.505	0.491	20.47
15					2.2	0.594	0.103	0.505	0.491	20.47
16					2.0	0.540	0.103	0.459	0.437	18.22
17					2.6	0.702	0.103	0.597	0.599	24.97
18					2.7	0.729	0.103	0.620	0.626	26.10
19					2.4	0.648	0.103	0.551	0.545	22.72
20					2.7	0.729	0.103	0.620	0.626	26.10
21					3.3	0.891	0.103	0.757	0.788	32.85
22					3.1	0.837	0.103	0.711	0.734	30.60
23					2.9	0.783	0.103	0.666	0.680	28.35
24					3.0	0.810	0.103	0.689	0.707	29.47
25					3.1	0.837	0.103	0.711	0.734	30.60
26					4.2	1.134	0.103	0.964	1.031	42.97
27					5.0	1.350	0.103	1.148	1.247	51.97
28					3.5	0.945	0.103	0.803	0.842	35.10
29					6.8	1.836	0.103	1.561	1.733	72.22
30					7.3	1.971	0.103	1.675	1.868	77.85
31					8.2	2.214	0.103	1.882	2.111	**87.97**
32					5.9	1.593	0.103	1.354	1.490	62.10
33					2.0	0.540	0.103	0.459	0.437	18.22
34					1.8	0.486	0.103	0.413	0.383	15.97
35					1.8	0.486	0.103	0.413	0.383	15.97
36					0.6	0.162	0.103	0.138	0.059	2.47
TOTALS					100.0				23.31	971.10

EFFECTIVE RAIN = 1.94 INCHES

TOTAL RUNOFF VOLUME = 6.69 AC-FT

R C F C & W C D HYDROLOGY MANUAL	"SHORTCUT METHOD" SYNTHETIC UNIT HYDROGRAPH METHOD Unit Hydrograph and Effective Rain Calculation Form	**Project** SMDC (Offsite North, Developed) **By** AJS **Date** 10/16/2017 **Checked**____________ **Date**________________	**Sheet** 1 / 1

[1] CONCENTRATION POINT ---
[3] DRAINAGE AREA-ACRES 41.32
[5] UNIT TIME-MINUTES 5
[7] UNIT TIME-PERCENT OF LAG (100*[5]/[6]) ---
[9] STORM FREQUENCY & DURATION 100-YR, 1-HR
[11] VARIABLE LOSS RATE (AVG)-INCHES/HOUR ---
[13] CONSTANT LOSS RATE-INCHES/HOUR 0.103

[2] AREA DESIGNATION ---
[4] ULTIMATE DISCHARGE-CFS-HRS/IN (645*[3]) ---
[6] LAG TIME-MINUTES ---
[8] S-CURVE ---
[10] TOTAL ADJUSTED STORM RAIN-INCHES 1.3
[12] MINIMUM LOSS RATE (FOR VAR. LOSS)-IN/HR ---
[14] LOW LOSS RATE-PERCENT 85

	UNIT HYDROGRAPH				**EFFECTIVE RAIN**					**FLOOD HYDROGRAPH**
[15] UNIT TIME PERIOD m	**[16] TIME PERCENT OF LAG [7]*[15]**	**[17] CUMULATIVE AVERAGE PERCENT OF ULTIMATE DISCHARGE (S-GRAPH)**	**[16] DISTRIB GRAPH PERCENT [17]m-[17]m-1**	**[17] UNIT HYDROGRAPH CFS-HRS/IN [4]*[18] 100.000**	**[20] PATTERN PERCENT (PL E-5.9)**	**[21] STORM RAIN IN/HR 60[10][20] 100[5]**	**[22] LOSS RATE IN/HR**		**[23] EFFECTIVE RAIN IN/HR [21]-[22]**	**[24] FLOW CFS**
							MAX	**LOW**		
1					4.2	0.655	0.103	0.557	0.553	23.02
2					4.3	0.671	0.103	0.570	0.568	23.67
3					5.0	0.780	0.103	0.663	0.677	28.22
4					5.0	0.780	0.103	0.663	0.677	28.22
5					5.8	0.905	0.103	0.769	0.802	33.42
6					6.5	1.014	0.103	0.862	0.911	37.97
7					7.4	1.154	0.103	0.981	1.052	43.82
8					8.6	1.342	0.103	1.140	1.239	51.62
9					12.3	1.919	0.103	1.631	1.816	75.67
10					29.1	4.540	0.103	3.859	4.437	**184.87**
11					6.8	1.061	0.103	0.902	0.958	39.92
12					5.0	0.780	0.103	0.663	0.677	28.22
TOTALS					100.0				14.37	598.70

EFFECTIVE RAIN = 1.20 INCHES
TOTAL RUNOFF VOLUME = 4.12 AC-FT

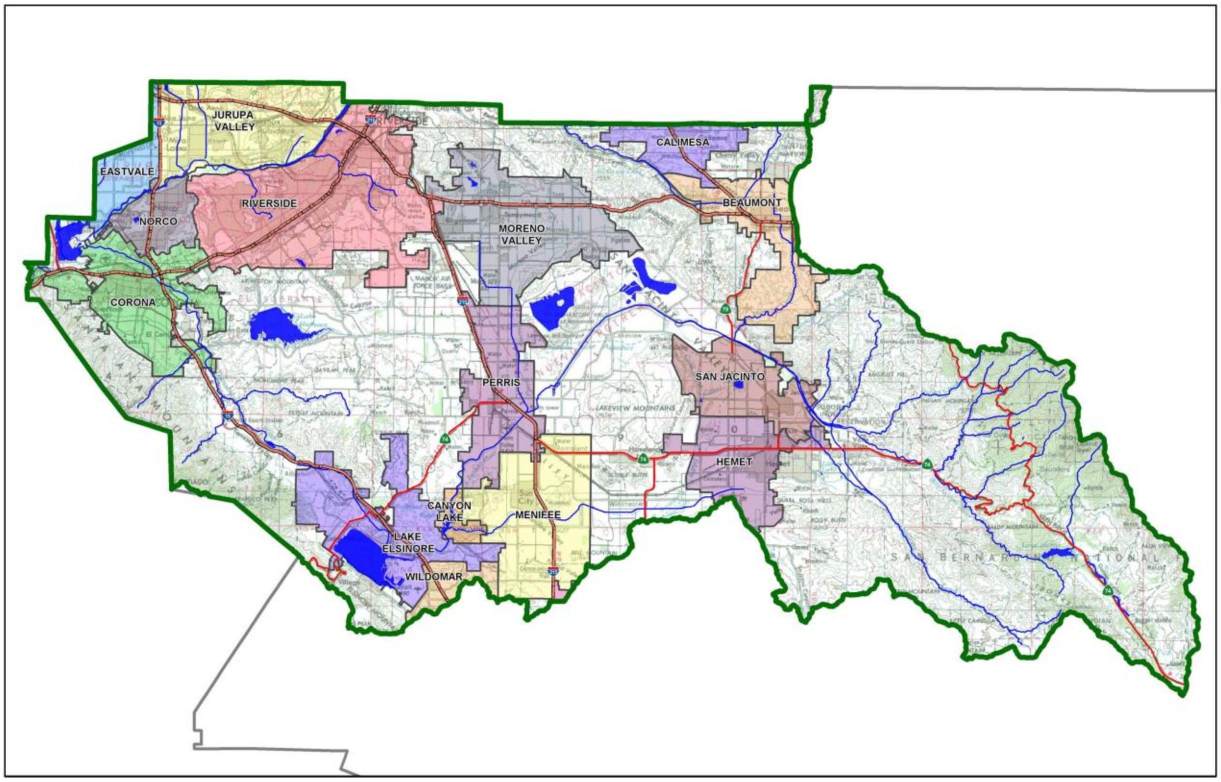
Project Specific Water Quality Management Plan

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

Project Title: South Milliken Distribution Center

Development No: PLN17-20013

Design Review/Case No: TBD



Contact Information:

Prepared for:
Newcastle Partners, Inc.
4740 Green River Road, Suite 118
Corona, California 92880

Prepared by:
Tory R. Walker Engineering, Inc.
122 Civic Center Drive, Suite 206
Vista, California 92084

☒ **Preliminary**
☐ **Final**

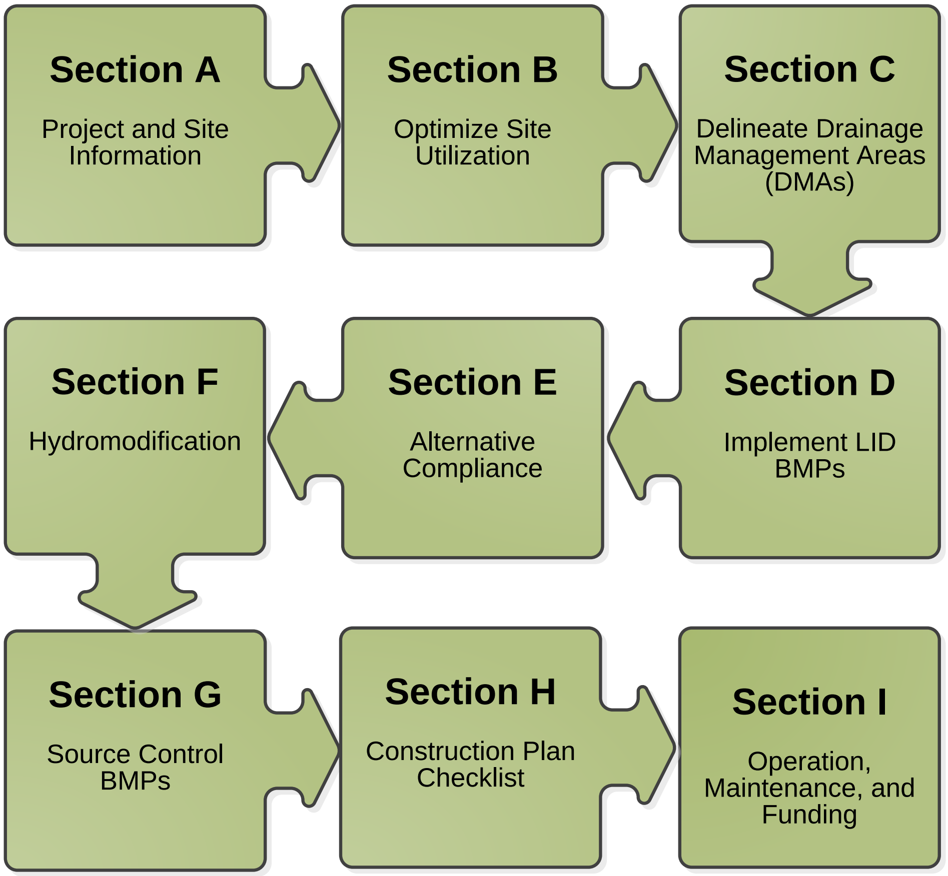
Original Date Prepared: April 24, 2017

Revision Date(s): August 14, 2017
October 17, 2017

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 Newcastle Partners, Inc. by Tory R. Walker Engineering, Inc. for the Newcastle Eastvale project.

This WQMP is intended to comply with the requirements of City of Eastvale for Municipal Code Section 14.12.060 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 City of Eastvale Water Quality Ordinance (Municipal Code Section 14.12.110).

"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 preliminary 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:	N/A	
Community Name:	N/A	
Development Name:	N/A	
Project Location		
Latitude & Longitude (DMS): 34°01’32”, -117°33’23”		
Project Watershed and Sub-Watershed: Santa Ana Watershed, Lower Cucamonga Creek		
Gross Acres: 15.6		
APN(s): 156-030-001 & 156-030-002		
Map Book and Page No.: Thomas Brothers Page 643		
Project Characteristics		
Proposed or Potential Land Use(s)	Light Industrial	
Proposed or Potential SIC Code(s)	TBD	
Area of Project Footprint (SF)	641,277	
Total Area of <u>proposed</u> Impervious Surfaces within the Project Footprint (SF)	532,860	
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 <u>existing</u> Impervious Surfaces within the Project limits Footprint (SF)	0	
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)	N/A	
What is the Water Quality Design Storm Depth for the project?	0.90 inches	

The South Milliken Distribution Center project is a proposed 15-acre light industrial development spanning over two parcels. The existing undeveloped site has been graded and cleared, discharging to the Eastvale MPD Line E-2. Existing land cover consists of poor vegetative cover.

The proposed development includes one building, paved parking and landscaped features. The developed site will discharge to two infiltration basins. Per the site’s geotechnical engineering investigation, infiltration was determined to be feasible for the LID BMP design.

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.

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
Cucamonga Creek Reach 1 (Valley Reach)	Cadmium, Coliform Bacteria, Copper, Lead, Zinc	GWR, REC2, LWRM, WILD	4.25 miles
Mill Creek (Prado Area)	Nutrients, Pathogens, Total Suspended Solids (TSS)	REC1, REC2, WARM, WILD, RARE	RARE
Chino Creek Reach 1B (Mill Creek confl to start of concrete lined channel)	Chemical Oxygen Demand (COD), Nutrients, Pathogens	REC1, REC2, WARM, WILD, RARE	2 miles
Chino Creek Reach 1A (Santa Ana River R5 confl to just downstream of confl with Mill Creek)	Nutrients, Pathogens	REC1, REC2, WARM, WILD, RARE	1.75 miles
Santa Ana River, Reach 3	Copper, Lead, Pathogens	AGR, GWR, REC1, REC2, WARM, WILD, RARE, SPWN	RARE
Santa Ana River, Reach 2	Indicator Bacteria	AGR, GWR, REC1, REC2, WARM, WILD, RARE	RARE
Santa Ana River, Reach 1	None	REC1, REC2, WARM, WILD	Downstream of RARE

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 (dependent on tenant)	☒ Y	☐ N
Western Riverside MSHCP Consistency Approval (e.g., JPR, DBESP)	☐ Y	☒ N
City of Eastvale Combination Building Permit	☒ Y	☐ N

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?

Existing drainage patterns have been identified, and the overall drainage pattern will be preserved. The existing site discharges to the existing open channel RCB along the southern boundary. The site will likewise discharge to the open channel RCB after draining through infiltration basins, providing a net water quality benefit.

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

Existing vegetation has been identified as poor and mostly non-existent. Existing vegetation, in locations where appropriate (i.e. perimeter, slopes), will be protected; most all existing sparse vegetation will be improved upon with native, drought-tolerant vegetation.

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

The natural infiltration capacity has been identified acceptable for infiltration per the site-specific geotechnical investigation. Therefore, natural infiltration capacity is an opportunity and preservation is a somewhat feasible measure for the site design.

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

Proposed impervious area has been limited to provide for essential proposed functions and safety (i.e., building footprint, parking, sidewalk, ADA compliance, etc.). The site will host high-occupancy light industrial activity; therefore paved parking and drive aisles are necessary to support the vehicular traffic required by the proposed function.

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

All runoff will be dispersed to pervious LID BMPs. Insufficient demand for harvest and use is a site constraint, therefore impervious area dispersion was considered as an opportunity for LID BMP design.

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.

Table C.1 DMA Classifications

DMA Name or ID	Surface Type(s)[1,2]	Area (Sq. Ft.)	DMA Type
DMA A/1	Compacted Soil	45,787	Type A
DMA D/1	Multi-Surface	356,370	Type D
DMA D/2	Multi-Surface	284,907	Type D

[1] *Reference Table 2-1 in the WQMP Guidance Document to populate this column*

[2] *If multi-surface provide back-up*

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

DMA Name or ID	Area (Sq. Ft.)	Stabilization Type	Irrigation Type (if any)
DMA A/1	45,787	Natural Grasses	N/A

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)	Storm Depth (inches)	DMA Name / ID	[C] from Table C.4 =	Required Retention Depth (inches)
		[A]	[B]		[C]	[D]
N/A	N/A	N/A	N/A	N/A	N/A	N/A

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

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

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

Table C.5 Type ‘D’, Areas Draining to BMPs

DMA Name or ID	BMP Name or ID
DMA D/1	BMP D/1
DMA D/2	BMP D/2

Note: 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.

**DMAs are identified as the sum of their parts (i.e., DMA D/1 = DMAs D/1 ROOF, D/1 CONC, and D/1 PERV, as classified in Table C.1, above)*

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?		✓
If Yes, list affected DMAs:		
…have any DMAs located within 100 feet of a water supply well?		✓
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?		✓
If Yes, list affected DMAs:		
…have measured in-situ infiltration rates of less than 1.6 inches / hour?	✓	
If Yes, list affected DMAs: DMA D/2		
…have significant cut and/or fill conditions that would preclude in-situ testing of infiltration rates at the final infiltration surface?		✓
If Yes, list affected DMAs:		
…geotechnical report identify other site-specific factors that would preclude effective and safe infiltration?	✓	
Describe here: Foundations shall be set back a minimum distance of 10 foot from any infiltration BMPs.		

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: N/A

Type of Landscaping (Conservation Design or Active Turf): N/A

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: N/A

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: N/A

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: N/A

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)**
N/A	N/A

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: N/A

Project Type: N/A

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: N/A

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: N/A

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: N/A

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)**
N/A	N/A

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.

N/A

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: N/A

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: N/A

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: N/A

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: N/A

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)**
N/A	N/A

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	
DMA D/1	☒	☐	☐	☐	☐
DMA D/2	☒	☐	☐	☐	☐

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.

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	***BMP D/1*** ***Infiltration Basin***		
	[A]		[B]	[C]	[A] x [C]			
D/1 ROOF	*136,615*	*Roofs*	*1*	*0.89*	*121,861*	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
D/1 IMP	*179,185*	*Concrete or Asphalt*	*1*	*0.89*	*159,833*			
D/1 PERV	*40,570*	*Ornamental Landscaping*	*0.1*	*0.11*	*4,481*			
	356,370				**286,175**	**0.90**	***21,368***	***23,946***

[B], [C] is obtained as described in Section 2.3.1 of the WQMP Guidance Document
[E] is obtained from Exhibit A in the WQMP Guidance Document
[G] is obtained from a design procedure sheet, such as in LID BMP Design Handbook and placed 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	***BMP D/2*** ***Infiltration Basin***		
	[A]		[B]	[C]	[A] x [C]			
D/2 ROOF	*137,790*	*Roofs*	*1*	*0.89*	*122,909*	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
D/2 IMP	*79,270*	*Concrete or Asphalt*	*1*	*0.89*	*70,709*			
D/2 PERV	*67,847*	*Ornamental Landscaping*	*0.1*	*0.11*	*7,494*			
	284,907				**201,112**	**0.90**	***15,016***	***15,201***

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.

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]
N/A	N/A
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]				
N/A	N/A	N/A	N/A	N/A	N/A	*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)*
	N/A				**N/A**	**N/A**	**N/A**	***N/A***	***N/A***

[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]
N/A	N/A	N/A

[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	N/A	N/A	N/A
Volume (Cubic Feet)	N/A	N/A	N/A

[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:

> Per the Riverside County Storm Water Conservation & Tracking Tool (SWCT[2]), the project site has been identified as “Potentially Exempt” on the Co-Permittees Hydromodification Susceptibility Map; therefore, HCOC mitigation is not required. Refer to Appendix 7 for the Co-Permittees Hydromodification Susceptibility Map.

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.	1. Maintain and periodically repaint or replace inlet markings. 2. Provide stormwater pollution prevention information to new site owners, lessees, or operators. 3. Include the following in lease agreements: “Tenant shall now allow anyone to discharge anything to storm drains or to store or deposit materials so as to create a potential discharge to storm drain.”
Landscape/outdoor pesticide use	1. Preserve existing native trees, shrubs, and ground cover to the maximum extent possible. 2. 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. 3. Where landscaped areas are used to retain or detain stormwater, specify plants that are tolerant of saturated soil conditions. 4. Consider using pest-resistant plants, especially adjacent to hardscape. 5. To insure successful establishment, select plants appropriate to site soils, slopes, climate, sun, wind, rain, land use, air movement, ecological consistency, and plant interactions.	1. Maintain landscaping using minimum or no pesticides. 2. Prevent erosion of slopes by planting fast-growing, dense ground covering plants. 3. Plant native vegetation to reduce the amount of water, fertilizers, and pesticides applied to the landscape. 4. Do not overwater. Use irrigation practices such as drip irrigation, soaker hoses or micro-spray systems. Periodically inspect and fix leaks and misdirected sprinklers. 5. 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. 6. Provide IPM information to new owners, lessees and operators.

Potential Sources of Runoff pollutants	Permanent Structural Source Control BMPs	Operational Source Control BMPs
Refuse areas	1. Site design features dumpster enclosures. 2. Signs will be posted on or near dumpsters with the words "Do not dump hazardous materials here" or similar.	1. Periodic inspections for leaky, overfilled, uncovered, or other problematic conditions will occur. Corrective action will be made upon detection, as circumstances permit. 2. Dumping of liquid or hazardous wastes will be prohibited. 3. Spill control materials will be available on-site.
Industrial processes	All process activities to be performed indoors. No processes to drain to exterior or to storm drain system.	1. CASQA Stormwater Quality Handbook for Industrial & Commercial Facilities Best Management Practices will be referenced, as appropriate. 2. RC Flood's Industrial & Commercial Facilities BMP fact sheet will be referenced, as appropriate.
Loading Docks	N/A	Move loaded and unloaded items indoors as soon as possible.
Plazas, Sidewalks, and Parking Lots	N/A	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.

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.

This section will be completed and addressed at the time of the final WQMP submittal.

Table H.1 Construction Plan Cross-reference

BMP No. or ID	BMP Identifier and Description	Corresponding Plan Sheet(s)	BMP Location (Lat/Long)
BMP D/1	Infiltration basin: • 5.0’ ponded depth • 1’ freeboard		34°01’30” -117°33’24”
BMP D/2	Infiltration basin: • 2.8’ ponded depth • 1’ freeboard		34°01’27” -117°33’17”

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: **This section will be completed and addressed at the time of the final WQMP submittal.**

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

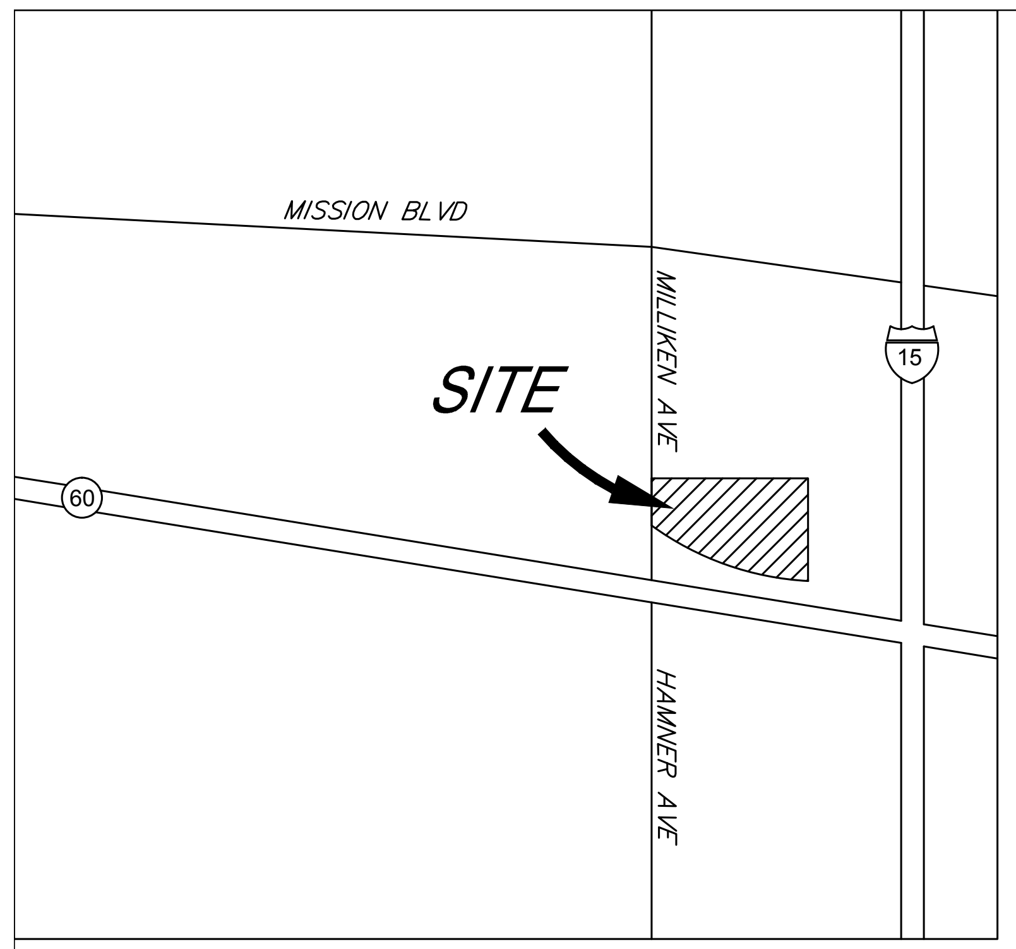
Location Map
3100 South Milliken Avenue
Eastvale, CA 91752

Exhibit Date: 7/19/2017
X:\Projects2\156 (Steve Sommers)\16 (On Call As Needed)\Projects\Newcastle Eastvale\05 GIS\Map Docs\Location Map.mxd

TRWE

WQMP SITE PLAN

SOUTH MILLIKEN DISTRIBUTION CENTER
PLN17–20013
CITY OF EASTVALE



VICINITY MAP
NOT TO SCALE
THOMAS GUIDE PAGE: 643

OWNER/APPLICANT

NEWCASTLE PARTNERS, INC.
4740 GREEN RIVER ROAD, SUITE 118
CORONA, CA 92880
TEL: (951) 582–9800
TEL: (951) 278–4740

ENGINEER

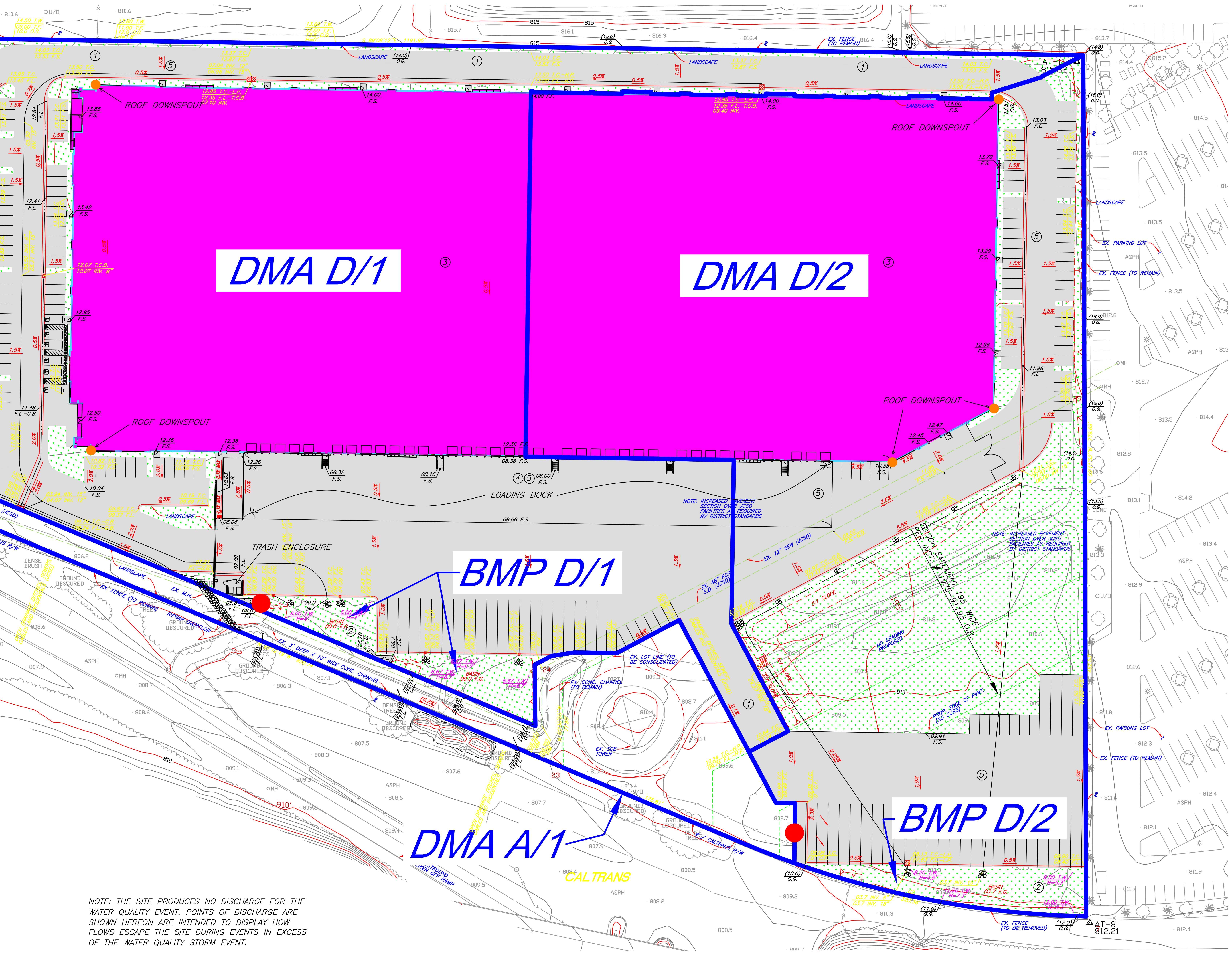
TORY R. WALKER ENGINEERING, INC.
122 CIVIC CENTER DRIVE, STE. 206
VISTA, CA 92084
VOICE: (760) 414–9212
FAX: (760) 414–9277

LEGEND

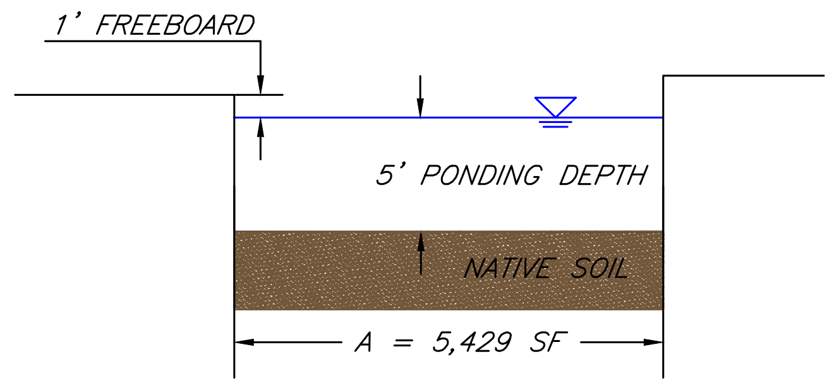
━━	DRAINAGE MANAGEMENT AREA
- - -	BMP FOOTPRINT
━━	PROPOSED STORM DRAIN
═══	RIBBON DRAIN
~ 1280 ~	EXISTING CONTOUR LINE
⊤ ⊤	SLOPE
▨	STORM DRAIN INLET
●	ROOF DOWNSPOUT
●	ESCAPE POINT
🟩	LANDSCAPE/PERVIOUS AREA
⬜	CONCRETE/IMPERVIOUS AREA
🟪	ROOFS/IMPERVIOUS AREA

SOURCE CONTROL BMPs

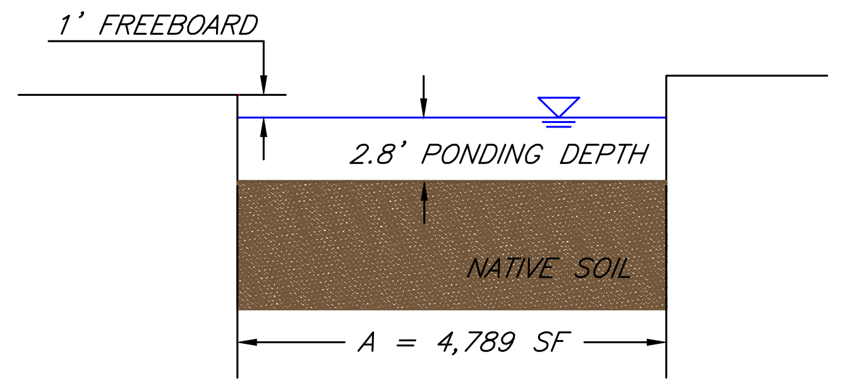
① ON–SITE STORM DRAIN INLETS
② STORMWATER TREATMENT BMPs
③ INDUSTRIAL PROCESSES
④ LOADING DOCKS
⑤ PLAZAS, SIDEWALKS, AND PARKING LOTS



NOTE: THE SITE PRODUCES NO DISCHARGE FOR THE WATER QUALITY EVENT. POINTS OF DISCHARGE ARE SHOWN HEREON ARE INTENDED TO DISPLAY HOW FLOWS ESCAPE THE SITE DURING EVENTS IN EXCESS OF THE WATER QUALITY STORM EVENT.

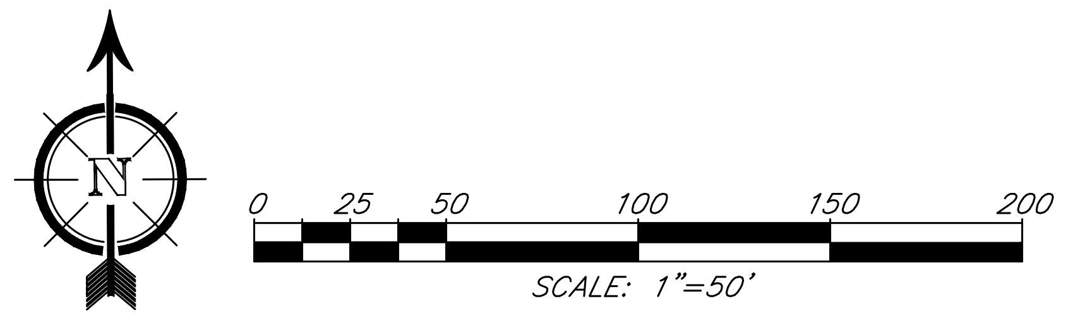


BMP D/1
NOT TO SCALE



BMP D/2
NOT TO SCALE

DMA	Total Area (sf)	Impervious (sf)	Pervious (sf)	BMP	V_{BMP} (cf)	V (cf)	A_S (sf)	A (sf)
D/1	356370	315800	40570	D/1	21,352	23,946	4,270	4,789
D/2	284907	217060	67847	D/2	15,016	15,201	5,363	5,429



W.D.I.D.# X XXXXXXXX
PLN17-20013

CITY OF EASTVALE

WQMP SITE PLAN
SOUTH MILLIKEN DISTRIBUTION CENTER

1 OF 1 SHEETS

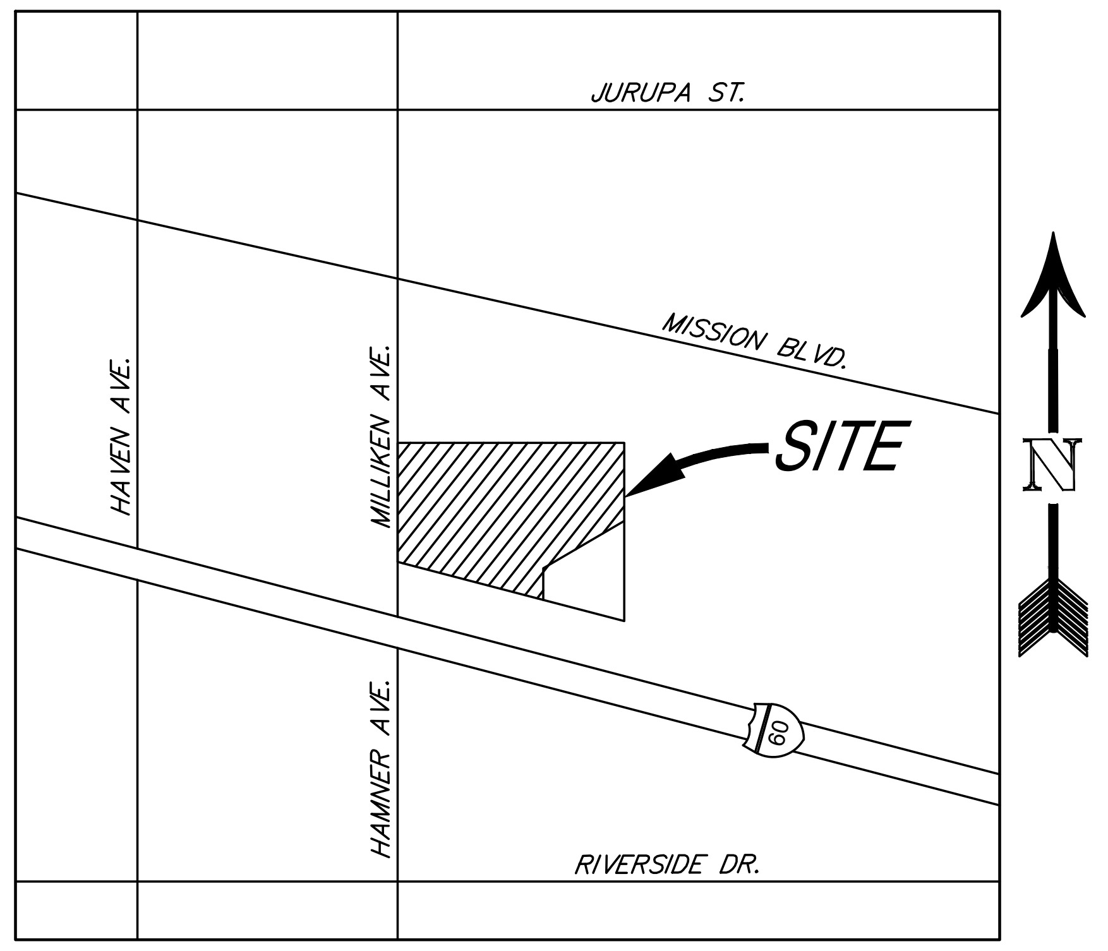
Receiving Waters Map
3500 South Milliken Avenue
Eastvale, CA 91752

Exhibit Date: 4/17/2017
X:\Projects2\156 (Steve Sommers)\16 (On Call As Needed)\Projects\Newcastle Eastvale\05 GIS\Map Docs\Receiving Waters Map.mxd

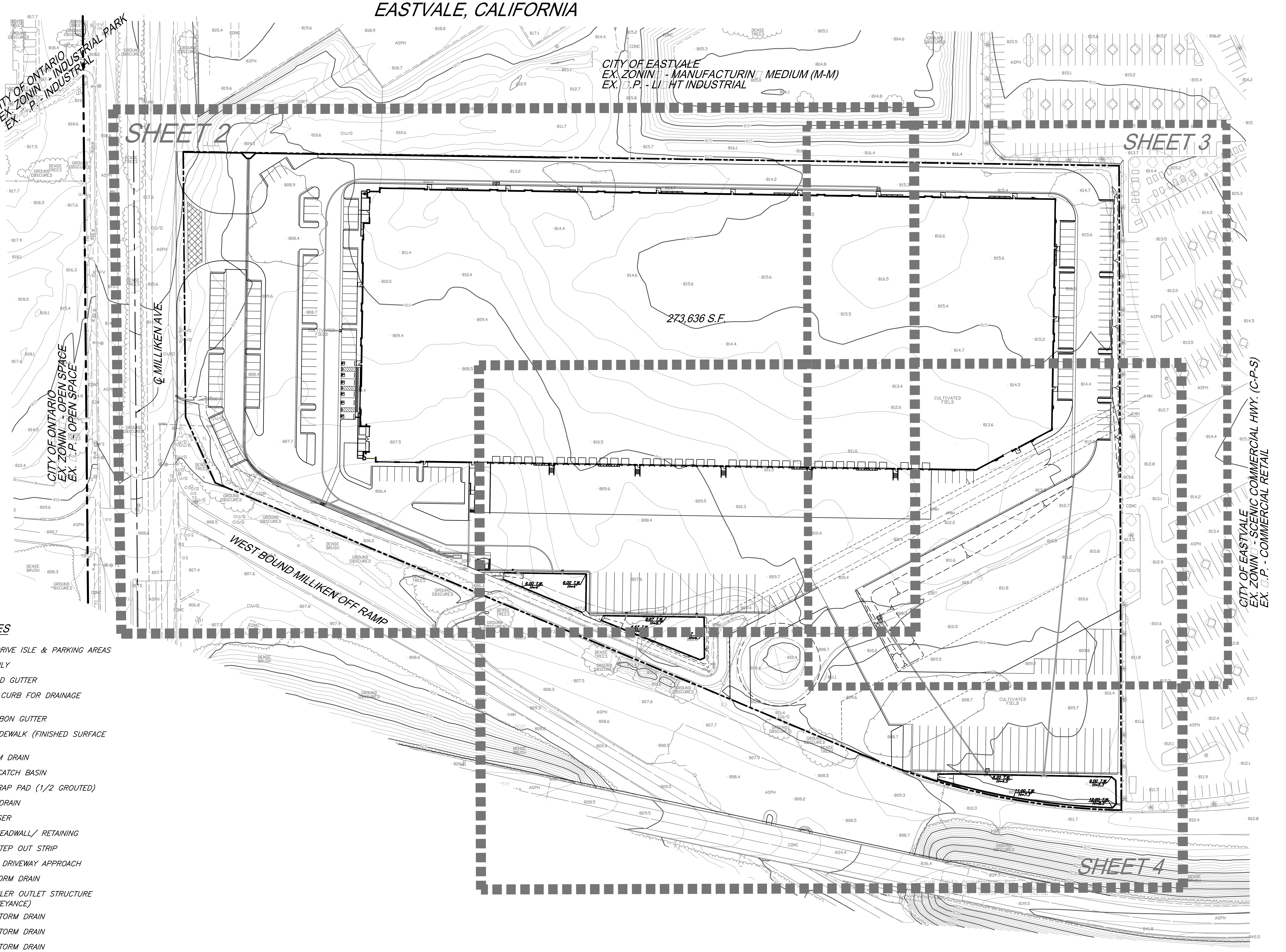
Appendix 2: Construction Plans

Grading and Drainage Plans

NEWCASTLE EASTVALE IDUSTRIAL
3100 MILLIKEN AVENUE
EASTVALE, CALIFORNIA



VICINITY MAP
NOT TO SCALE



OWNER/APPLICANT

NEWCASLE PARTNERS, INC.
470 GREEN RIVER, STE 118
CORONA, CA 92880
TEL: (951) 582-9800
ATTN: JACKSON SMITH

ENGINEER

SDH & ASSOCIATES, INC
5225 CANYON CREST DRIVE 71439
RIVERSIDE, CA. 92507
VOICE: (951) 683-3691
FAX: (951) 788-2314

SOURCE OF TOPO

ARROWHEAD MAPPING CORP.
431 W. MACKAY RIVE
SAN BERNARDINO, CA. 92408
VOICE: (909) 889-2420

SHEET INDEX

SHEET 1: TITLE SHEET/ INDEX
SHEET 2: PRELIM. GRADING
SHEET 3: PRELIM. GRADING / SECTIONS
SHEET 4: PRELIM. GRADING

ARCHITECT

HPA ARCHITECTURE
18831 BARDEEN AVE. STE. #100
IRVINE, CA 92612
VOICE: (949) 863-1700

SOILS ENGINEER

NORCAL ENGINEERING
10641 HUMBOLT STREET
LOS ALAMITOS, CA. 90720
VOICE: (562) 799-9469

PROJ. NO. 19503-17

PROJECT INFO

AREA OF SITE = 687,069 SF (15.77 AC)
LANDSCAPE AREA = 69,662 (1.6 AC)

TOTAL BUILDING AREA = 273,636 (6.3 AC)

- OFFICES = 8,000 SF
- WAREHOUSE = 265,636 SF

EXISTING ZONING–

SCENIC HIGHWAY COMMERCIAL (C-P-S)
MANUFACTURING MEDIUM (M-M)

PROPOSED ZONING–

MANUFACTURING MEDIUM (M-M)

FEMA INFO–

ZONE X
PANEL 18 OF 3805
RIVERSIDE CO./ NO. 060245

ASSESSORS PARCEL NO'S

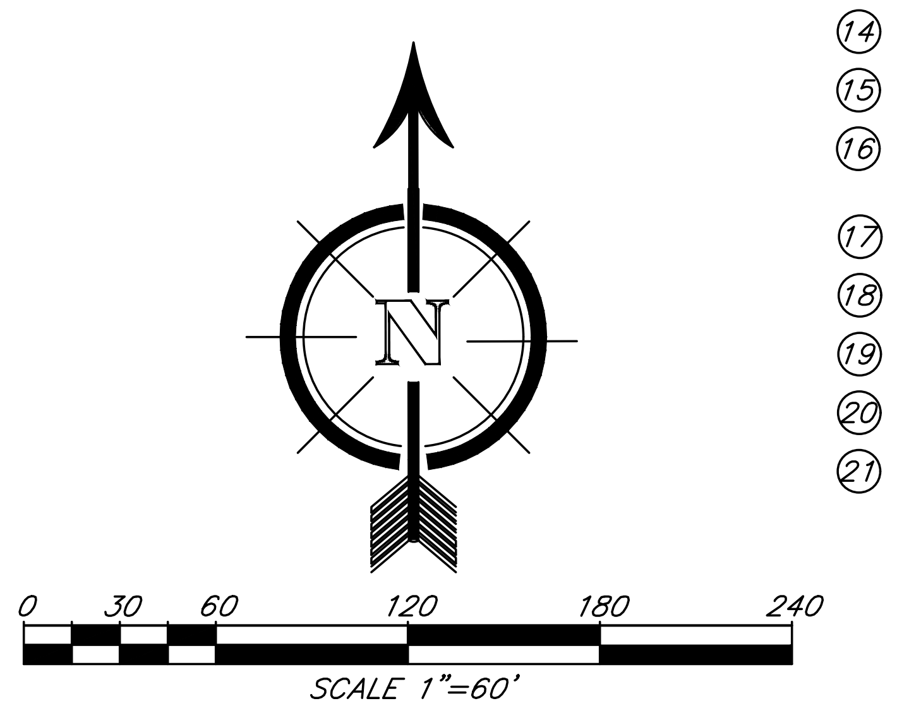
156-030-001 AND 002

UTILITY PURVEYORS

WATER......................JCSD
GAS..........................SOCAL GAS
SEWER.....................JCSD
ELECTRIC.................EDISON

CONSTRUCTION NOTES

① CONSTRUCT CONCRETE DRIVE ISLE & PARKING AREAS
② CONSTRUCT 6" CURB ONLY
③ CONSTRUCT 6" CURB AND GUTTER
④ CONSTRUCT 12" GAP IN CURB FOR DRAINAGE CONVEYANCE
⑤ CONSTRUCT 3" WIDE RIBBON GUTTER
⑥ CONSTRUCT 4" P.C.C. SIDEWALK (FINISHED SURFACE PER ARCH. PLANS)
⑦ CONSTRUCT P.V.C. STORM DRAIN
⑧ CONSTRUCT 24" X 24" CATCH BASIN
⑨ CONSTRUCT COBBLE RIPRAP PAD (1/2 GROUTED)
⑩ CONSTRUCT 30" STORM DRAIN
⑪ CONSTRUCT 36" CMP RISER
⑫ CONSTRUCT CONCRETE HEADWALL/ RETAINING
⑬ CONSTRUCT CONCRETE STEP OUT STRIP
⑭ CONSTRUCT COMMERCIAL DRIVEWAY APPROACH
⑮ CONSTRUCT 8" HDPE STORM DRAIN
⑯ CONSTRUCT 3'X10' BUBBLER OUTLET STRUCTURE (OFFSITE DRAINAGE CONVEYANCE)
⑰ CONSTRUCT 12" HDPE STORM DRAIN
⑱ CONSTRUCT 15" HDPE STORM DRAIN
⑲ CONSTRUCT 18" HDPE STORM DRAIN
⑳ CONSTRUCT 4' WIDE CURB INLET CATCH BASIN
㉑ CONSTRUCT SEGMENTED RETAINING WALL



SCALE 1"=60'

PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS

MARK	DESCRIPTION	BY	APPR	DATE

DESIGNED BY: S.S.
DRAWN BY: S.J.S.
CHECKED BY: R.V.Z.
PROJECT MANAGER: S.S.

DATE: ____________

PREPARED BY: DATE: ____________

ROBERT VAN ZANTEN
R.C.E. NO.: 62325 EXP. 9-30-17

SEAL:
No. 62325
Exp. 9-30-17

PREPARED BY:

SDH &ASSOCIATES INCORPORATED
SDH AND ASSOCIATES INC.
5225 CANYON CREST DRIVE 71439
Riverside, California 92507
TEL: (951) 683-3691 FAX (951) 788-2314

SCALE: 1"=60'

DATE: APRIL 2017

BENCHMARK M.L. 38-654
AT THE SOUTHEAST CORNER OF THE INTERSECTION OF HAMNER AVENUE AND RIVERSIDE AVENUE, 47.0 FEET EAST OF HAMNER AVENUE, 30.0 FEET SOUTH OF RIVERSIDE AVENUE 5.0 FEET NORTH OF POWER POLE #674422E, 4.0 FEET SOUTHEAST OF A SIGNAL LIGHT STANCHIAN, 1.0 FOOT WEST OF A MARKER POST, A BRASS DISK SET IN THE TOP OF A CONCRETE POST, AND MARKED M.L. 38 APRIL 1964. 1968 ELEV.: 794.743, 5-71 ELEV.: 794.579

CITY OF EASTVALE

NEWCASTLE DEVELOPMENT
PRELIMINARY GRADING PLAN
3100 MILLIKEN

1
OF
5
SHEETS

CONSTRUCTION NOTES

1. CONSTRUCT CONCRETE DRIVE ISLE & PARKING AREAS
2. CONSTRUCT 6" CURB ONLY
3. CONSTRUCT 6" CURB AND GUTTER
4. CONSTRUCT 12" GAP IN CURB FOR DRAINAGE CONVEYANCE
5. CONSTRUCT 3" WIDE RIBBON GUTTER
6. CONSTRUCT 4" P.C.C. SIDEWALK (FINISHED SURFACE PER ARCH. PLANS)
7. CONSTRUCT P.V.C. STORM DRAIN
8. CONSTRUCT 24" X 24" CATCH BASIN
9. CONSTRUCT COBBLE RIPRAP PAD (1/2 GROUTED)
10. CONSTRUCT 30" STORM DRAIN
11. CONSTRUCT 36" CMP RISER
12. CONSTRUCT CONCRETE HEADWALL/ RETAINING
13. CONSTRUCT CONCRETE STEP OUT STRIP
14. CONSTRUCT COMMERCIAL DRIVEWAY APPROACH
15. CONSTRUCT 8" HDPE STORM DRAIN
16. CONSTRUCT 3'X10' BUBBLER OUTLET STRUCTURE (OFFSITE DRAINAGE CONVEYANCE)
17. CONSTRUCT 12" HDPE STORM DRAIN
18. CONSTRUCT 15" HDPE STORM DRAIN
19. CONSTRUCT 18" HDPE STORM DRAIN
20. CONSTRUCT 4' WIDE CURB INLET CATCH BASIN
21. CONSTRUCT SEGMENTED RETAINING WALL

✳ NOTE: INCREASED PAVEMENT SECTION OVER JCSD FACILITIES AS REQUIRED BY DISTRICT STANDARDS

PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS

MARK	DESCRIPTION	BY	APPR	DATE

DESIGNED BY: S.S.
DRAWN BY: S.J.S.
CHECKED BY: R.V.Z.
PROJECT MANAGER: S.S.

DATE: ________

PREPARED BY:
DATE: ________
ROBERT VAN ZANTEN
R.C.E. NO.: 62325 EXP. 9-30-17

SEAL:
No. 62325
Exp. 9-30-17

PREPARED BY:
SDH & ASSOCIATES INCORPORATED
SDH AND ASSOCIATES INC.
5225 CANYON CREST DRIVE 71439
Riverside, California 92507
TEL: (951) 683-3691 FAX (951) 788-2314

SCALE: 1"=50'

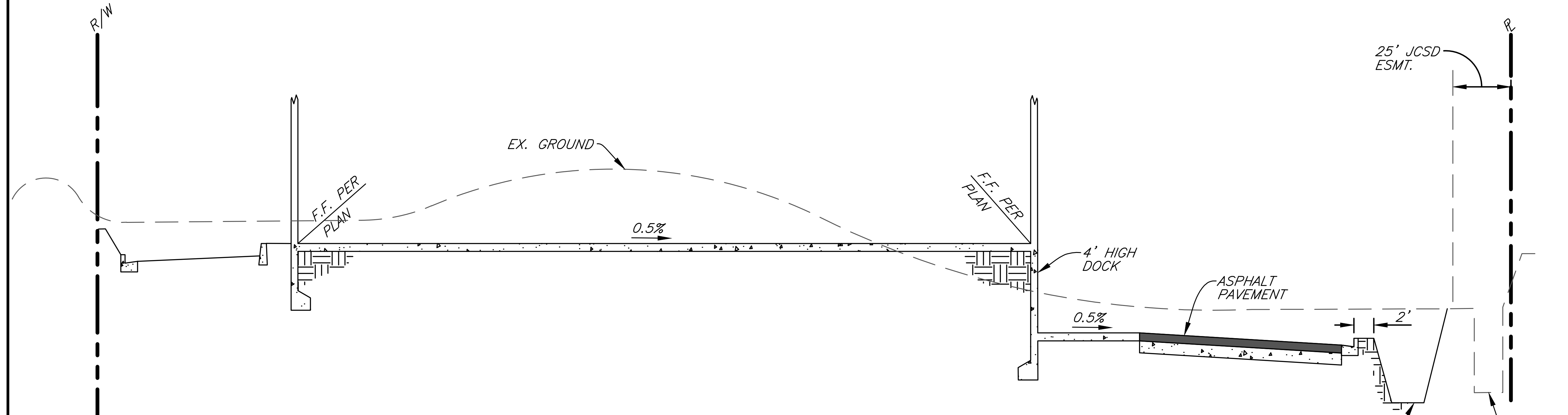
DATE: MARCH 2017

BENCHMARK M.L. 38-654
AT THE SOUTHEAST CORNER OF THE INTERSECTION OF HAMNER AVENUE AND RIVERSIDE AVENUE, 47.0 FEET EAST OF HAMNER AVENUE, 30.0 FEET SOUTH OF RIVERSIDE AVENUE 5.0 FEET NORTH OF POWER POLE #674422E, 4.0 FEET SOUTHEAST OF A SIGNAL LIGHT STANCHIAN, 1.0 FOOT WEST OF A MARKER POST, A BRASS DISK SET IN THE TOP OF A CONCRETE POST, AND MARKED M.L. 38 APRIL 1964, 1968 ELEV.: 794.743, 5-71 ELEV.: 794.579

CITY OF EASTVALE

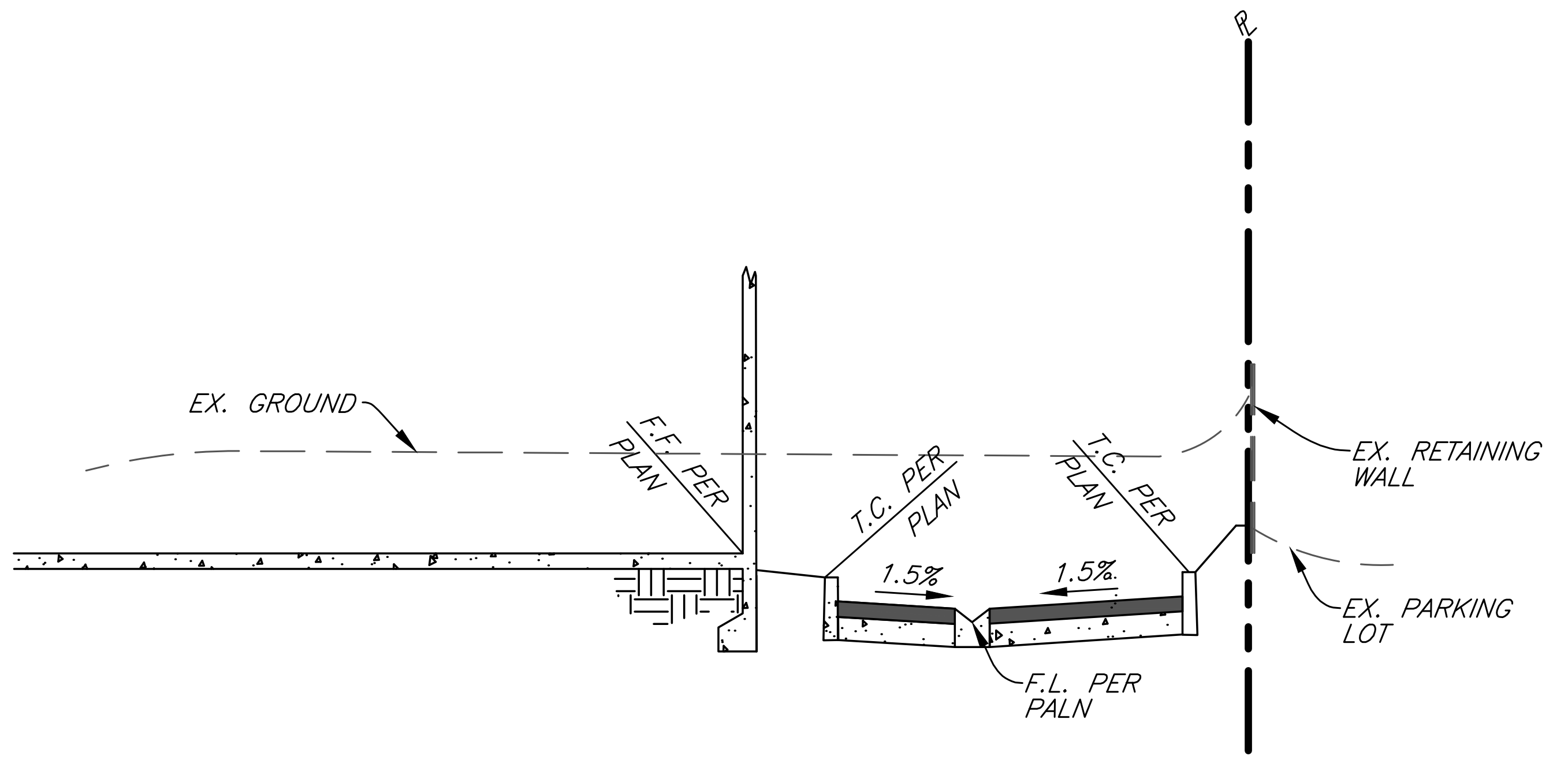
NEWCASTLE DEVELOPMENT
PRELIMINARY GRADING PLAN
EASTVALE-MILLIKEN

2 OF 4 SHEETS



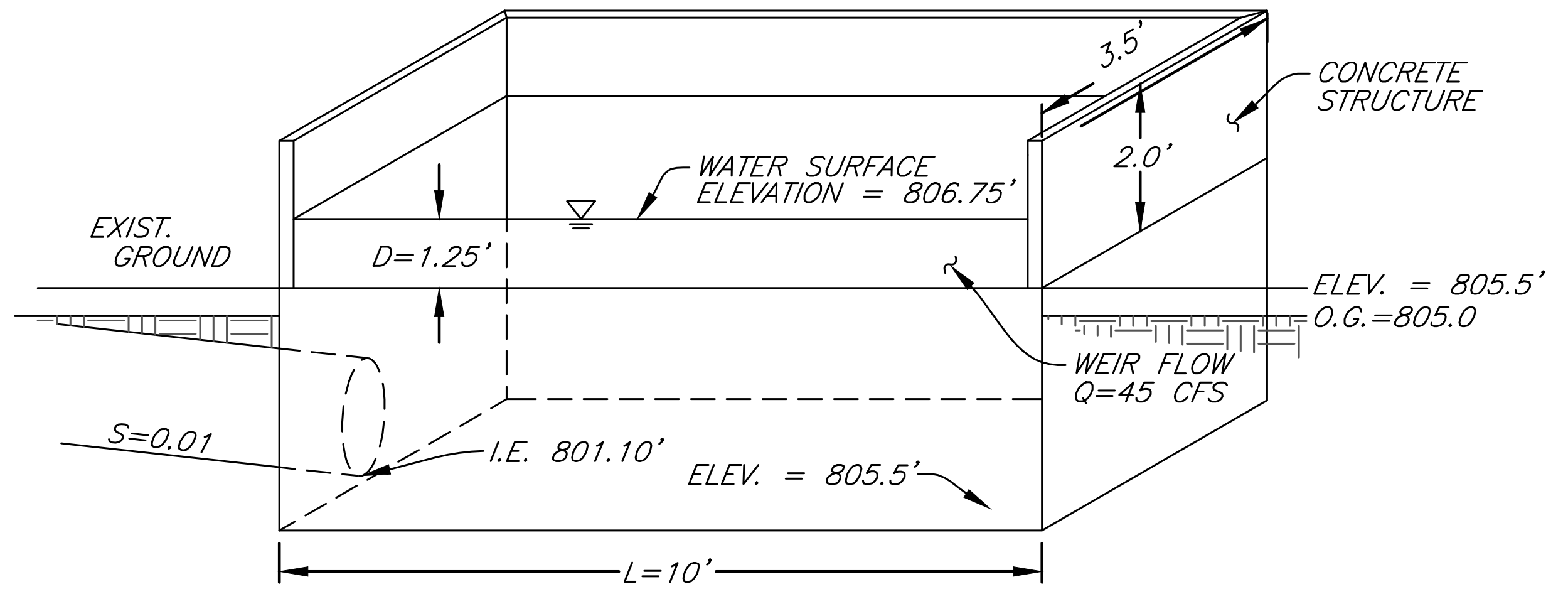
SECTION A-A

NO SCALE



SECTION B-B

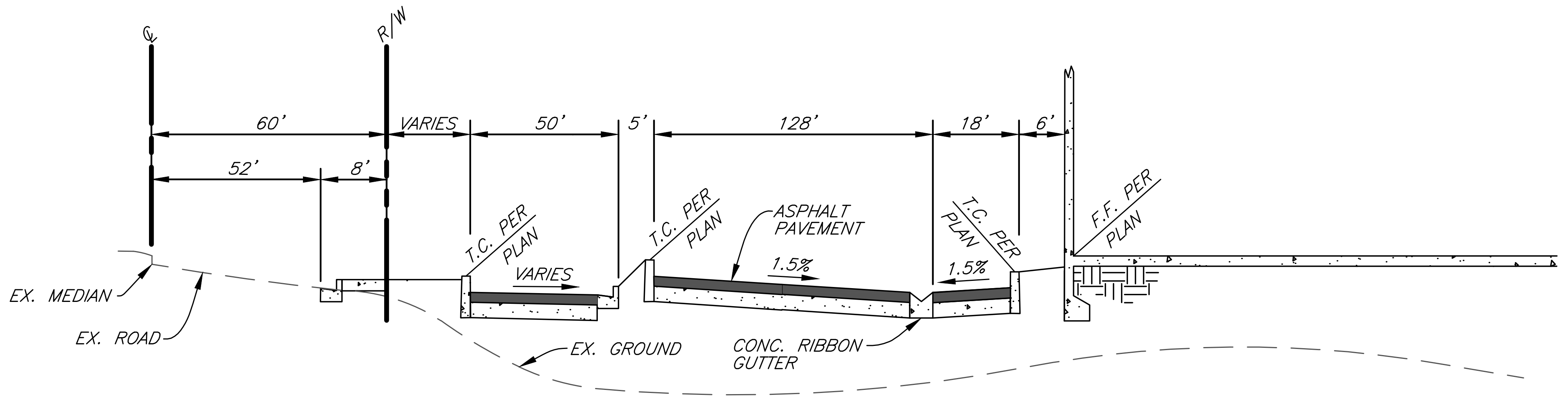
NO SCALE



* NOTE: REQUIRES SUMP PUMP TO DISCHARGE PONDED WATER WHEN WSEL < 805.50

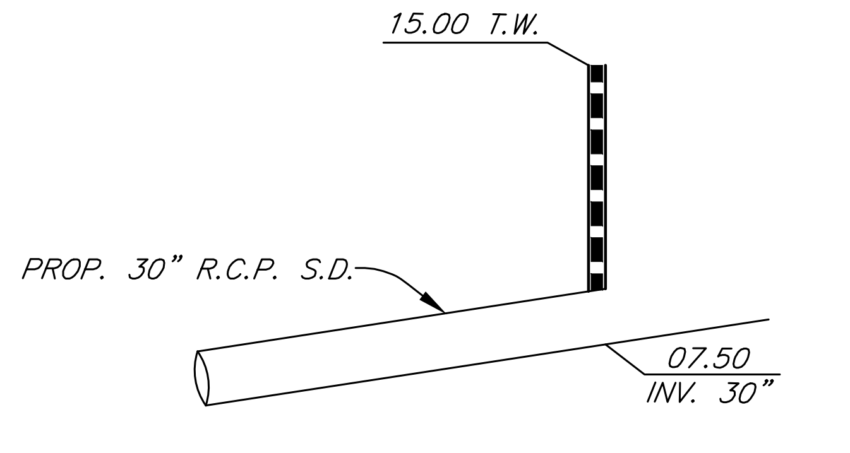
BUBBLER OVERFLOW STRUCTURE DETAIL

NO SCALE



SECTION C-C

NO SCALE

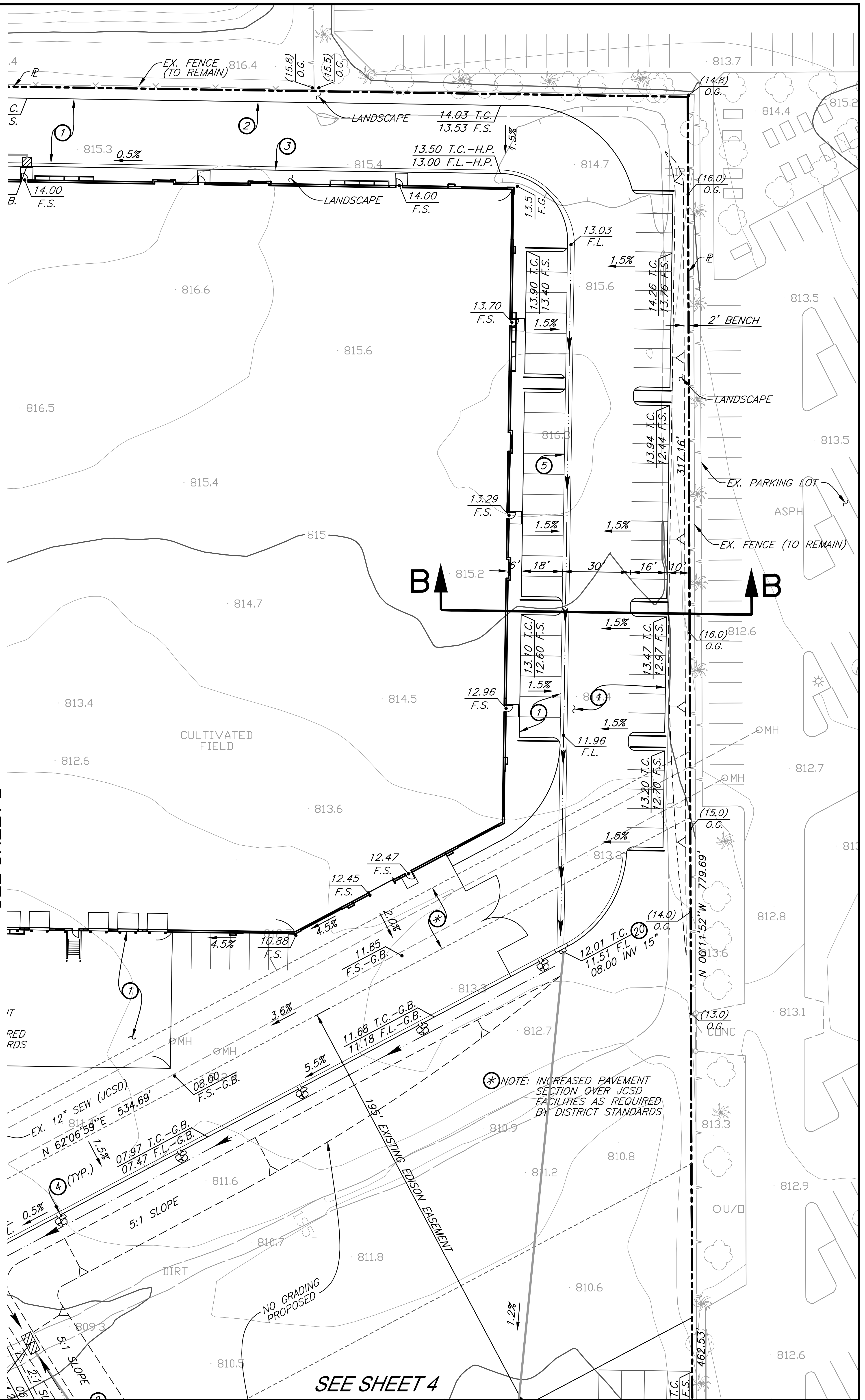


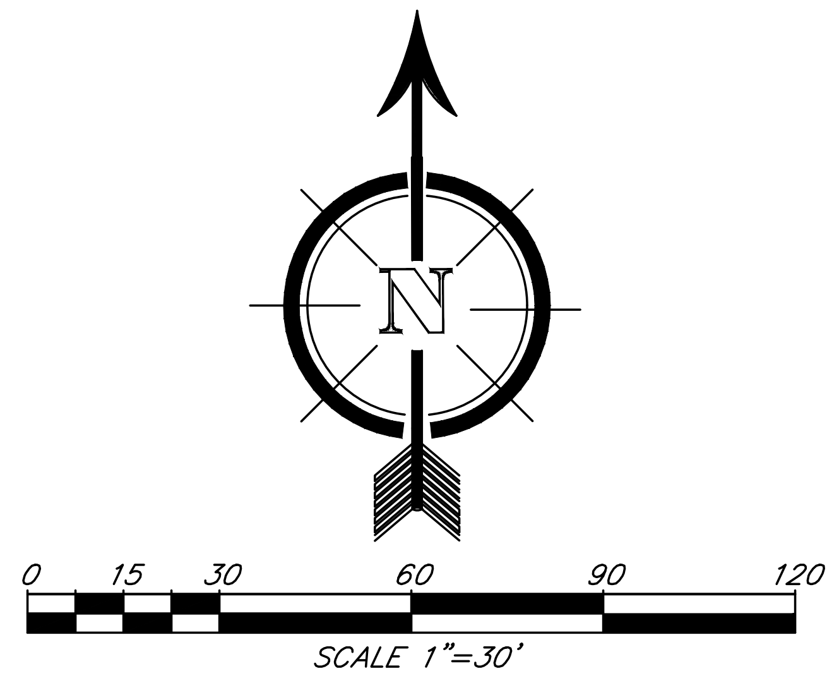
HEADWALL DETAIL

NO SCALE

CONSTRUCTION NOTES

① CONSTRUCT CONCRETE DRIVE ISLE & PARKING AREAS
② CONSTRUCT 6" CURB ONLY
③ CONSTRUCT 6" CURB AND GUTTER
④ CONSTRUCT 12" GAP IN CURB FOR DRAINAGE CONVEYANCE
⑤ CONSTRUCT 3" WIDE RIBBON GUTTER
⑥ CONSTRUCT 4" P.C.C. SIDEWALK (FINISHED SURFACE PER ARCH. PLANS)
⑦ CONSTRUCT P.V.C. STORM DRAIN
⑧ CONSTRUCT 24" X 24" CATCH BASIN
⑨ CONSTRUCT COBBLE RIPRAP PAD (1/2 GROUTED)
⑩ CONSTRUCT 30" STORM DRAIN
⑪ CONSTRUCT 36" CMP RISER
⑫ CONSTRUCT CONCRETE HEADWALL/ RETAINING
⑬ CONSTRUCT CONCRETE STEP OUT STRIP
⑭ CONSTRUCT COMMERCIAL DRIVEWAY APPROACH
⑮ CONSTRUCT 8" HDPE STORM DRAIN
⑯ CONSTRUCT 3'X10' BUBBLER OUTLET STRUCTURE (OFFSITE DRAINAGE CONVEYANCE)
⑰ CONSTRUCT 12" HDPE STORM DRAIN
⑱ CONSTRUCT 15" HDPE STORM DRAIN
⑲ CONSTRUCT 18" HDPE STORM DRAIN
⑳ CONSTRUCT 4' WIDE CURB INLET CATCH BASIN
㉑ CONSTRUCT SEGMENTED RETAINING WALL





PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS

MARK	DESCRIPTION	BY	APPR	DATE

DESIGNED BY: S.S.
DRAWN BY: S.J.S.
CHECKED BY: R.V.Z.
PROJECT MANAGER: S.S.

DATE: ______

PREPARED BY: DATE: ______
ROBERT VAN ZANTEN
R.C.E. NO.: 62325 EXP. 9-30-17

SEAL:
No. 62325
Exp. 9-30-17
CIVIL

PREPARED BY:
SDH & ASSOCIATES INCORPORATED
SDH AND ASSOCIATES INC.
5225 CANYON CREST DRIVE 71439
Riverside, California 92507
TEL: (951) 683-3691 FAX (951) 788-2314

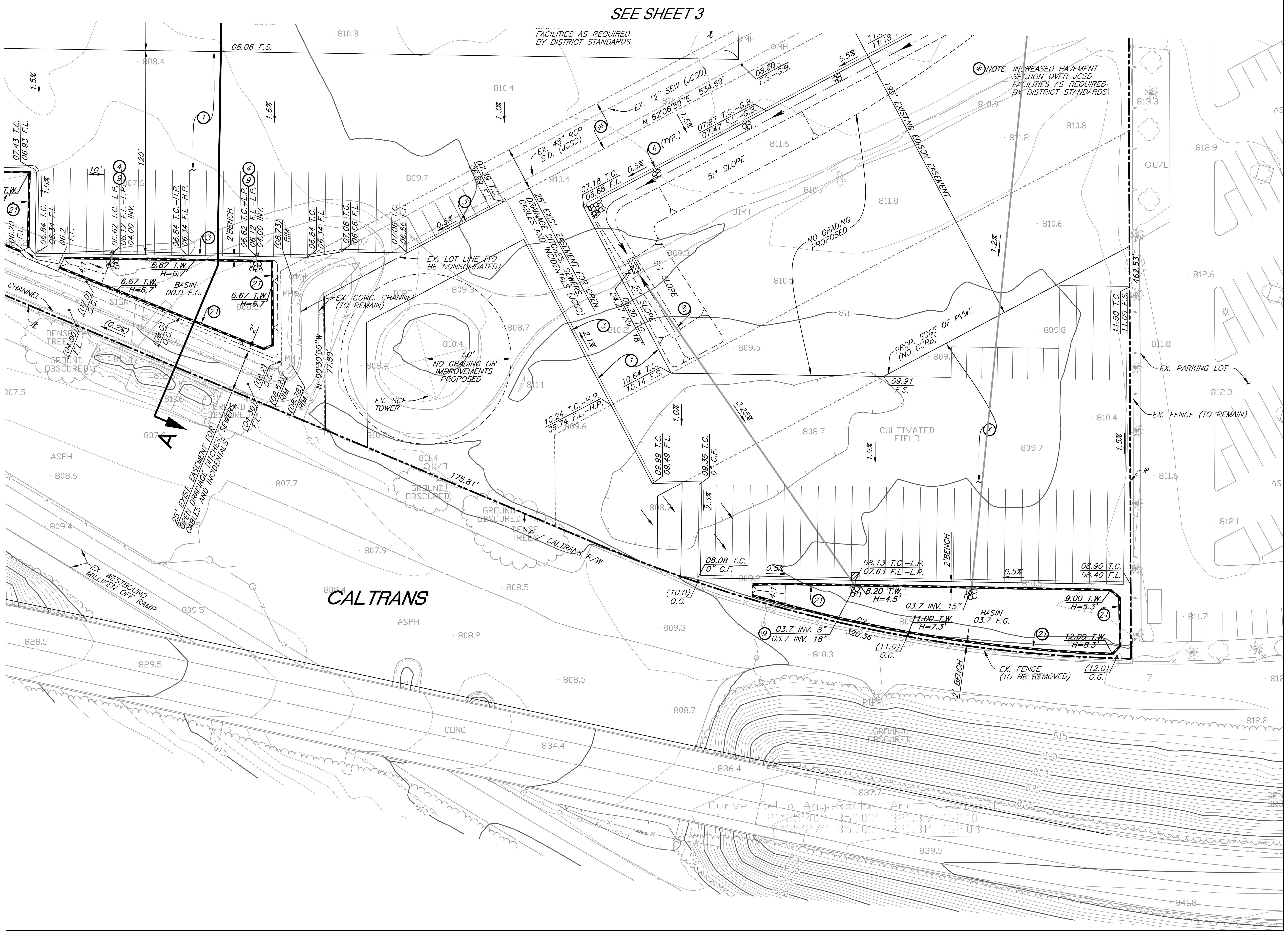
SCALE: 1"=50'
DATE: MARCH 2017

BENCHMARK M.L. 38-654
AT THE SOUTHEAST CORNER OF THE INTERSECTION OF HAMNER AVENUE AND RIVERSIDE AVENUE, 47.0 FEET EAST OF HAMNER AVENUE, 30.0 FEET SOUTH OF RIVERSIDE AVENUE 5.0 FEET NORTH OF POWER POLE #674422E, 4.0 FEET SOUTHEAST OF A SIGNAL LIGHT STANCHIAN, 1.0 FOOT WEST OF A MARKER POST, A BRASS DISK SET IN THE TOP OF A CONCRETE POST, AND MARKED M.L. 38 APRIL 1964. 1968 ELEV.: 794.743, 5-71 ELEV.: 794.579

CITY OF EASTVALE

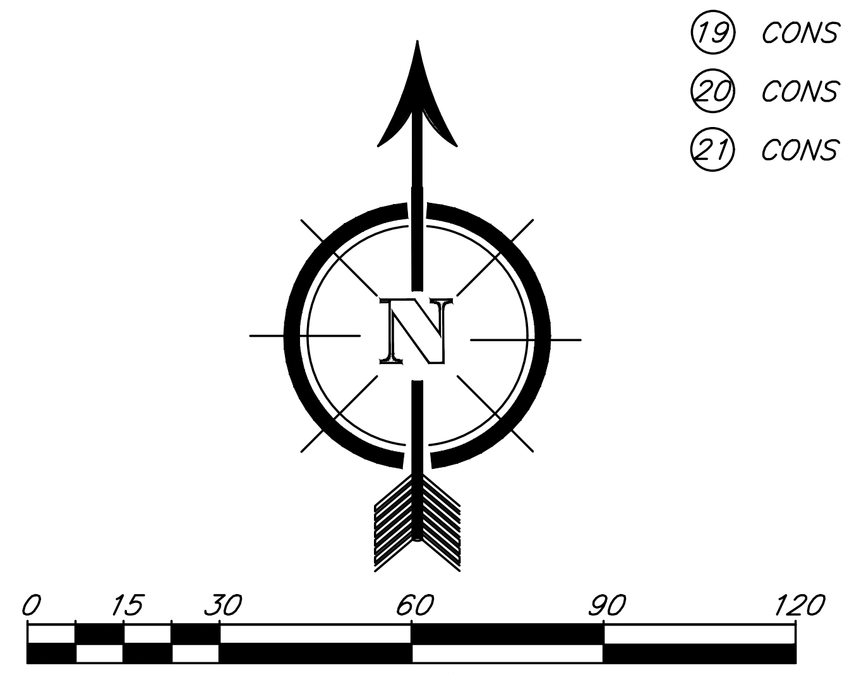
NEWCASTLE DEVELOPMENT
PRELIMINARY GRADING PLAN
EASTVALE-MILLIKEN

3
OF
5
SHEETS



CONSTRUCTION NOTES

① CONSTRUCT CONCRETE DRIVE ISLE & PARKING AREAS
② CONSTRUCT 6" CURB ONLY
③ CONSTRUCT 6" CURB AND GUTTER
④ CONSTRUCT 12" GAP IN CURB FOR DRAINAGE CONVEYANCE
⑤ CONSTRUCT 3" WIDE RIBBON GUTTER
⑥ CONSTRUCT 4" P.C.C. SIDEWALK (FINISHED SURFACE PER ARCH. PLANS)
⑦ CONSTRUCT P.V.C. STORM DRAIN
⑧ CONSTRUCT 24" X 24" CATCH BASIN
⑨ CONSTRUCT COBBLE RIPRAP PAD (1/2 GROUTED)
⑩ CONSTRUCT 30" STORM DRAIN
⑪ CONSTRUCT 36" CMP RISER
⑫ CONSTRUCT CONCRETE HEADWALL/ RETAINING
⑬ CONSTRUCT CONCRETE STEP OUT STRIP
⑭ CONSTRUCT COMMERCIAL DRIVEWAY APPROACH
⑮ CONSTRUCT 8" HDPE STORM DRAIN
⑯ CONSTRUCT 3'X10' BUBBLER OUTLET STRUCTURE (OFFSITE DRAINAGE CONVEYANCE)
⑰ CONSTRUCT 12" HDPE STORM DRAIN
⑱ CONSTRUCT 15" HDPE STORM DRAIN
⑲ CONSTRUCT 18" HDPE STORM DRAIN
⑳ CONSTRUCT 4' WIDE CURB INLET CATCH BASIN
㉑ CONSTRUCT SEGMENTED RETAINING WALL



PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS

MARK	DESCRIPTION	BY	APPR	DATE

DESIGNED BY: S.S.
DRAWN BY: S.J.S.
CHECKED BY: R.V.Z.
PROJECT MANAGER: S.S.

DATE: ____________

PREPARED BY: DATE: ____________
ROBERT VAN ZANTEN
R.C.E. NO.: 62325 EXP. 9-30-17

SEAL:
No. 62325
Exp. 9-30-17

PREPARED BY:
SDH & ASSOCIATES INCORPORATED
SDH AND ASSOCIATES INC.
5225 CANYON CREST DRIVE 71439
Riverside, California 92507
TEL: (951) 683-3691 FAX (951) 788-2314

SCALE: 1"=50'
DATE: MARCH 2017

BENCHMARK M.L. 38–654
AT THE SOUTHEAST CORNER OF THE INTERSECTION OF HAMNER AVENUE AND RIVERSIDE AVENUE, 47.0 FEET EAST OF HAMNER AVENUE, 30.0 FEET SOUTH OF RIVERSIDE AVENUE 5.0 FEET NORTH OF POWER POLE #674422E, 4.0 FEET SOUTHEAST OF A SIGNAL LIGHT STANCHIAN, 1.0 FOOT WEST OF A MARKER POST, A BRASS DISK SET IN THE TOP OF A CONCRETE POST, AND MARKED M.L. 38 APRIL 1964. 1968 ELEV.: 794.743, 5–71 ELEV.: 794.579

CITY OF EASTVALE

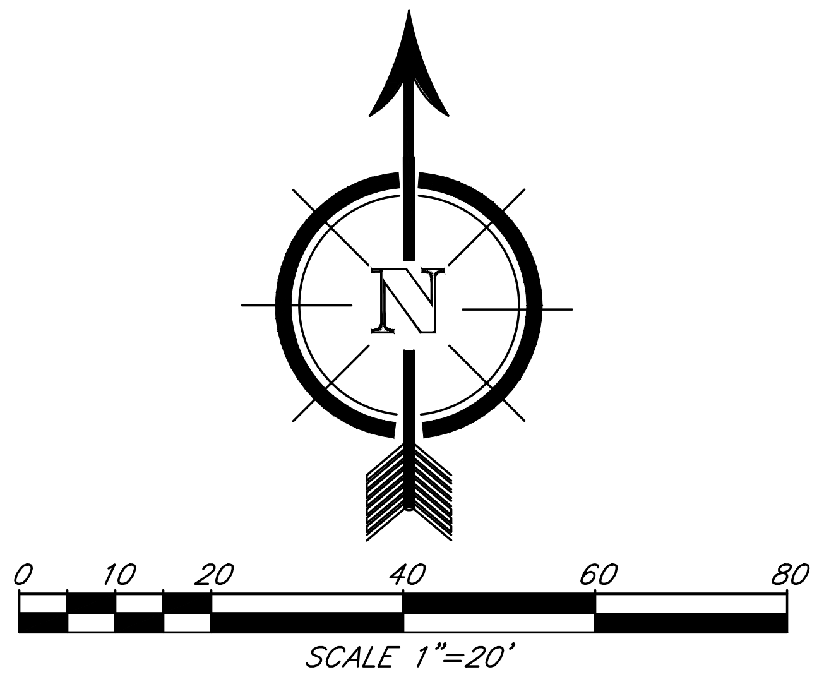
NEWCASTLE DEVELOPMENT
PRELIMINARY GRADING PLAN
EASTVALE-MILLIKEN

4
OF
5
SHEETS

PHOTO NO. 1

PHOTO NO. 2

PHOTO NO. 3



PRELIMINARY
NOT FOR CONSTRUCTION

REVISIONS

MARK	DESCRIPTION	BY	APPR	DATE

DESIGNED BY: S.S.
DRAWN BY: S.J.S.
CHECKED BY: R.V.Z.
PROJECT MANAGER: S.S.

DATE: ______

PREPARED BY:
DATE: ______
ROBERT VAN ZANTEN
R.C.E. NO.: 62325
EXP. 9-30-17

SEAL:
ROBERT C VAN ZANTEN
No. 62325
Exp. 9-30-17
CIVIL

PREPARED BY:
SDH & ASSOCIATES INCORPORATED
SDH AND ASSOCIATES INC.
5225 CANYON CREST DRIVE 71439
Riverside, California 92507
TEL: (951) 683-3691 FAX (951) 788-2314

SCALE: 1"=20'
DATE: JULY 2017

BENCHMARK M.L. 38–654
AT THE SOUTHEAST CORNER OF THE INTERSECTION OF HAMNER AVENUE AND RIVERSIDE AVENUE, 47.0 FEET EAST OF HAMNER AVENUE, 30.0 FEET SOUTH OF RIVERSIDE AVENUE 5.0 FEET NORTH OF POWER POLE #674422E, 4.0 FEET SOUTHEAST OF A SIGNAL LIGHT STANCHIAN, 1.0 FOOT WEST OF A MARKER POST, A BRASS DISK SET IN THE TOP OF A CONCRETE POST, AND MARKED M.L. 38 APRIL 1964. 1968 ELEV.: 794.743, 5–71 ELEV.: 794.579

CITY OF EASTVALE

NEWCASTLE DEVELOPMENT
STREET IMPROVEMENT EXHIBIT
MILLIKEN AVENUE

5
OF
5
SHEETS

Appendix 3: Soils Information

Geotechnical Study and Other Infiltration Testing Data

Geotechnical Engineering Investigation

Proposed Industrial Warehouse
3100 Milliken Avenue
Eastvale, California

Newcastle Partners
4740 Green River Road, Suite 118
Corona, California 92880

Project Number 19503-17
April 4, 2017

TABLE OF CONTENTS

NorCal Engineering
Soils and Geotechnical Consultants
10641 Humbolt Street Los Alamitos, CA 90720
(562) 799-9469 Fax (562) 799-9459

April 4, 2017 Project Number 19503-17

Newcastle Partners
4740 Green River Road, Suite 118
Corona, California 92880

Attn.: Mr. Jackson Smith

RE: **Geotechnical Engineering Investigation** - Proposed Industrial Warehouse Development - Located at 3100 Milliken Avenue, in the City of Eastvale, California

Dear Mr. Smith:

Pursuant to your request, this firm has performed a Geotechnical Engineering Investigation in accordance with your authorization of signed proposal dated January 12, 2017 for the above referenced project. The purpose of this investigation is to evaluate the subsurface conditions of the subject site and to provide recommendations for the proposed industrial development.

The scope of work included the following: 1) site reconnaissance; 2) subsurface geotechnical exploration and sampling; 3) laboratory testing; 4) engineering analysis of field and laboratory data; 5) and preparation of a geotechnical engineering report. It is the opinion of this firm that the proposed development is feasible from a geotechnical standpoint provided that the recommendations presented in this report are followed in the design and construction of the project.

1.0 Project Description

It is proposed to construct an industrial development consisting of an industrial warehouse building totaling 277,200 square feet in area on the 15.8-acre subject property as shown on the attached site plan. The industrial building will consist of concrete tilt-up structure supported by a conventional slab-on-grade foundation system with perimeter-spread footings and isolated interior footings. Other improvements will consist of screen walls, concrete and asphaltic pavement, landscaping and hardscape. It is assumed that the proposed grading will include cuts and fills to achieve finished grade elevations. Final building plans shall be reviewed by this firm prior to submittal for city/county approval to determine the need for any additional study and revised recommendations pertinent to the proposed development, if necessary.

2.0 Site Description

The subject project is located at the northeast corner of Milliken Avenue and the 60 Freeway, in the City of Eastvale. The generally triangular-shaped parcel is elongated in an east to west direction with topography of the relatively level parcel descending gradually from north to south on the order of a few feet. The site is currently an undeveloped parcel covered with a moderate vegetation growth of natural grasses and weeds.

3.0 Site Exploration

The investigation consisted of the placement of twelve (12) subsurface exploratory trenches by a backhoe to depths ranging between 5 and 18 feet below current ground elevations. The explorations were visually classified and logged by a field engineer with locations of the subsurface explorations shown on the attached Site Plan. The exploratory trenches revealed the existing earth materials to consist of a fill and natural soil. A detailed description of the subsurface conditions is listed on the excavation logs in Appendix A.

Fill: A fill soil and disturbed top soils classifying as a brown, fine to medium grained, silty SAND was encountered to a depth of 1 to 2 feet. These soils were noted to be loose and moist.

Natural: An undisturbed alluvium soil classifying as a brown, fine to medium grained, silty SAND was encountered directly beneath the fill and observed to be medium dense and damp to moist. Deeper soils consisted of a fine to coarse grained, gravelly SAND with cobbles.

The overall engineering characteristics of the earth material were relatively uniform with each excavation. No groundwater was encountered to the depth of our trenches and slight caving occurred in the deeper cohesionless soils.

4.0 Laboratory Tests

Relatively undisturbed samples of the subsurface soils were obtained to perform laboratory testing and analysis for direct shear, consolidation tests, and to determine in-place moisture/densities. These relatively undisturbed ring samples were obtained by driving a thin-walled steel sampler lined with one inch long brass rings with an inside diameter of 2.42 inches into the undisturbed soils. Bulk bag samples were obtained in the upper soils for expansion index tests and maximum density tests. All test results are included in Appendix B, unless otherwise noted.

4.1 **Field moisture content** (ASTM: D 2216) and the dry density of the ring samples were determined in the laboratory. This data is listed on the logs of explorations.

4.2 **Maximum density tests** (ASTM: D 1557) were performed on typical samples of the upper soils. Results of these tests are shown on Table I.

4.3 **Expansion index tests** (ASTM: D 4829) were performed on remolded samples of the upper soils. Results of these tests are provided on Table II.

4.4 **Corrosion tests** consisting of sulfate, pH, resistivity and chloride analysis to determine potential corrosive effects of soils on concrete and underground utilities. Test results are provided on Table III.

4.5 **R-Value test** per California Test Method 301 was performed on a representative sample, which may be anticipated to be near subgrade to determine pavement design. Result provided within pavement section design section of report.

4.6 **Direct Shear tests** (ASTM: D 3080) were performed on undisturbed and disturbed samples of the subsurface soils. The test is performed under saturated conditions at loads of 1,000 lbs./sq.ft., 2,000 lbs./sq.ft., and 3,000 lbs./sq.ft. with results shown on Plate A.

4.7 **Consolidation tests** (ASTM: D 2435) were performed on undisturbed samples to determine the differential and total settlement which may be anticipated based upon the proposed loads. Water was added to the samples at a surcharge of one KSF and the settlement curves are plotted on Plates B to D.

5.0 Infiltration Characteristics

Infiltration tests within the site were performed to provide preliminary infiltration rates for the purpose of planning and design of an on-site water disposal system. The infiltration tests consisted of the double ring infiltration test per ASTM Method D 3385. Based upon the results of our testing, the soils encountered in the planned on-site drainage disposal system area exhibit the following infiltration rates. The field infiltration rate is listed below for two exploratory trenches at depths of 5 and 10 feet measured from existing ground surface with our calculations given in Appendix C.

Test No.	Depth	Infiltration Rate
P-1	5’	2.6 in/hr
P-2	10’	1.4 in/hr

The correction factors CF_t, CF_v and CF_s are given below based on soils in the upper 10 feet from our field tests.

a) $CF_t = R_f = 1.0$ for our double ring infiltration test holes.

b) $CF_v = 1.0$ based on uniform soils encountered in two trenches for infiltration tests.

c) $CF_s = 3.0$ for long-term siltation, plugging and maintenance. The subsurface soils are likely to have some plugging and regular maintenance of storm water discharge devices is required.

All systems must meet the latest city and/or county specifications and California Regional Water Quality Control Board (CRWQCB) requirements. Foundations shall be set back a minimum distance of 10 feet from the drainage disposal system and the bottom of footing shall be a minimum of 10 feet from the expected zone of saturation. The boundary of the zone of saturation may be assumed to project downward from the top of the permeable portion of the disposal system at an inclination of 1 to 1 or flatter, as determined by the soils engineer.

6.0 Seismicity Evaluation

The proposed development lies outside of any Alquist Priolo Special Studies Zone and the potential for damage due to direct fault rupture is considered very remote. The site is located in an area of high regional seismicity and the Cucamonga fault is located about 15 kilometers from the site. Ground shaking originating from earthquakes along other active faults in the region is expected to induce lower horizontal accelerations due to smaller anticipated earthquakes and/or greater distances to other faults. The seismic design of the project has been updated to the latest 2010 ASCE 7-10 (with July 2013 errata) standards and the mapped seismic ground motions were provided by using the Java based program available from the United States Geological Survey (USGS) website: http://geohazards.usgs.gov/designmaps/us/application.php.

Seismic Design Parameters

Site Location	Latitude	34.025°
	Longitude	-117.556°
Site Class		D
Maximum Spectral Response Acceleration	S_S	1.500g
	S_1	0.600g
Adjusted Maximum Acceleration	S_{MS}	1.500g
	S_{M1}	0.900g
Design Spectral Response Acceleration Parameters	S_{DS}	1.000g
	S_{D1}	0.600g

7.0 Liquefaction Evaluation

The site is expected to experience ground shaking and earthquake activity that is typical of Southern California area. It is during severe ground shaking that loose, granular soils below the groundwater table can liquefy. Based upon information in the City of Riverside Public Safety Element "Liquefaction Zones (2006)", the subject site is not situated in an area of generalized liquefaction susceptibility.

Our analysis indicates the potential for liquefaction at this site is considered to be very low due to the density of the subsurface soils and groundwater in excess of 200 feet based on review with the State of California Department of Water Resources of nearby water wells. Thus, the design of the proposed construction in conformance with the latest Building Code provisions for earthquake design is expected to provide mitigation of ground shaking hazards that are typical to Southern California.

8.0 Conclusions and Recommendations

Based upon our evaluations, the proposed development is acceptable from a geotechnical engineering standpoint. By following the recommendations and guidelines set forth in our report, the structures will be safe from excessive settlements under the anticipated design loadings and conditions. The proposed development shall meet all requirements of the City/County Building Ordinance and will not impose any adverse effect on existing adjacent structures.

The following recommendations are based upon geotechnical conditions encountered in our field investigation and laboratory data. Therefore, these surface and subsurface conditions could vary across the site. Variations in these conditions may not become evident until the commencement of grading operations and any unusual conditions which may be encountered in the course of the project development may require the need for additional study and revised recommendations.

It is recommended that site inspections be performed by a representative of this firm during all grading and construction of the development to verify the findings and recommendations documented in this report. The following sections present a discussion of geotechnical related requirements for specific design recommendations of different aspects of the project.

8.1 Site Grading Recommendations

Any vegetation and or demolition debris shall be removed and hauled from proposed grading areas prior to the start of grading operations. Existing vegetation shall not be mixed or disced into the soils. Any removed soils may be reutilized as compacted fill once any deleterious material or oversized materials (in excess of eight inches) is removed. Grading operations shall be performed in accordance with the attached "Specifications for Compacted Fill Operations".

8.1.1 Removal and Recompaction Recommendations

All disturbed/fill soils (about 1 to 2 feet below existing ground surface) shall be removed to competent native material, the exposed surface scarified to a depth of 12 inches, brought to within 2% of optimum moisture content and compacted to a minimum of 90% of the laboratory standard (ASTM: D-1557) prior to placement of any additional compacted fill soils, foundations, slabs-on-grade and pavement. Grading shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

It is possible that isolated areas of undiscovered fill not described in this report are present on site. If found, these areas should be treated as discussed earlier. A diligent search shall also be conducted during grading operations in an effort to uncover any underground structures, irrigation or utility lines. If encountered, these structures and lines shall be either removed or properly abandoned prior to the proposed construction.

Any imported fill material should be preferably soil similar to the upper soils encountered at the subject site. All soils shall be approved by this firm prior to importing at the site and will be subjected to additional laboratory testing to assure concurrence with the recommendations stated in this report.

Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase. Adequate drainage away from the structures, pavement and slopes should be provided at all times.

If placement of slabs-on-grade and pavement is not completed immediately upon completion of grading operations, additional testing and grading of the areas may be necessary prior to continuation of construction operations. Likewise, if adverse weather conditions occur which may damage the subgrade soils, additional assessment by the geotechnical engineer as to the suitability of the supporting soils may be needed.

8.1.2 Fill Blanket Recommendations

Due to the potential for differential settlement of foundations placed on compacted fill and the medium dense native materials, it is recommended that all foundations including floor slab areas be underlain by a uniform compacted fill blanket at least two feet in thickness. This fill blanket shall extend a minimum of five horizontal feet outside the edges of foundations or equidistant to the depth of fill placed, whichever is greater.

8.2 Shrinkage and Subsidence

Results of our in-place density tests reveal that the soil shrinkage will be on the order of 10 to 15% due to excavation and recompaction, based upon the assumption that the fill is compacted to 92% of the maximum dry density per ASTM standards. Subsidence should be 0.2 feet due to earthwork operations. The volume change does not include any allowance for vegetation or organic stripping, removal of subsurface improvements or topographic approximations. Although these values are only approximate, they represent our best estimate of lost yardage which will likely occur during grading. If more accurate shrinkage and subsidence factors are needed, it is recommended that field testing using the actual equipment and grading techniques should be conducted.

8.3 Temporary Excavations

Temporary unsurcharged excavations in the existing site materials less than 4 feet high may be made at a vertical gradient unless cohesionless soils are encountered. In areas where soils with little or no binder are encountered, where adverse geological conditions are exposed, or where excavations are adjacent to existing structures, shoring, slot-cutting, or flatter excavations may be required. The temporary cut slope gradients given do not preclude local raveling and sloughing.

All excavations shall be made in accordance with the requirements of CAL-OSHA and other public agencies having jurisdiction. Care should be taken to provide or maintain adequate lateral support for all adjacent improvements and structures at all times during the grading operations and construction phase.

8.4 Foundation Design

All foundations may be designed utilizing the following safe bearing capacities for an embedded depth of 18 inches into approved engineered fill with the corresponding widths:

Allowable Safe Bearing Capacity (psf)

Width (ft)	Continuous Foundation	Isolated Foundation
1.5	2000	2500
2.0	2075	2575
4.0	2375	2875
6.0	2500	3000

The bearing value may be increased by 500 psf for each additional foot of depth in excess of the 18-inch minimum depth, up to a maximum of 4,000 psf. A one third increase may be used when considering short term loading and seismic forces. Any foundations located along the property lines or where lateral overexcavation is not possible shall utilize a safe bearing capacity of 1,500 psf. A representative of this firm shall inspect all foundation excavations prior to pouring concrete.

8.5 Settlement Analysis

Resultant pressure curves for the consolidation tests are shown on Plates B to D. Computations utilizing these curves and the recommended safe bearing capacities reveal that the foundations will experience settlements on the order of 3/4 inch and differential settlements of less than 1/4 inch.

8.6 Lateral Resistance

The following values may be utilized in resisting lateral loads imposed on the structure. Requirements of the California Building Code should be adhered to when the coefficient of friction and passive pressures are combined.

Coefficient of Friction – 0.40
Equivalent Passive Fluid Pressure = 250 lbs./cu.ft.
Maximum Passive Pressure = 2,500 lbs./cu.ft.

The passive pressure recommendations are valid only for approved compacted fill soils.

8.7 Retaining Wall Design Parameters

Active earth pressures against retaining wall will be equal to the pressures developed by the following fluid densities. These values are for **granular backfill material** placed behind the walls at various ground slopes above the walls.

Surface Slope of Retained Materials (Horizontal to Vertical)	Equivalent Fluid Density (lb./cu.ft.)
Level	30
5 to 1	35
4 to 1	38
3 to 1	40
2 to 1	45

Any applicable short-term construction surcharges and seismic forces should be added to the referenced lateral pressure values.

All walls shall be waterproofed as needed and protected from hydrostatic pressure by a reliable permanent subdrain system. The subsurface drainage system shall consist of 4-inch diameter perforated PVC pipe encased with gravel and wrapped with filter fabric. The granular backfill to be utilized immediately adjacent to the walls shall consist of an approved granular soils with a sand equivalency greater than 30. This backfill zone of free draining material shall consist of a wedge beginning a minimum of one horizontal foot from the base of the wall extending upward at an inclination of no less than 3/4 to 1 (horizontal to vertical).

The seismic-induced lateral soil pressure for walls greater than 6 feet shall be computed using a triangular pressure distribution with the maximum value at the top of the wall. The maximum lateral pressure of (20 pcf) H, where H is the height of the retained soils above the wall footing should be utilized in final design of retaining walls. Sliding resistance values and passive fluid pressures given in our referenced report may be increased by 1/3 during short-term wind and seismic loading conditions.

8.8 **Slab Design**

All concrete slabs-on-grade shall be at least six inches in thickness for warehouse, four inches for office and hardscape and placed on approved subgrade soils. A vapor retarder (10-mil minimum thickness) should be utilized in areas which would be sensitive to the infiltration of moisture. This retarder shall meet requirements of ASTM E 96, *Water Vapor Transmission of Materials* and ASTM E 1745, *Standard Specification for Water Vapor Retarders used in Contact with Soil or Granular Fill Under Concrete Slabs*. The vapor retarder shall be installed in accordance with procedures stated in ASTM E 1643, *Standard practice for Installation of Water Vapor Retarders used in Contact with Earth or Granular Fill Under Concrete Slabs*.

The moisture retarder may be placed directly upon approved subgrade soils, although one to two inches of sand beneath the membrane is desirable. The subgrade upon which the retarder is placed shall be smooth and free of rocks, gravel or other protrusions which may damage the retarder. Use of sand above the retarder is under the purview of the structural engineer; if sand is used over the retarder, it should be placed in a dry condition.

8.9 **Pavement Section Design**

The table below provides a preliminary pavement design based upon an R-Value of 75 for the proposed pavement areas. Final pavement design may need to be based on R-Value testing of the subgrade soils near the conclusion of rough grading to assure that these soils are consistent with those assumed in this preliminary design.

Type of Traffic	Traffic Index	Asphaltic Concrete (in)	Base Material (in)
Automobile Parking Stalls	4.0	3.0	3.0
Light Vehicle Circulation Areas	5.5	3.5	4.5
Heavy Truck Access Areas (GVW < 90,000 lbs; 5-axle)	7.0	4.0	8.0

All concrete slabs to be utilized for pavement shall be a minimum of six inches in thickness and placed on approved subgrade soils. The recommendations are based upon estimated traffic loads. Client should submit anticipated traffic loadings, when available, so that pavement sections may be reviewed to determine adequacy to support these loads.

Any approved base material shall consist of a Class II aggregate or equivalent and should be compacted to a minimum of 95% relative compaction. All pavement materials shall conform to the requirements set forth by the City of Eastvale. The base material and asphaltic concrete should be tested prior to delivery to the site and during placement to determine conformance with the project specifications. A pavement engineer shall designate the specific asphalt mix design to meet the required project specifications.

All pavement areas shall have positive drainage toward an approved outlet from the site. Drain lines behind curbs and/or adjacent to landscape areas should be considered by client and the appropriate design engineers to prevent water from infiltrating beneath pavement. If such infiltration occurs, damage to pavement, curbs and flow lines, especially on sites with expansive soils, may occur during the life of the project.

8.10 Utility Trench and Excavation Backfill

Trenches from installation of utility lines and other excavations may be backfilled with on-site soils or approved imported soils compacted to a minimum of 90% relative compaction. All utility lines shall be properly bedded with clean sand having a sand equivalency rating of 30 (SE > 30) or more. This bedding material shall be thoroughly water jetted around the pipe structure prior to placement of compacted backfill soils.

8.11 Corrosion Design Criteria

Representative samples of the surficial soils, typical of the subgrade soils expected to be encountered within foundation excavations and underground utilities were tested for corrosion potential. The minimum resistivity value obtained for the samples tested is representative of an environment that may be corrosive to metals. The soil pH value was considered mildly alkaline and may have a significant effect on soil corrosivity.

Consideration should be given to corrosion protection systems for buried metal such as protective coatings, wrappings or the use of PVC where permitted by local building codes.

According to Table 4.3.1, ACI 318 Building Code and Commentary, these contents revealed negligible levels of sulfate exposure. Therefore, a Type II cement according to latest CBC specifications may be utilized for building foundations at this time. Additional sulfate tests shall be performed at the completion of site grading to assure that these soils are consistent with the recommendations stated in this design. Sulfate test results may be found on the attached Table III.

8.12 **Expansive Soil**

If expansive soils are encountered (EI > 20), special attention should be given to the project design and maintenance. The attached *Expansive Soil Guidelines* should be reviewed by the engineers, architects, owner, maintenance personnel and other interested parties and considered during the design of the project and future property maintenance.

9.0 **Closure**

The recommendations and conclusions contained in this report are based upon the soil conditions uncovered in our test excavations. No warranty of the soil condition between our excavations is implied. NorCal Engineering should be notified for possible further recommendations if unexpected to unfavorable conditions are encountered during construction phase. It is the responsibility of the owner to ensure that all information within this report is submitted to the Architect and appropriate Engineers for the project.

This firm should have the opportunity to review the final plans to verify that all our recommendations are incorporated. This report and all conclusions are subject to the review of the controlling authorities for the project.

A preconstruction conference should be held between the developer, general contractor, grading contractor, city inspector, architect, and soil engineer to clarify any questions relating to the grading operations and subsequent construction. Our representative should be present during the grading operations and construction phase to certify that such recommendations are complied within the field.

This geotechnical investigation has been conducted in a manner consistent with the level of care and skill exercised by members of our profession currently practicing under similar conditions in the Southern California area. No other warranty, expressed or implied is made.

We appreciate this opportunity to be of service to you. If you have any further questions, please do not hesitate to contact the undersigned.

Respectfully submitted,
NORCAL ENGINEERING

Keith D Tucker

Keith D. Tucker
Project Engineer
R.G.E. 841

REGISTERED PROFESSIONAL ENGINEER
KEITH D. TUCKER
No. 841
Exp. 12/31/18
GEOTECHNICAL
STATE OF CALIFORNIA

Scott D. Spensiero
Project Manager

SPECIFICATIONS FOR PLACEMENT OF COMPACTED FILL

Excavation

Any existing low density soils and/or saturated soils shall be removed to competent natural soil under the inspection of the Soils Engineering Firm. After the exposed surface has been cleansed of debris and/or vegetation, it shall be scarified until it is uniform in consistency, brought to the proper moisture content and compacted to a minimum of 90% relative compaction (in accordance with ASTM: D-1557).

In any area where a transition between fill and native soil or between bedrock and soil are encountered, additional excavation beneath foundations and slabs will be necessary in order to provide uniform support and avoid differential settlement of the structure.

Material For Fill

The on-site soils or approved import soils may be utilized for the compacted fill provided they are free of any deleterious materials and shall not contain any rocks, brick, asphaltic concrete, concrete or other hard materials greater than eight inches in maximum dimensions. Any import soil must be approved by the Soils Engineering firm a minimum of 24 hours prior to importation of site.

Placement of Compacted Fill Soils

The approved fill soils shall be placed in layers not excess of six inches in thickness. Each lift shall be uniform in thickness and thoroughly blended. The fill soils shall be brought to within 2% of the optimum moisture content, unless otherwise specified by the Soils Engineering firm. Each lift shall be compacted to a minimum of 90% relative compaction (in accordance with ASTM: D-1557) and approved prior to the placement of the next layer of soil. Compaction tests shall be obtained at the discretion of the Soils Engineering firm but to a minimum of one test for every 500 cubic yards placed and/or for every 2 feet of compacted fill placed.

The minimum relative compaction shall be obtained in accordance with accepted methods in the construction industry. The final grade of the structural areas shall be in a dense and smooth condition prior to placement of slabs-on-grade or pavement areas. No fill soils shall be placed, spread or compacted during unfavorable weather conditions. When the grading is interrupted by heavy rains, compaction operations shall not be resumed until approved by the Soils Engineering firm.

Grading Observations

The controlling governmental agencies should be notified prior to commencement of any grading operations. This firm recommends that the grading operations be conducted under the observation of a Soils Engineering firm as deemed necessary. A 24 hour notice must be provided to this firm prior to the time of our initial inspection.

Observation shall include the clearing and grubbing operations to assure that all unsuitable materials have been properly removed; approve the exposed subgrade in areas to receive fill and in areas where excavation has resulted in the desired finished grade and designate areas of overexcavation; and perform field compaction tests to determine relative compaction achieved during fill placement. In addition, all foundation excavations shall be observed by the Soils Engineering firm to confirm that appropriate bearing materials are present at the design grades and recommend any modifications to construct footings.

Expansive Soil Guidelines

The following expansive soil guidelines are provided for your project. The intent of these guidelines is to inform you, the client, of the importance of proper design and maintenance of projects supported on expansive soils. ***You, as the owner or other interested party, should be warned that you have a duty to provide the information contained in the soil report including these guidelines to your design engineers, architects, landscapers and other design parties in order to enable them to provide a design that takes into consideration expansive soils.***

In addition, you should provide the soil report with these guidelines to any property manager, lessee, property purchaser or other interested party that will have or assume the responsibility of maintaining the development in the future.

Expansive soils are fine-grained silts and clays which are subject to swelling and contracting. The amount of this swelling and contracting is subject to the amount of fine-grained clay materials present in the soils and the amount of moisture either introduced or extracted from the soils. Expansive soils are divided into five categories ranging from "very low" to "very high". Expansion indices are assigned to each classification and are included in the laboratory testing section of this report. *If the expansion index of the soils on your site, as stated in this report, is 21 or higher, you have expansive soils.* The classifications of expansive soils are as follows:

Classification of Expansive Soil*

Expansion Index	Potential Expansion
0-20	Very Low
21-50	Low
51-90	Medium
91-130	High
Above 130	Very High

When expansive soils are compacted during site grading operations, care is taken to place the materials at or slightly above optimum moisture levels and perform proper compaction operations. Any subsequent excessive wetting and/or drying of expansive soils will cause the soil materials to expand and/or contract. These actions are likely to cause distress of foundations, structures, slabs-on-grade, sidewalks and pavement over the life of the structure. ***It is therefore imperative that even after construction of improvements, the moisture contents are maintained at relatively constant levels, allowing neither excessive wetting or drying of soils.***

Evidence of excessive wetting of expansive soils may be seen in concrete slabs, both interior and exterior. Slabs may lift at construction joints producing a trip hazard or may crack from the pressure of soil expansion. Wet clays in foundation areas may result in lifting of the structure causing difficulty in the opening and closing of doors and windows, as well as cracking in exterior and interior wall surfaces. In extreme wetting of soils to depth, settlement of the structure may eventually result. Excessive wetting of soils in landscape areas adjacent to concrete or asphaltic pavement areas may also result in expansion of soils beneath pavement and resultant distress to the pavement surface.

Excessive drying of expansive soils is initially evidenced by cracking in the surface of the soils due to contraction. Settlement of structures and on-grade slabs may also eventually result along with problems in the operation of doors and windows.

Projects located in areas of expansive clay soils will be subject to more movement and "hairline" cracking of walls and slabs than similar projects situated on non-expansive sandy soils. There are, however, measures that developers and property owners may take to reduce the amount of movement over the life the development. The following guidelines are provided to assist you in both design and maintenance of projects on expansive soils:

- Drainage away from structures and pavement is essential to prevent excessive wetting of expansive soils. Grades of at least 3% should be designed and maintained to allow flow of irrigation and rain water to approved drainage devices or to the street. Any "ponding" of water adjacent to buildings, slabs and pavement after rains is evidence of poor drainage; the installation of drainage devices or regrading of the area may be required to assure proper drainage. Installation of rain gutters is also recommended to control the introduction of moisture next to buildings. Gutters should discharge into a drainage device or onto pavement which drains to roadways.

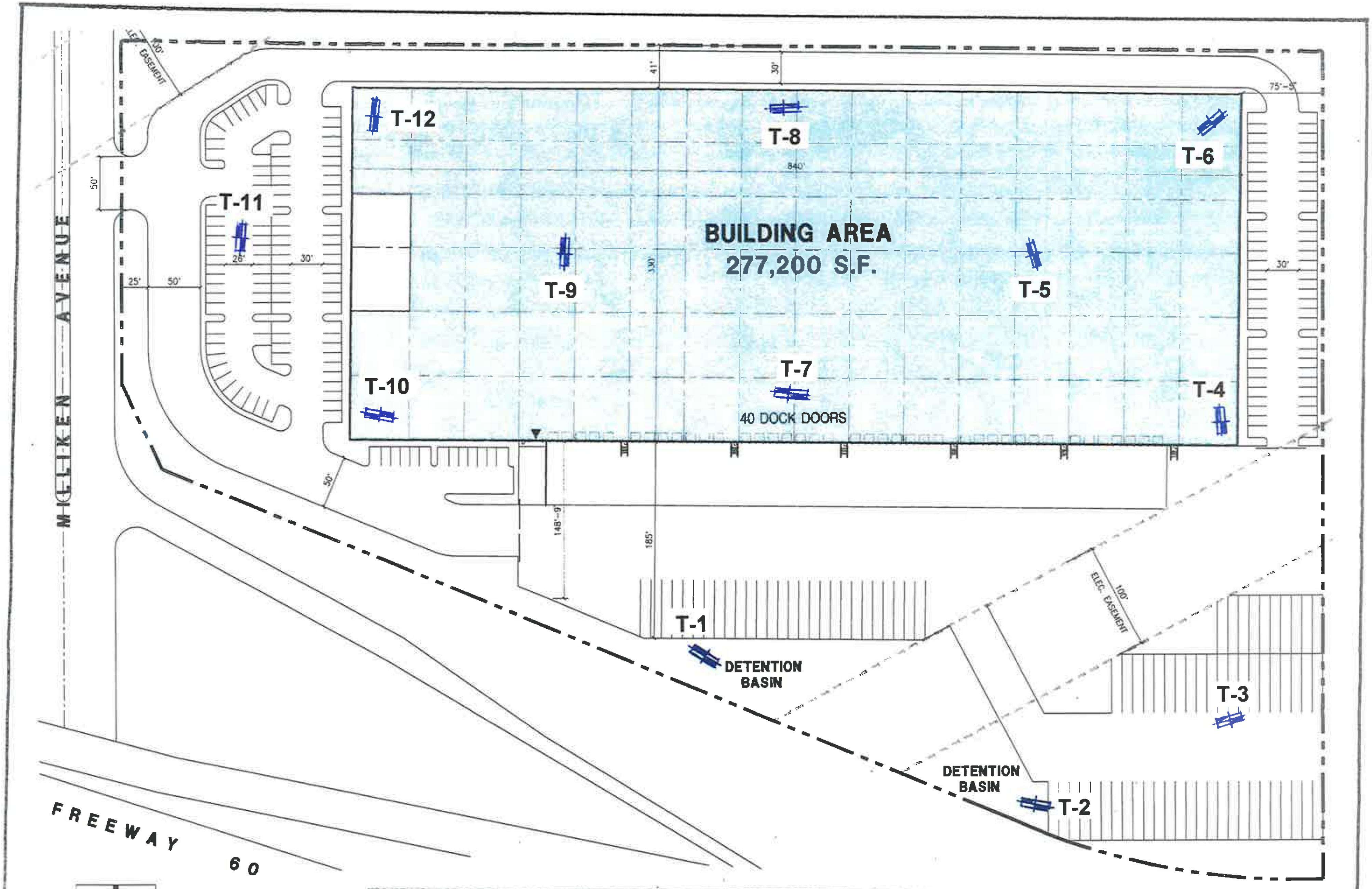
- Irrigation should be strictly controlled around building foundations, slabs and pavement and may need to be adjusted depending upon season. This control is essential to maintain relatively uniform moisture content in the expansive soils and to prevent swelling and contracting. Over-watering adjacent to improvements may result in damage to those improvements. NorCal Engineering makes no specific recommendations regarding landscape irrigation schedules.

- Planting schemes for landscaping around structures and pavement should be analyzed carefully. Plants (including sod) requiring high amounts of water may result in excessive wetting of soils. Trees and large shrubs may actually extract moisture from the expansive soils, thus causing contraction of the fine-grained soils.

- Thickened edges on exterior slabs will assist in keeping excessive moisture from entering directly beneath the concrete. A six-inch thick or greater deepened edge on slabs may be considered. Underlying interior and exterior slabs with 6 to 12 inches or more of non-expansive soils and providing presaturation of the underlying clayey soils as recommended in the soil report will improve the overall performance of on-grade slabs.

- Increase the amount of steel reinforcing in concrete slabs, foundations and other structures to resist the forces of expansive soils. The precise amount of reinforcing should be determined by the appropriate design engineers and/or architects.

- Recommendations of the soil report should always be followed in the development of the project. Any recommendations regarding presaturation of the upper subgrade soils in slab areas should be performed in the field and verified by the Soil Engineer.



SITE PLAN

NorCal Engineering
SOILS AND GEOTECHNICAL CONSULTANTS

PROJECT 19503-17
DATE APRIL 2017

List of Appendices

(in order of appearance)

Appendix A - Log of Excavations

- Log of Trenches T-1 to T-12

Appendix B - Laboratory Tests

- Table I - Maximum Dry Density
- Table II – Expansion
- Table III – Atterberg Limits
- Table IV – Corrosion
- Plate A - Direct Shear
- Plates D to D – Consolidation

Appendix C – Infiltration Study

Field Test Data

Appendix A

MAJOR DIVISION			GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)	▨	GW	WELL-GRADED GRAVELS, GRAVEL. SAND MIXTURES, LITTLE OR NO FINES
			▨	GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)	▨	GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
			▨	GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SAND (LITTLE OR NO FINES)	▨	SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
			▨	SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
		SANDS WITH FINE (APPRECIABLE AMOUNT OF FINES)	▨	SM	SILTY SANDS, SAND-SILT MIXTURES
			▨	SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50	▨	ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
			▨	CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
			▨	OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50	▨	MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
			▨	CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
			▨	OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS			▨	PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

UNIFIED SOIL CLASSIFICATION SYSTEM

KEY:

■ Indicates 2.5-inch Inside Diameter. Ring Sample.

☒ Indicates 2-inch OD Split Spoon Sample (SPT).

⧅ Indicates Shelby Tube Sample.

◫ Indicates No Recovery.

◧ Indicates SPT with 140# Hammer 30 in. Drop.

🖂 Indicates Bulk Sample.

◩ Indicates Small Bag Sample.

◨ Indicates Non-Standard

⧗ Indicates Core Run.

COMPONENT PROPORTIONS

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	1 - 5%
Few	5 - 10%
Little	10 - 20%
Some	20 - 35%
And	35 - 50%

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5mm) to No. 200 (0.074mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074 mm)

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
DAMP	Some perceptible moisture; below optimum
MOIST	No visible water; near optimum moisture content
WET	Visible free water, usually soil is below water table.

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N -VALUE

COHESIONLESS SOILS		COHESIVE SOILS		
Density	N (blows/ft)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	Very Soft	0 to 2	< 250
Loose	4 to 10	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	Very Stiff	15 to 30	2000 - 4000
		Hard	over 30	> 4000

Newcastle Partners
19503-17

Log of Trench T-1

Boring Location: 3100 Milliken, Eastvale

Date of Drilling: 3/24/17

Groundwater Depth: None Encountered

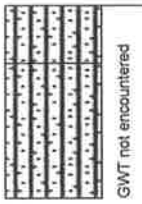
Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Relative Compaction
0		FILL Silty (fine to medium grained) SAND Brown, loose, damp					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist					
5		Trench completed at depth of 5'					
10							
15							
20							
25							
30							
35							

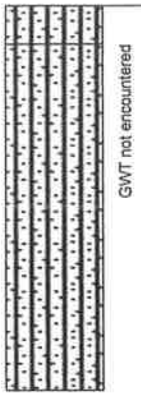


NorCal Engineering

Newcastle Partners
19503-17

Log of Trench T-2

Boring Location: 3100 Milliken, Eastvale	
Date of Drilling: 3/24/17	Groundwater Depth: None Encountered
Drilling Method: Backhoe	
Hammer Weight:	Drop:
Surface Elevation: Not Measured	



Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Relative Compaction
0		FILL Silty (fine to medium grained) SAND Brown, loose, damp					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist					
5							
10		Trench completed at depth of 10'					
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\19503-17.log Date: 3/30/2017

NorCal Engineering

Newcastle Partners
19503-17

Log o Trench T-3

Boring Location: 3100 Milliken, Eastvale

Date of Drilling: 3/24/17

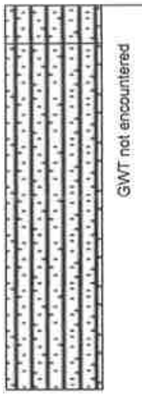
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples		Laboratory		
		Type	Blow Counts	Moisture	Dry Density	Relative Compaction
0	FILL Silty (fine to medium grained) SAND Brown, loose, damp					
		■ ▽		5.8	105.5	
	NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist					
5		■		6.7	103.3	
10	Trench completed at depth of 10'					
15						
20						
25						
30						
35						

Newcastle Partners
19503-17

Log of Trench T-4

Boring Location: 3100 Milliken, Eastvale

Date of Drilling: 3/24/17

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Relative Compaction
0		GWT not encountered	FILL SOILS silty (fine to medium grained) SAND Brown, loose, damp					
			NATURAL SOILS silty (fine to medium grained) SAND Brown, medium dense, moist	■		9.6	108.7	
5								
				■		7.1	111.2	
10			Boring completed at depth of 10'					
15								
20								
25								
30								
35								

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\19503-17.log Date: 4/4/2017

Newcastle Partners
19503-17

Log of Trench T-5

Boring Location: 3100 Milliken, Eastvale

Date of Drilling: 3/24/17

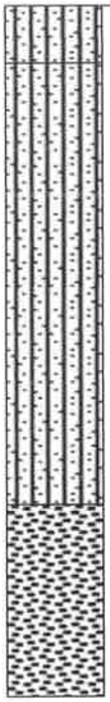
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Lith-ology	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Relative Compaction
0		FILL Silty (fine to medium grained) SAND Brown, loose, damp					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist	■ ☐		5.9	107.1	
5			■		6.9	109.7	
10			■		3.6	114.8	
		gravelly (medium to coarse grained) SAND Light brown, medium dense, damp slightly silty with cobbles					
15			■		2.6	115.2	
		Boring completed at depth of 18'					
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\19503-17.log Date: 4/4/2017

Newcastle Partners
19503-17

Log of Trench T-6

Boring Location: 3100 Milliken, Eastvale

Date of Drilling: 3/24/17

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

GWT not encountered

Depth (feet)	Material Description	Samples Type	Samples Blow Counts	Laboratory Moisture	Laboratory Dry Density	Laboratory Relative Compaction
0	FILL Silty (fine to medium grained) SAND Brown, loose, damp					
	NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist					
5		■		6.5	100.9	
10	Boring completed at depth of 10'	■		5.8	106.6	
15						
20						
25						
30						
35						

NorCal Engineering

Newcastle Partners

19503-17

Log of Trench T-7

Boring Location: 3100 Milliken, Eastvale

Date of Drilling: 3/24/17

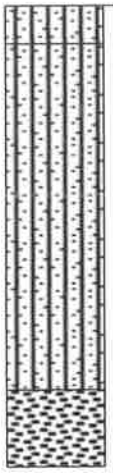
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



GWT not encountered

Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Relative Compaction
0	FILL Silty (fine to medium grained) SAND Brown, loose, damp	■		6.6	102.3	
	NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist					
5		■		7.4	107.1	
10	Gravelly (fine to coarse grained) SAND Light brown, medium dense, damp slightly silty with some cobbles	■		3.5	109.9	
	Boring completed at depth of 12'					
15						
20						
25						
30						
35						

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\19503-17.log Date: 4/4/2017

NorCal Engineering

Newcastle Partners
19503-17

Log of Trench T-8

Boring Location: 3100 Milliken, Eastvale

Date of Drilling: 3/24/17

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology		Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Relative Compaction
0		GWT not encountered	FILL Silty (fine to medium grained) SAND Brown, loose, damp					
			NATURAL Silty (fine to medium grained) SAND Brown, medium dense, damp to moist	■		3.8	104.5	
5								
				■		12.5	102.7	
10			Trench completed at depth of 10'					
15								
20								
25								
30								
35								

Newcastle Partners
19503-17

Log of Trench T-9

Boring Location: 3100 Milliken, Eastvale

Date of Drilling: 3/24/17

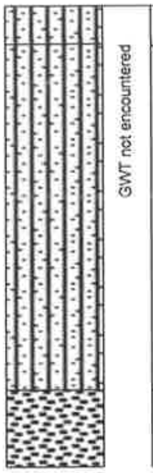
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Relative Compaction
0	FILL Silty (fine to medium grained) SAND Brown, loose, damp					
	NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist	■ ▽		6.3	102.5	
5						
		■		8.0	105.1	
10	Gravelly (fine to coarse grained) SAND Light brown, medium dense, slightly moist slightly silty with cobbles	■		4.0	108.2	
	Boring completed at depth of 12'					
15						
20						
25						
30						
35						

Newcastle Partners
19503-17

Log of Trench T-10

Boring Location: 3100 Milliken, Eastvale

Date of Drilling: 3/24/17

Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

Depth (feet)	Lith-ology	Material Description	Samples		Laboratory		
			Type	Blow Counts	Moisture	Dry Density	Relative Compaction
0	GWT not encountered	FILL Silty (fine to medium grained) SAND Brown, loose, damp					
		NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist					
5			■		8.2	107.8	
10		Boring completed at depth of 10'	■		12.2	103.9	
15							
20							
25							
30							
35							

SuperLog CivilTech Software, USA www.civiltech.com File: C:\Superlog4\PROJECT\19503-17.log Date: 4/4/2017

Newcastle Partners
19503-17

Log of Trench T-11

Boring Location: 3100 Milliken, Eastvale

Date of Drilling: 3/24/17

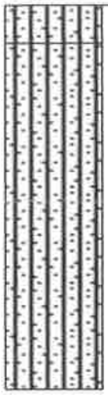
Groundwater Depth: None Encountered

Drilling Method: Backhoe

Hammer Weight:

Drop:

Surface Elevation: Not Measured

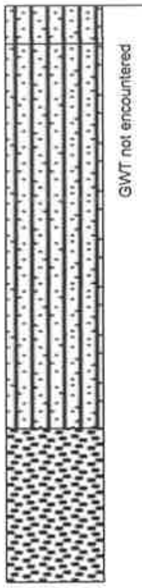
Depth (feet)	Lith-ology		Material Description	Samples		Laboratory		
				Type	Blow Counts	Moisture	Dry Density	Relative Compaction
0		GWT not encountered	FILL Silty (fine to medium grained) SAND Brown, loose, damp					
			NATURAL Silty (fine to medium grained) SAND Brown, medium dense, moist					
5								
10			Boring completed at depth of 10'					
15								
20								
25								
30								
35								

NorCal Engineering

Newcastle Partners
19503-17

Log of Trench T-12

Boring Location: 3100 Milliken, Eastvale
Date of Drilling: 3/24/17
Groundwater Depth: None Encountered
Drilling Method: Backhoe
Hammer Weight:
Drop:
Surface Elevation: Not Measured



Depth (feet)	Material Description	Samples: Type	Samples: Blow Counts	Laboratory: Moisture	Laboratory: Dry Density	Laboratory: Relative Compaction
0	FILL Silty (fine to medium grained) SAND Brown, loose, damp					
	NATURAL Silty (fine to medium grained) SAND Brown, medium dense, damp to moist					
5		■		4.7	105.9	
10		■		12.2	100.9	
	Gravelly (medium to coarse grained) SAND Light brown, medium dense, moist slightly silty with cobbles					
15	Boring completed at depth of 15'	■		5.1	110.3	
20						
25						
30						
35						

Appendix B

TABLE I
MAXIMUM DENSITY TESTS

Sample	Classification	Optimum Moisture	Maximum Dry Density (lbs./cu.ft.)
T-5 @ 2'	Silty SAND	11.0	121.0
T-9 @ 2'	Silty SAND	10.0	123.0

TABLE II
EXPANSION INDEX TESTS

Soil Type	Classification	Expansion Index
T-5 @ 2'	Silty SAND	3
T-9 @ 2'	Silty SAND	4

TABLE III
CORROSION TESTS

Sample	pH	Electrical Resistivity (ohm-cm)	Sulfate (%)	Chloride (ppm)
T-5 @ 2'	7.1	4,023	0.003	244
T-9 @ 2'	7.2	3,532	0.005	230

ND denotes not detected
% by weight
ppm – mg/kg

GMU
GEOTECHNICAL, INC.

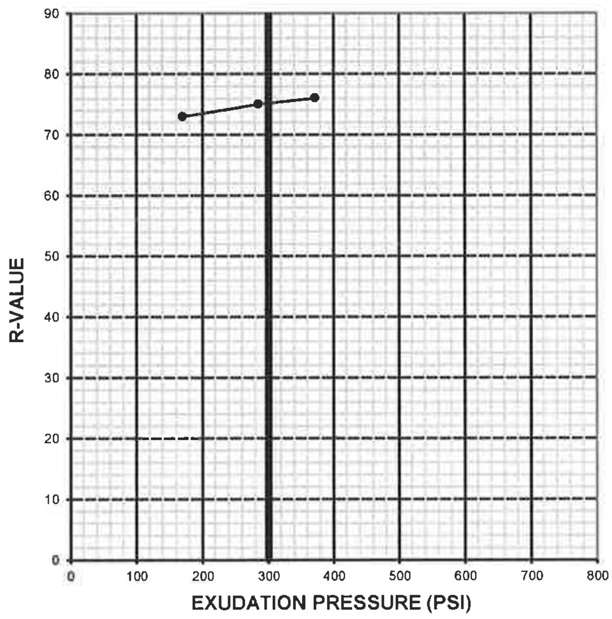
R-VALUE TEST REPORT

☑ CT-301 ☐ ASTM-D2844

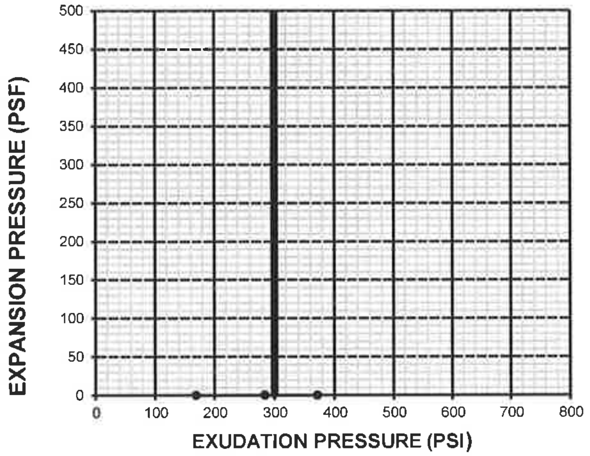
PROJECT NAME: Norcal (Newcastle Partners)
PROJECT NUMBER: L-170303
SAMPLE LOCATION: 3100 Milliken Ave East Vale, Riverside County, CA
SAMPLE NUMBER: T-3
SAMPLE DESCRIPTION: Silty Sand (SM)
SAMPLE DEPTH: 1'
SAMPLED BY: Norcal
TESTED BY: CD
DATE TESTED: 3/28/2017

TEST SPECIMEN	A	B	C
MOISTURE AT COMPACTION %	13.3	13.0	12.7
WEIGHT OF SAMPLE, grams	1042	1051	1067
HEIGHT OF SAMPLE, Inches	2.53	2.65	2.60
DRY DENSITY, pcf	110.2	106.4	110.3
COMPACTOR AIR PRESSURE, psi	300	300	300
EXUDATION PRESSURE, psi	169	284	371
EXPANSION, Inches x 10exp-4	0	0	0
STABILITY Ph 2,000 lbs (160 psi)	34	34	32
TURNS DISPLACEMENT	3.46	3.35	3.32
R-VALUE UNCORRECTED	73	73	75
R-VALUE CORRECTED	73	75	76
EXPANSION PRESSURE (psf)	0.0	0.0	0.0

R-VALUE VS. EXUDATION PRESSURE



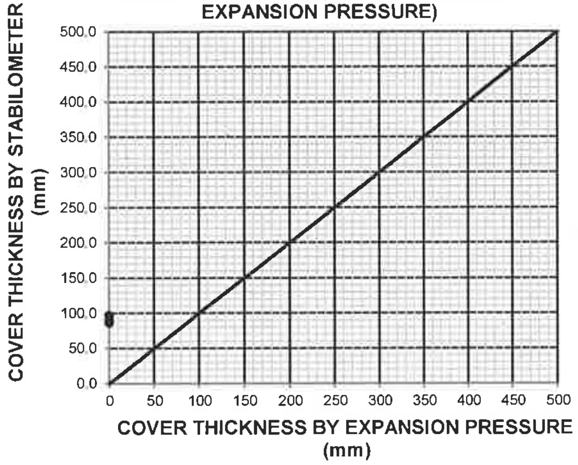
EXPANSION PRESSURE VS. EXUDATION PRESSURE



R-VALUE AT EQUILIBRIUM:	75

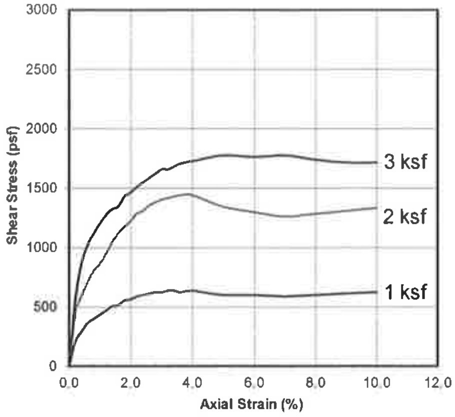
R-VALUE BY EXUDATION PRESSURE:	75
R-VALUE BY EXPANSION PRESSURE:	N.A.
EXPANSION PRESSURE AT 300 PSI EXUDATION:	0
TRAFFIC INDEX (Assumed):	5.5
GRAVEL FACTOR (Assumed):	1.5
UNIT MASS OF COVER MATERIAL, kg/m^3 (Assumed):	2100.0

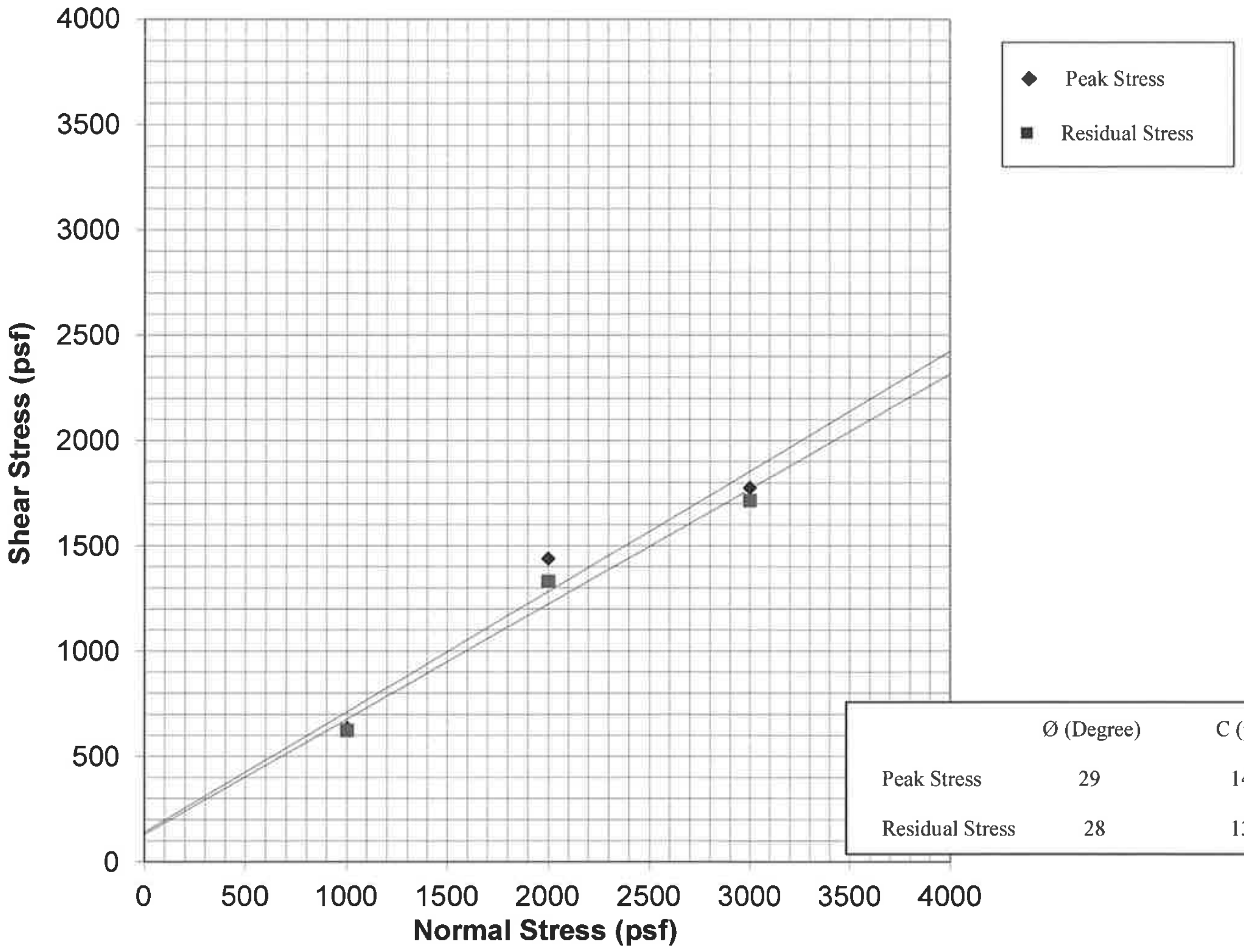
COVER THICKNESS (STABILOMETER BY EXPANSION PRESSURE)



Sample No. T5@2'
Sample Type: Undisturbed/Saturated
Soil Description: Fine-Medium Grained Sand w/ Some Silt

		1	2	3
Normal Stress	(psf)	1000	2000	3000
Peak Stress	(psf)	636	1440	1776
Displacement	(in)	0.080	0.090	0.125
Residual Stress	(psf)	624	1332	1716
Displacement	(in.)	0.250	0.250	0.250
In Situ Dry Density	(pcf)	107.1	107.1	107.1
In Situ Water Content	(%)	5.9	5.9	5.9
Saturated Water Content	(%)	21.2	21.2	21.2
Strain Rate	(in/min)	0.020	0.020	0.020





	Ø (Degree)	C (psf)
Peak Stress	29	140
Residual Stress	28	130

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

Newcastle Partners

PROJECT NUMBER: 19503-17 DATE: 3/29/2017

DIRECT SHEAR TEST

ASTM D3080

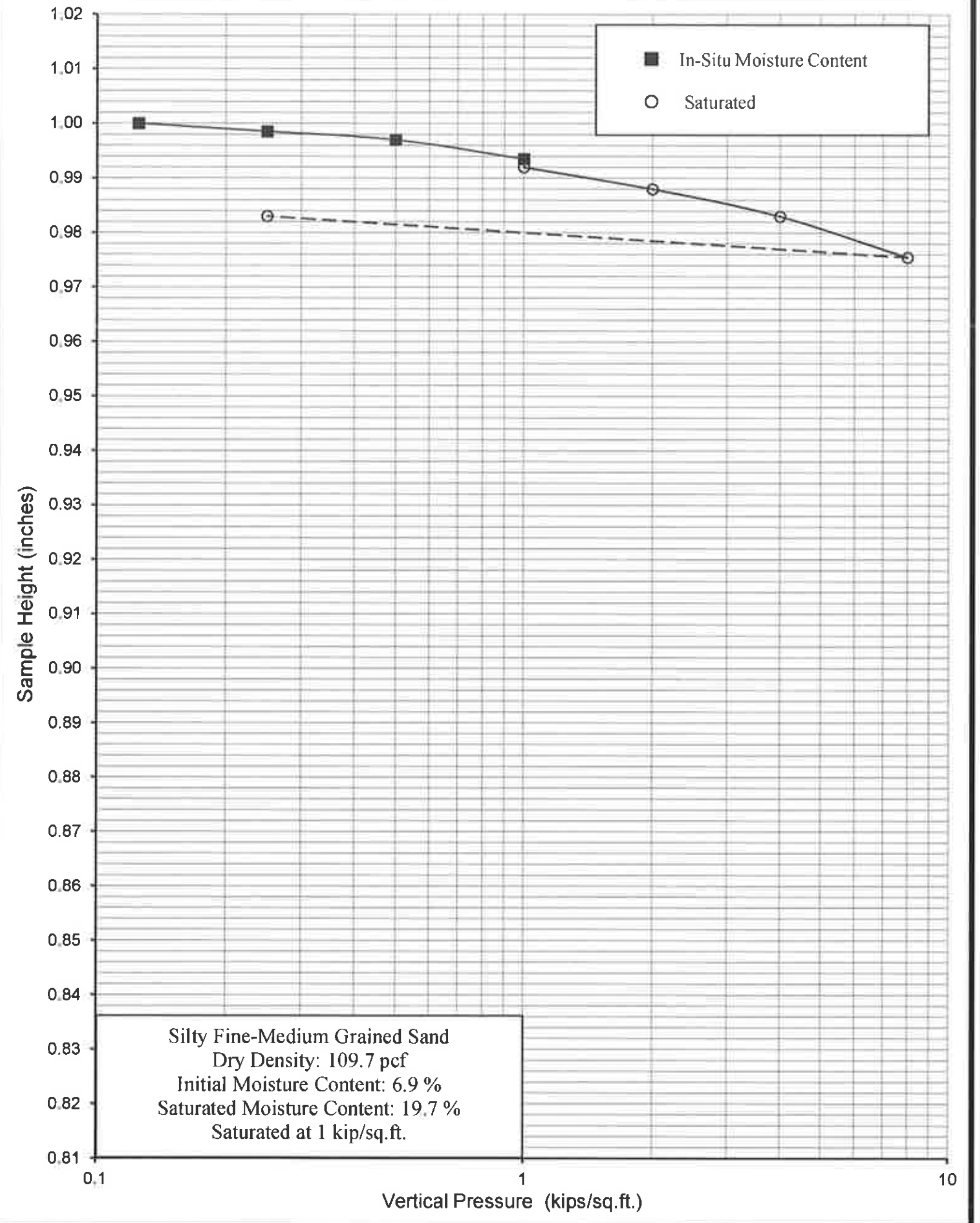
Plate A

Sample No. T5 Depth 5' Date 3/29/2017

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9985	0.2
0.5	0.9970	0.3
1	0.9935	0.6
1	0.9920	0.8
2	0.9880	1.2
4	0.9830	1.7
8	0.9755	2.5
0.25	0.9830	1.7

Saturated

Date Tested: 3/28/2017
Sample: T5
Depth: 5'



Silty Fine-Medium Grained Sand
Dry Density: 109.7 pcf
Initial Moisture Content: 6.9 %
Saturated Moisture Content: 19.7 %
Saturated at 1 kip/sq.ft.

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

Newcastle Partners

PROJECT NUMBER: 19503-17 DATE: 3/29/2017

CONSOLIDATION TEST

ASTM D2435

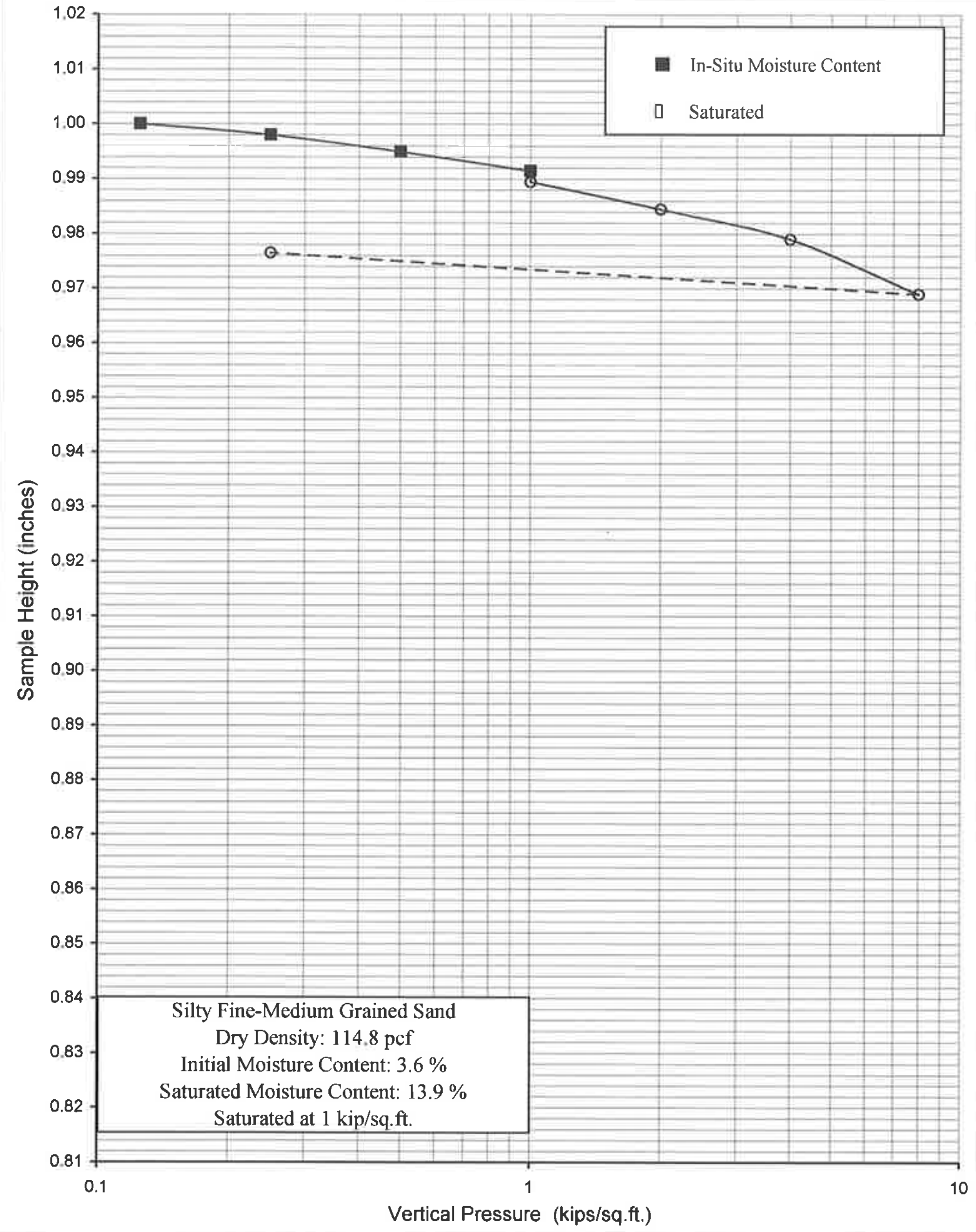
Plate B

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	1.0000	0.0
0.25	0.9980	0.2
0.5	0.9950	0.5
1	0.9915	0.8
1	0.9895	1.1
2	0.9845	1.6
4	0.9790	2.1
8	0.9690	3.1
0.25	0.9765	2.4

Saturated

Sample No. T5 Depth 10' Date 3/29/2017

Date Tested: 3/28/2017
Sample: T5
Depth: 10'



Silty Fine-Medium Grained Sand
Dry Density: 114.8 pcf
Initial Moisture Content: 3.6 %
Saturated Moisture Content: 13.9 %
Saturated at 1 kip/sq.ft.

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

Newcastle Partners

PROJECT NUMBER: 19503-17 DATE: 3/29/2017

CONSOLIDATION TEST

ASTM D2435

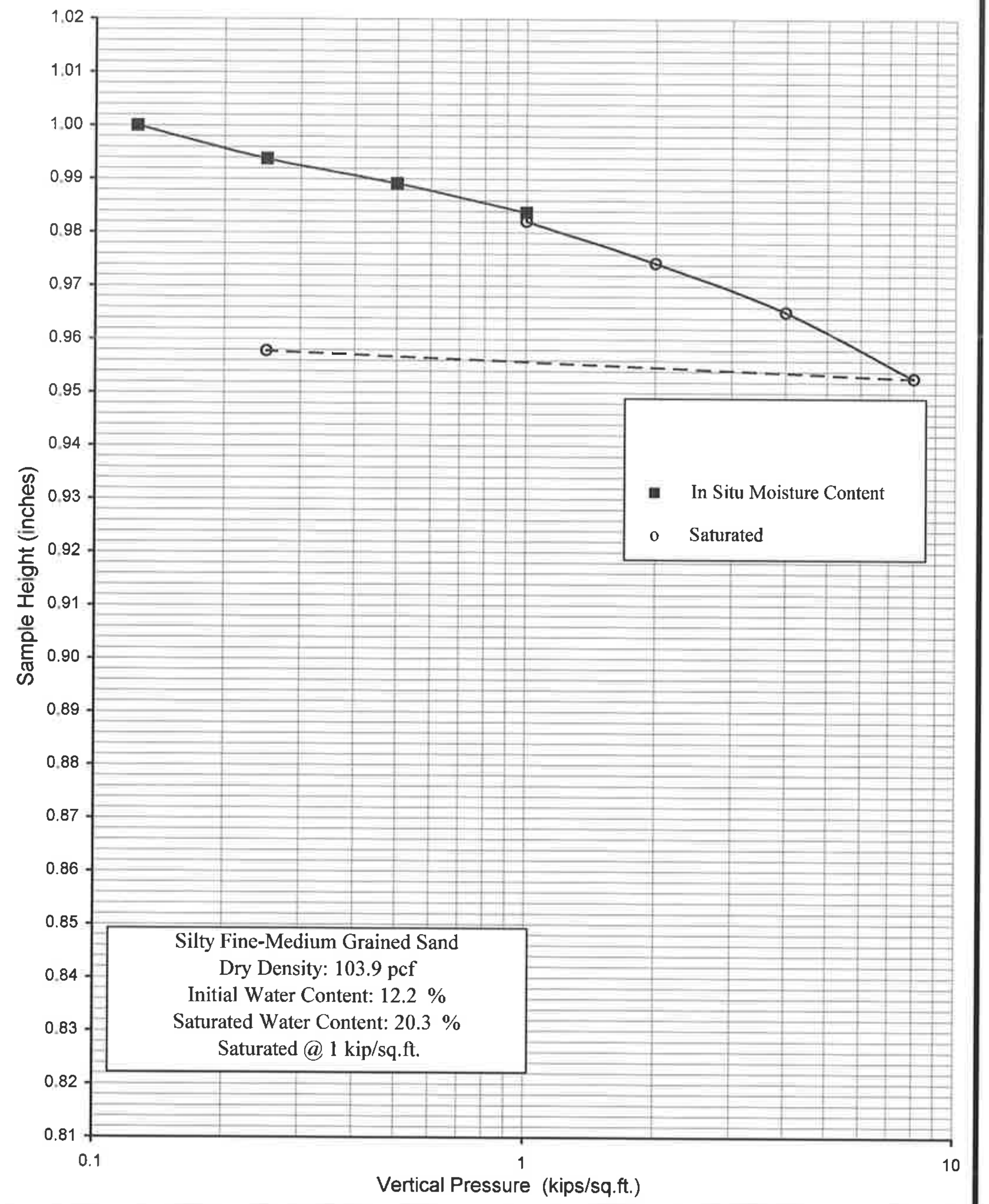
Plate C

Sample No. T12 | Depth 10' | Date 3/29/2017

Vertical Pressure (kips/sq.ft.)	Sample Height (inches)	Consolidation (percent)
0.125	**1.0000**	**0.0**
0.25	**0.9938**	**0.6**
0.5	**0.9892**	**1.1**
1	**0.9838**	**1.6**
1	**0.9821**	**1.8**
2	**0.9743**	**2.6**
4	**0.9652**	**3.5**
8	**0.9528**	**4.7**
0.25	**0.9578**	**4.2**

Saturated

Date Tested: 3/28/2017
Sample: T12
Depth: 10'



Silty Fine-Medium Grained Sand
Dry Density: 103.9 pcf
Initial Water Content: 12.2 %
Saturated Water Content: 20.3 %
Saturated @ 1 kip/sq.ft.

NorCal Engineering

SOILS AND GEOTECHNICAL CONSULTANTS

Newcastle Partners

PROJECT NUMBER: 19503-17 DATE: 3/29/2017

CONSOLIDATION TEST
ASTM D2435
Plate D

Appendix C

NORCAL
ENGINEERING
SOILS AND GEOTECHNICAL CONSULTANTS

Project: Newcastle Partners
Project No: 19503-17
Date: 3/24/17
Test No. 1
Depth: 5'
Tested By: J.S.

	TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE (cm)	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
1	7:40			101.0			44.0					
	7:45	5	5	102.5	1.5		45.7	1.7				
2	7:45			102.5			45.7					
	7:50	5	10	103.4	0.9		46.7	1.0				
3	7:50			103.4			46.7					
	7:55	5	15	104.0	0.6		47.6	0.9				
4	7:55			104.0			47.6					
	8:00	5	20	104.7	0.7		48.8	1.2				
5	8:00			98.5			41.1					
	8:05	5	25	99.0	0.5		42.1	1.0				
6	8:05			99.0			42.1					
	8:10	5	30	99.6	0.6		43.1	1.0				
7	8:10			99.6			43.1					
	8:15	5	35	100.0	0.4		43.9	0.8				
8	8:15			100.0			43.9					
	8:20	5	40	100.7	0.7		44.7	0.8				
9	8:20			100.7			44.7					
	8:25	5	45	101.3	0.6		45.6	0.9				
10	8:25			101.3			45.6					
	8:30	5	50	101.8	0.5		46.4	0.8				
11	8:30			101.8			46.4					
	8:35	5	55	102.3	0.5		47.2	0.8				
12	8:35			102.3			47.2					
	8:40	5	60	102.8	0.5		47.9	0.7				

Project:	**Newcastle Partners**
Project No:	19503-17
Date:	3/24/17
Test No.	2
Depth:	10'
Tested By:	J.S.

	TIME (hr/min)	CHANGE TIME (min)	CUMULATIVE TIME (min)	INNER RING READING (cm)	INNER RING CHANGE	INNER RING FLOW (cc)	OUTER RING READING (cm)	OUTER RING CHANGE (cm)	OUTER RING FLOW (cc)	INNER RING INF RATE (cm/hr)	OUTER RING INF RATE (cm/hr)	INNER RING INF RATE (ft/hr)
1	9:00			101.0			42.8					
	9:10	10	10	101.9	0.9		43.8	1.0				
2	9:10			101.9			43.8					
	9:20	10	20	102.5	0.6		44.1	0.3				
3	9:20			102.5			44.1					
	9:30	10	30	103.2	0.7		45.1	1.0				
4	9:30			103.2			45.1					
	9:40	10	40	103.8	0.6		45.7	0.6				
5	9:40			103.8			45.7					
	9:50	10	50	104.5	0.7		47.0	1.3				
6	9:50			104.5			47.0					
	10:00	10	60	104.9	0.4		47.5	0.5				
7	10:00			104.9			47.5					
	10:10	10	70	105.6	0.7		48.3	0.8				
8	10:10			105.6			48.3					
	10:20	10	80	106.1	0.5		48.9	0.6				
9	10:20			106.1			48.9					
	10:30	10	90	106.8	0.7		49.7	0.8				
10	10:30			100.5			43.4					
	10:40	10	100	101.1	0.6		44.2	0.8				
11	10:40			101.1			44.2					
	10:50	10	110	101.7	0.6		44.9	0.7				
12	10:50			101.7			44.9					
	11:00	10	120	102.2	0.5		45.7	0.8				

Appendix 4: Historical Site Conditions

Phase I Environmental Site Assessment or Other Information on Past Site Use

TO BE PROVIDED WITH FINAL WQMP

Appendix 5: LID Infeasibility

LID Technical Infeasibility Analysis

NOT APPLICABLE

Appendix 6: BMP Design Details

BMP Sizing, Design Details and other Supporting Documentation

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend:	🟦	Required Entries
	▨	Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name	Tory R. Walker Engineering, Inc.	Date	8/14/2017
Designed by	AJS	Case No	TBD

Company Project Number/Name South Milliken Distribution Center

BMP Identification

BMP NAME / ID BMP D/1

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.90 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume,* V_{BMP} *(cubic feet)*	*Proposed Volume on Plans (cubic feet)*
D/1 ROOF	*136615*	*Roofs*	*1*	*0.89*	*121860.6*			
D/1 IMP	*179185*	*Concrete or Asphalt*	*1*	*0.89*	*159833*			
D/1 PERV	*40570*	*Ornamental Landscaping*	*0.1*	*0.11*	*4481.3*			
	356370	***Total***			**286174.9**	**0.90**	***21367.7***	***23946***

Notes:

Infiltration Basin - Design Procedure

(Rev. 03-2012)

BMP ID: BMP D/1

Legend: Required Entries / Calculated Cells

Company Name: Tory R. Walker Engineering, Inc.

Date: ##########

Designed by: AJS

County/City Case No.: TBD

Design Volume

a) Tributary area (BMP subarea) A_T = 8.18113 acres

b) Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 21,368 ft^3

Maximum Depth

a) Infiltration rate I = 2.6 in/hr

b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook) FS = 3

c) Calculate D_1

$$D_1 = \frac{\text{I (in/hr) x 72 hrs}}{\text{12 (in/ft) x FS}}$$

D_1 = 5.2 ft

d) Enter the depth of freeboard (at least 1 ft) 1 ft

e) Enter depth to historic high ground water (measured from **top** of basin) 16 ft

f) Enter depth to top of bedrock or impermeable layer (measured from **top** of basin) 16 ft

g) D_2 is the smaller of:

Depth to groundwater - (10 ft + freeboard) and
Depth to impermeable layer - (5 ft + freeboard)

D_2 = 5.0 ft

h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet D_{MAX} = 5.0 ft

Basin Geometry

a) Basin side slopes (no steeper than 4:1) z = 0 :1

b) Proposed basin depth (excluding freeboard) d_B = 5 ft

c) Minimum bottom surface area of basin (A_S= V_{BMP}/d_B) A_S = 4274 ft^2

d) Proposed Design Surface Area A_D = 4789 ft^2

Forebay

a) Forebay volume (minimum 0.5% V_{BMP}) Volume = 107 ft^3

b) Forebay depth (height of berm/splashwall. 1 foot min.) Depth = 1 ft

c) Forebay surface area (minimum) Area = 107 ft^2

d) Full height notch-type weir Width (W) = 6.0 in

Notes: BMP is composed of two vertical-walled basins that are hydraulically connected.
Infiltration information per 4/14/17 Geotechnical Investigation, Test No. P-1.

BMP D/1 Storage Curve

Depth (ft)	Area (ft^2)	Volume (ft^3)
0.00	4789	0
0.10	4789	479
0.20	4789	958
0.30	4789	1437
0.40	4789	1916
0.50	4789	2395
0.60	4789	2874
0.70	4789	3352
0.80	4789	3831
0.90	4789	4310
1.00	4789	4789
1.10	4789	5268
1.20	4789	5747
1.30	4789	6226
1.40	4789	6705
1.50	4789	7184
1.60	4789	7663
1.70	4789	8142
1.80	4789	8621
1.90	4789	9100
2.00	4789	9578
2.10	4789	10057
2.20	4789	10536
2.30	4789	11015
2.40	4789	11494
2.50	4789	11973
2.60	4789	12452
2.70	4789	12931
2.80	4789	13410
2.90	4789	13889
3.00	4789	14368
3.10	4789	14847
3.20	4789	15326
3.30	4789	15804
3.40	4789	16283
3.50	4789	16762
3.60	4789	17241
3.70	4789	17720
3.80	4789	18199
3.90	4789	18678
4.00	4789	19157
4.10	4789	19636
4.20	4789	20115

BMP D/1 Storage Curve

Depth (ft)	Area (ft^2)	Volume (ft^3)
4.30	4789	20594
4.40	4789	21073
4.50	4789	21552
4.60	4789	22031
4.70	4789	22509
4.80	4789	22988
4.90	4789	23467
5.00	4789	23946
5.10	4789	24425
5.20	4789	24904
5.30	4789	25383
5.40	4789	25862
5.50	4789	26341
5.60	4789	26820
5.70	4789	27299
5.80	4789	27778
5.90	4789	28257
6.00	4789	28735

Santa Ana Watershed - BMP Design Volume, V_{BMP}

(Rev. 10-2011)

Legend: 🟦 Required Entries
▨ Calculated Cells

*(Note this worksheet shall **only** be used in conjunction with BMP designs from the **LID BMP Design Handbook**)*

Company Name Tory R. Walker Engineering, Inc.
Date 8/14/2017
Designed by AJS
Case No TBD
Company Project Number/Name South Milliken Distribution Center

BMP Identification

BMP NAME / ID BMP D/2

Must match Name/ID used on BMP Design Calculation Sheet

Design Rainfall Depth

85th Percentile, 24-hour Rainfall Depth,
from the Isohyetal Map in Handbook Appendix E

D_{85}= 0.90 inches

Drainage Management Area Tabulation

Insert additional rows if needed to accommodate all DMAs draining to the BMP

DMA Type/ID	DMA Area (square feet)	Post-Project Surface Type	Effective Imperivous Fraction, I_f	DMA Runoff Factor	DMA Areas x Runoff Factor	*Design Storm Depth (in)*	*Design Capture Volume, V_{BMP} (cubic feet)*	*Proposed Volume on Plans (cubic feet)*
D/2 ROOF	*137790*	*Roofs*	*1*	*0.89*	*122908.7*			
D/2 IMP	*79270*	*Concrete or Asphalt*	*1*	*0.89*	*70708.8*			
D/2 PERV	*67847*	*Ornamental Landscaping*	*0.1*	*0.11*	*7494.2*			
	284907		***Total***		**201111.7**	**0.90**	***15016.3***	***15201***

Notes:

Infiltration Basin - Design Procedure
(Rev. 03-2012)

BMP ID: BMP D/2

Legend: Required Entries
Calculated Cells

Company Name: Tory R. Walker Engineering, Inc.
Date: ##########
Designed by: AJS
County/City Case No.: TBD

Design Volume

a) Tributary area (BMP subarea) A_T = 6.54056 acres

b) Enter V_{BMP} determined from Section 2.1 of this Handbook V_{BMP}= 15,016 ft^3

Maximum Depth

a) Infiltration rate I = 1.4 in/hr

b) Factor of Safety (See Table 1, Appendix A: "Infiltration Testing" from this BMP Handbook) FS = 3

c) Calculate D_1 $D_1 = \frac{\text{I (in/hr) x 72 hrs}}{\text{12 (in/ft) x FS}}$ D_1 = 2.8 ft

d) Enter the depth of freeboard (at least 1 ft) 1 ft

e) Enter depth to historic high ground water (measured from **top** of basin) 18 ft

f) Enter depth to top of bedrock or impermeable layer (measured from **top** of basin) 18 ft

g) D_2 is the smaller of:

Depth to groundwater - (10 ft + freeboard) and
Depth to impermeable layer - (5 ft + freeboard)
D_2 = 7.0 ft

h) D_{MAX} is the smaller value of D_1 and D_2 but shall not exceed 5 feet D_{MAX} = 2.8 ft

Basin Geometry

a) Basin side slopes (no steeper than 4:1) z = 0 :1

b) Proposed basin depth (excluding freeboard) d_B = 2.8 ft

c) Minimum bottom surface area of basin ($A_S = V_{BMP}/d_B$) A_S = 5363 ft^2

d) Proposed Design Surface Area A_D = 5429 ft^2

Forebay

a) Forebay volume (minimum 0.5% V_{BMP}) Volume = 75 ft^3

b) Forebay depth (height of berm/splashwall. 1 foot min.) Depth = 1 ft

c) Forebay surface area (minimum) Area = 75 ft^2

d) Full height notch-type weir Width (W) = 6.0 in

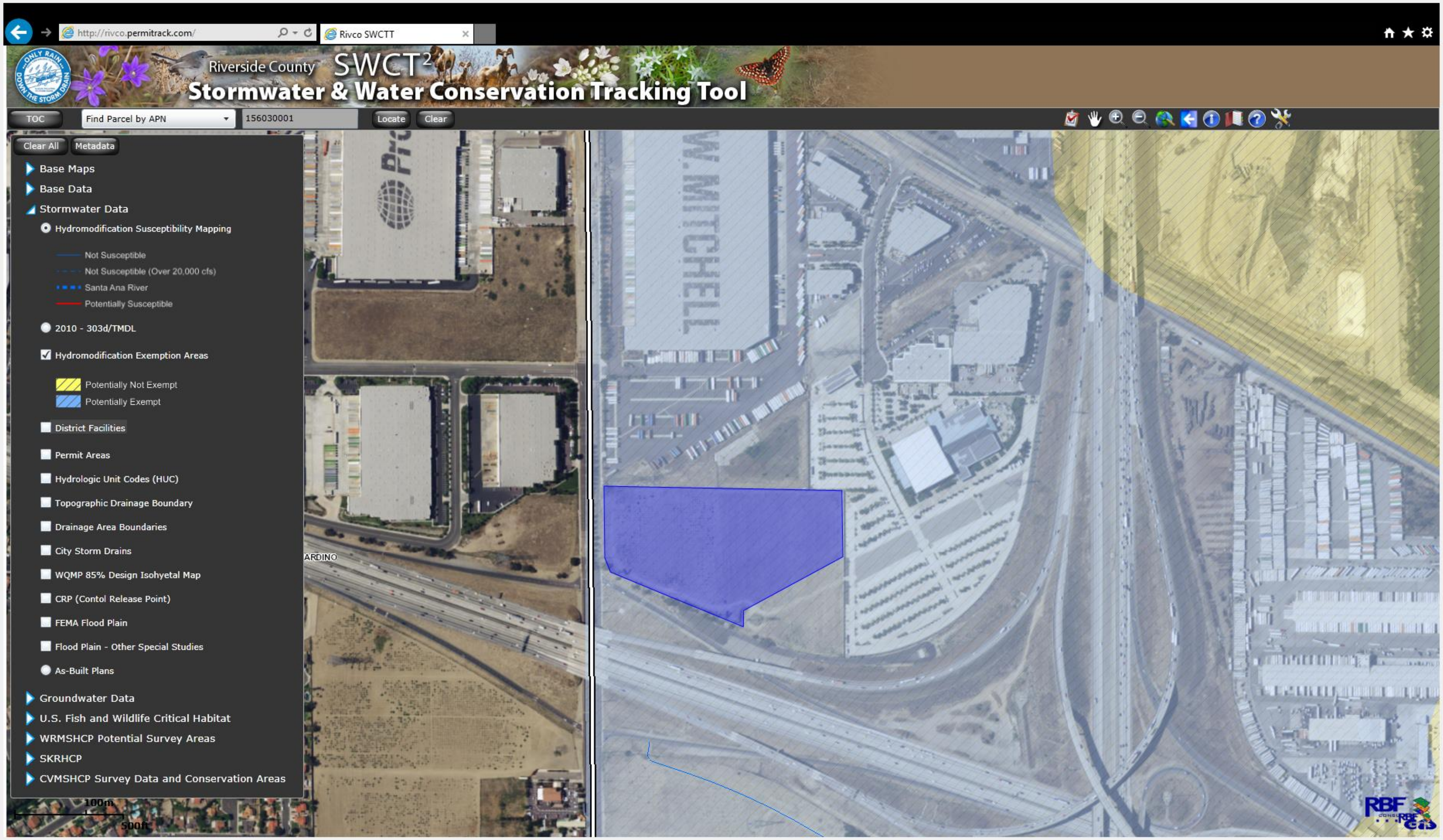
Notes: Basin has vertical sidewalls
Infiltration information per 4/14/17 Geotechnical Investigation, Test No. P-2.

BMP D/2 Storage Curve

Depth (ft)	Area (ft^2)	Volume (ft^3)
0.00	5429	0
0.10	5429	543
0.20	5429	1086
0.30	5429	1629
0.40	5429	2172
0.50	5429	2715
0.60	5429	3257
0.70	5429	3800
0.80	5429	4343
0.90	5429	4886
1.00	5429	5429
1.10	5429	5972
1.20	5429	6515
1.30	5429	7058
1.40	5429	7601
1.50	5429	8144
1.60	5429	8686
1.70	5429	9229
1.80	5429	9772
1.90	5429	10315
2.00	5429	10858
2.10	5429	11401
2.20	5429	11944
2.30	5429	12487
2.40	5429	13030
2.50	5429	13573
2.60	5429	14115
2.70	5429	14658
2.80	5429	15201
2.90	5429	15744
3.00	5429	16287
3.10	5429	16830
3.20	5429	17373
3.30	5429	17916
3.40	5429	18459
3.50	5429	19002
3.60	5429	19544
3.70	5429	20087
3.80	5429	20630

Appendix 7: Hydromodification

Supporting Detail Relating to Hydrologic Conditions of Concern



Find Parcel by APN 156030001

- Base Maps
- Base Data
- Stormwater Data
  - ● Hydromodification Susceptibility Mapping
    - Not Susceptible
    - Not Susceptible (Over 20,000 cfs)
    - Santa Ana River
    - Potentially Susceptible
  - ○ 2010 - 303d/TMDL
  - ☑ Hydromodification Exemption Areas
    - ▨ Potentially Not Exempt
    - ▨ Potentially Exempt
  - ☐ District Facilities
  - ☐ Permit Areas
  - ☐ Hydrologic Unit Codes (HUC)
  - ☐ Topographic Drainage Boundary
  - ☐ Drainage Area Boundaries
  - ☐ City Storm Drains
  - ☐ WQMP 85% Design Isohyetal Map
  - ☐ CRP (Contol Release Point)
  - ☐ FEMA Flood Plain
  - ☐ Flood Plain - Other Special Studies
  - ○ As-Built Plans
- Groundwater Data
- U.S. Fish and Wildlife Critical Habitat
- WRMSHCP Potential Survey Areas
- SKRHCP
- CVMSHCP Survey Data and Conservation Areas

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.**

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
☐ 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

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**

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
☐ 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.**

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
☐ 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.**

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
☑ 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.	

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
☑ 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

TO BE PROVIDED WITH FINAL WQMP